Science and Mathematics Education Centre

The Relationship Between Individual Type, Underachievement and the Attributional Motivation of Secondary School Science Students: Intervention Approaches for Underachievers

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Abstract

Relationships between underachievement, individual type and attributional motivation were investigated among 37 underachieving senior science students from a boys' college, a girls' college and a coeducational college in New Zealand. An adaptation of the Myers-Briggs type inventory was used to identify individual type, and attributional motivation was determined by using two questionnaires, based upon attributional constructs established by Weiner (1979). Students in the sample were also interviewed. Results show a significant difference, too great to be attributed to a sampling fluctuation, between the observed number of students and the greater than expected number of students, particularly for the ESFJ (Extrovert-Sensing-Feeling-Judging) and ISFJ (Introvert-Sensing-Feeling-Judging) individual 'types' within the sample of underachieving students. A difference also was found between the observed number of Function Pairs, derived from the Myers-Briggs descriptions, and the expected number of Pairs within the sample. These differences were also too great to be attributed to a sampling fluctuation.

A general lack of motivation was found among the students, with 'lack of effort' being attributed as a major cause of underachievement. Differences in attribution trends were found between different 'types'. Most of the students indicated that they were passive learners and generally were unaware of how to use metacognitive strategies to improve their learning and motivation.

Abstract (cont)

Implications from this research suggest that intervention approaches should be made by educators to improve accountability and reduce underachievement by students. Recommendations for various approaches used by the author, and by others described in the thesis to reduce or overcome underachievement are suggested.
These might be used for individual types who are prone to underachieve, and for underachievers generally.

Candidate's Statement

I certify that this statement is the result of my own work except where otherwise acknowledged and has not been submitted, in part or in full, for any other papers or degrees for which credit or qualification have been granted.

Leonard Joshua Restall

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I thank the teachers and students who cooperated in this research study and hope that the knowledge and experience gained by them in reflecting upon their achievements in science will profit them and reduce future underachievement.

I also appreciate the patience endured and encouragement given by my wife and members of my family during the work on this thesis.

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Chapter 1 -

Background to the Problem of Underachievement

Introduction

Learning outcomes and achievements are affected by many factors. This can be seen in the wide range of results that come from similar teaching styles, which suggest that the effect of any one factor or a combination of factors may be the cause of differential attainment by students. The main research programmes undertaken in this area and in the sociology of education in the period up to the 1980s have mainly concentrated on variations in attainment of pupils from different social and ethnic backgrounds (Flude, 1974). However, various forms of legislation enacted in the United States of America, such as amendments in 1977 to Public Law 101- 476 [Individuals With Disabilities Education Act], and England and Wales in making amendments in 1997 to the Education Act:1993, indicate that the emphasis may be moving more towards other causes of underachievement, beyond social causes such as learning disabilities (Adelman & Taylor, 1993; Clay, 1998).

Underachievement is a complex problem and although it may be a consequence of a learning disability, or a learning problem, the exact nature of the causal factor is not so easily identified because of the possibility of various factors interacting such as socio-economic reasons with 'cultural capital' deficiencies (Bordieu, 1971). There have been various successful approaches made by educators in USA, New Zealand, England and Wales, (countries familiar to the writer) to reduce underachievement, but the problem according to recent results given at an OECD and Ministry of Education conference in New Zealand in 1998 still remains a major educational concern (Lawton, 1998). Therefore, some factors relating to underachievement will be considered throughout this thesis and some workable definition of underachievement will be arbitrarily used. A factor that contributes towards underachievement needs to be identified and if possible dealt with to reduce underachievement. However, the

emphasis within this thesis will be upon the problems associated with individual 'type', which includes the personality characteristics relating to a person's preferences and style of decision making that may contribute towards learning problems causing underachievement. Some suggestions for intervention approaches used by the author and obtained by other experts in the field of learning problems, learning strategies and styles, and motivation to reduce underachievement are given.

The sociological theory of Bordieu (1971) of social and cultural reproduction postulates that certain classes of students have advantages over others because of their 'cultural capital' gained from their home background. Bordieu considers that 'cultural capital' contains the attitudes and values towards learning that a student may have gained because of environmental experiences within their home. The 'cultural capital' becomes an important component of a student's background. More important, Bordieu argues that 'cultural capital' of middle-class students may be reinforced by practices within schools. The legitimacy of socio-cultural theories developed to account for differences in educational achievement are not questioned in this thesis; however, they should not be ignored as important explanations of causal factors affecting educational achievement (Bourdieu, 1971; Bourdieu, 1974, cited in Nash, 1986)

Several countries such as USA, New Zealand, England, and Wales use remedial programmes for underachievers irrespective of whether the cause of underachievement is from social inequality, learning disability, or a specific learning problem. In some countries individual education programmes (IEPs) are mandatory for 'special needs' students; this not so for New Zealand, but eligibility for funding is based upon a student having an IEP. Currently there is a move in New Zealand to set national guidelines for IEPs, but at the time of writing this is in the planning stage (Carroll-Lind, 1998a). The differences between the various programmes and their effectiveness vary. For example, the New Zealand 'reading recovery' programme has

been subjected to criticism regarding its effectiveness over the long term (Clay, 1987b; Chapman & Turner, 1991; Glynn, Crooks, Bethune, Ballard, & Smith, 1989; Stanovich, 1991). Glynn et al. (1991) argue that some data suggest that gains made in reading recovery are lost after two years. Also some children do not appear to benefit from the 'reading recovery' programmes and may be seen as having a specific learning disability that requires another form of a programme (SPELD, undated). The details of specific programmes are beyond the scope of this thesis and therefore will only be mentioned in respect to their use for learning problems.

Programmes such as 'recovery reading' in New Zealand (Clay, 1985, 1987b), and 'head start' in USA (Adelman & Taylor, 1993) are just two examples of programmes that have been useful in various countries, although not without criticism as mentioned earlier. In the USA, legislation in the1960s stimulated initiation of a variety of early education programmes, including programmes for children with disabilities. (Adelman & Taylor, 1993; Hebbeler, Smith & Black, 1991; Swan, 1980, 1981). By 1980 over 350 early education projects for those with 'special needs' had been funded but by the end of 1980 there were still about half the States without legislation mandating educational services for children with disabilities under the age of 5 years. The earlier policy of intervention for handicapped students in the USA in 1963 did not recognise learning disabilities as a type of handicap; however, in 1990 amendments were made to the Public Law 101- 476 [Individuals With Disabilities Education Act - IDEA] to include individuals with learning disabilities. Further amendments in 1997 have been made to IDEA to shift the legislation's emphasis from the service provisions of 'special needs' education to the outcome measurement from such service. This means that not only is a service provided but it must prove to be effective (Clay, 1998).

A continuing debate for clarification and refinement of definitions for learning problems and disabilities can be found within the relevant literature

(e.g. Adelman & Taylor, 1993; Ariel, 1992; Chapman, 1992a, 1992b; Clay, 1987a; Graham & Harris, 1989; Hammill, 1990; Hynd, Marshall & Gonzalez, 1991; Kavale & Forness, 1992; Sleeter, 1986; Stanovich, 1991; Swanson, 1991; Siegal, 1989, 1992; Torgesen, 1989, 1991; Ysseldyke, Algozzine, Shinn & McGue, 1982). The most widely accepted definition of learning disabilities in use in the USA today is that provided by the National Joint Committee on Learning Disabilities (NJCLD) (Hamill, 1990). It is as follows:

> 'Learning disabilities is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction, and may occur across the life span. Problems in self-regulatory behaviours, social perception, and social interaction may exist with learning disabilities but do not by themselves form a learning disability.
>
> Although learning disabilities may occur concomitantly with other handicapping conditions (for example, sensory impairment, mental retardation, serious emotional disturbance) or extrinsic influences (such as cultural differences, insufficient or inappropriate instruction), they are not the result of those conditions or influences' (p. 77).

The debate over definitions is largely one over the causes of learning disabilities. At the centre of the field of learning disabilities is the belief that the causes of learning disabilities are due to some brain-dysfunction. According to Chapman (1994, p.12)

> 'Research has not yet proved that learning disabilities are, beyond reasonable doubt, due to brain dysfunction'.

Chapman (1994) argues that a part of the debate is whether the intention of the term 'learning disabilities' should include the area of mild intellectual disability along with mild behaviour problems: should this be so then larger numbers of people could be included and require greater funding. New Zealand does not have an official definition

of learning disabilities, but recognises that there are children who have particular academic difficulties or learning problems (Department. of Education, NZ, 1987).

Whatever conceptual definition of learning disabilities, learning problems or underachievement is chosen, identification depends upon a workable set of criteria to select people. Mercer (1987) argues that there are several problems relating to their identification. These included a lack of consensus regarding the definition, difficulty in operationalizing any discrepancy factor, technically inadequate tests, and inadequately trained teachers. Also the larger the number of students that can be included within a definition requires greater funding for 'special needs' education. It is estimated in New Zealand that 7% of students are consistently identified by specialists as 'learning disabled', but this figure can be as high as 15% if teachers assessments are used (Chapman, 1994). In Cork, Ireland, the estimate is 15% for students underachieving, with the figure possibly being higher in disadvantaged areas (Department of Education, Eire, 1998) Within this thesis an operational means of identifying underachieving students is explained later. The various terms such as learning disabilities, learning problems and underachievement used in this thesis require some clarification to distinguish any fundamental differences or similarities between them. Learning disability, will be considered any disability of the physical senses or brain that impedes the learning process. A learning problem is considered by the author to be the inability to respond for one reason or another to the learning process. This means that a student with a learning problem does not necessarily have a learning disability, but a person with a disability could have a learning problem. Either or both these conditions will cause a student to underachieve or fail to achieve that for which is expected. There are many reasons, some being complex, for learning problems but they will not be dealt with in this thesis other than how the problems may relate to underachievement. The idea that learning disabilities can and should be distinguished from other known causes of learning problems (low intellectual ability, lack of

opportunity to learn, poor teaching, emotional problems) has been challenged in the learning disability literature (Brody & Mills, 1997).

According to Kavale (1980) learning disabilities have more similarities than differences (Brody & Mills, 1997). This view simplifies the problem of identification but may lead to other problems. Adelman (1992, p.18) states;

> 'Failure to differentiate underachievement caused by neurological dysfunction from that caused by other factors has been cited specifically as a major deterrent to important lines of research...'

Academic failure in the form of performance discrepancy has become the most commonly accepted characteristics of the learning disabled and for the underachiever, however, the definition of discrepancy is a complex issue because it may be difficult to measure 'actual' achievement based on standardised achievement measures because of the variety of tests available, or to assess the expected achievement, which is usually measured based on intelligence tests (Kavale & Forness, 1989, 1992; Mercer, 1987). Kirk and Chalfant (1984) consider that underachievement is shown when there is a discrepancy between aptitude identified by IQ, and achievement identified by performance at some test such as a reading test. Many objections to a performance discrepancy being used in an operational definition of learning disabilities can be found in the literature, because of the way in which a discrepancy is identified (Stanovich, 1991).

The main objection against the use of IQ scores for assessing the potential ability of a student in order for a discrepancy to be found between the student's perceived ability and achievement is based upon how intellectual potential may be measured (Stanovich, 1989). Stanovich (1989) considers that the professional use of IQ test scores in the discrepancy definition was based upon 'the mistaken belief that IQ sores were valid measures of intellectual potential' (p. 487). The support of The Psychological Corporaton (USA) in using the choice of IQ tests performance as the

baseline from which to measure achievement discrepancies may have given added weight to the wide use of IQ tests by teachers, schools, professional organisations, and government agencies (p. 487). According to Stanovich (1989) most psychometricians, developmental psychologists, and educational psychologists have now discarded the use of IQ test scores as a measure of potential in any valid sense. IQ tests may be at their best measures of present cognitive functioning (Detterman, 1982; Stankovich, 1989). According to Anastasi (1988), Cronbach (1984) and Thorndike (1963), IQ tests should not be used as measures of intellectual potential (Stankovich, 1989).

Many compensatory educational programmes have been established or are in the process of being implemented because of research into aspects of cultural and educational deprivation affecting 'low socio-economic status' pupils. In New Zealand for example, the Labour Party spokesperson for Education in Parliament favours the introduction of 'homework' centres, especially for students in low income areas. This is because many households lack the parental support for study, and homework is a big element of academic failure. It is inferred that low income families are associated with low parental support, which may be true sometimes, but not necessarily true always. This concern is also expressed by the British Government who require students aged 11 years to reach a better standard of literacy and numeracy by the year 2002. The Education and Employment Secretary in Britain lays the blame of many problems of underachievement on parents and is attempting to remedy the situation within the provisions contained in a Standards Bill, which will set out the parent's as well as school's responsibilities in areas such as homework, truancy and discipline (Christchurch 'Press', 1998a). Research is also being conducted and planned to be completed in 1999 in Cork, Eire to examine various schemes for underachievers, such as 'early start' programmes, homework support, and out-of-school support schemes (Department of Education, Eire, 1998). A.H. Halsey, Director of The Educational Priority Area Project in the United Kingdom (1968)

considered that compensatory education could be used as an approach to the problems of cultural and educational deprivation to ensure that disadvantaged pupils would get an equal share of educational resources (Flude, 1974). The results of various compensatory programmes have been of value, but according to Halsey, the 'aims can only be fully realised if they are accompanied by other social reforms' (Flude 1974, p. 28). It is thought that the 'social engineering' reforms envisaged by the British Government and New Zealand politicians will provide compensatory education and redress some causes of underachievement (Christchurch 'Press', 1998a). However, the tendency is still to apportion blame for underachievement mainly on social factors and students' background.

Without losing sight of the effects of socio-cultural factors on educational achievement, and by recognising the enormous social reforms and finance that would be required to redress differences between socio-economic classes, there are other areas where achievement may be improved by using a wider range of specific cognitive and metacognitive skills such as the teaching of strategies and the use of memory skills that are more appropriate for the students. This is especially necessary for students who may have been affected by their socio-cultural background and low family income status.

This thesis concentrates upon the aspects relating to the individuality of the learner and examines individual 'type' in relation to underachievement. Relationships, are indications of some form of connection or corresponding association existing between people, events and factors. Sometimes a particular relationship may cause an automatic consequence. However, relationships may only be a causal factor if the conditions are appropriate for an expected consequence. For example, a person may have been in contact with a pathogen but not succumb to a disease usually caused by the particular pathogen because of immunity factors being present in the person to counteract the pathogen. In this example a relationship or connection exists between

the pathogen and the person, but the consequence is not what may be expected. This medical analogy can be applied to the meaning of relationship used in this thesis. Because this study is looking for any statistical relationship between individual 'type' and underachievement, any significant correlations between 'type' and underachievement does not automatically mean that individual 'type' causes underachievement, neither does it exclude it from being a causal factor. It is suggested that the characteristics associated or related to individual personality types may be factors that tend to affect achievement if other conditions are present. Some of these conditions will become clear later in this thesis. Therefore, if one individual 'type' appears common among underachievers it does not infer that all individuals of that particular 'type' will underachieve, or that no other 'types' will underachieve.

The method for identifying 'individual type' used for this study is the Lawrence (1984) form of Myers-Briggs Type Inventory (MBTI) (Briggs-Myers & Briggs, 1992) because it considers the personality characteristics relating to a person's preferences and style of decision making. The MBTI is a questionnaire inventory designed to assess a person's individual personality type from responses relating to four dimensions of personality. It is based upon Jung's theory of psychological type using preferences contained within four bipolar scales that will be discussed in Chapter 2 (Briggs-Myers & Briggs, 1992; Jung, 1971).

This approach to the study does not necessarily address the issue of causality between 'type' and underachievement, but in the classroom this issue is not as important as finding out the influence one may have on the other, especially relating to the effect of different learning outcomes. Pintrich and Schrauben (1992) argue that there is an issue relating to the nature of academic tasks, and the links between these tasks and students' cognitive and self-regulating strategies. The different possible preferences in learning styles available suggest that changes in the classroom activity could help student motivation and cognitive engagement. It may be that certain types of

strategies are tied closely to certain types of tasks, for example, specific memory tasks, and that these tasks may be responded to quite differently by different individual 'types' (Dunn, 1990; Pintrich & Schrauben, 1992). This thesis sets out to find some links between individuality and underachievement. It is possible that the personality characteristics relating to preferences and style of decision making, and motivational differences, which vary among different individual 'types', are associated with underachievement. Therefore, this thesis aims to examine aspects relating to individual 'type', motivation, and to suggest approaches that may reduce underachievement. Various forms of motivation are covered in this thesis including achievement and attributional motivation (Dweck, 1986; Weiner, 1979; Weiner, 1984; Weiner, undated; Weiner & Kukla, 1970a,b). The attributional form of motivation is based upon the causal statements or attributions given as reasons for successes and failures, which contribute towards the achievement motivation. These forms will be described in more detail later.

Aims of the Thesis

- To investigate the link between individual 'type' based on the Myers-Briggs Type Inventory, and underachievement among a sample of senior science students.
- To investigate the link between the motivational attributions for success and failure used by underachievers relating to individual 'type'.
- To investigate whether attributes for success and failure are related to underachievement.
- To prescribe some methods of intervention to prevent, reduce, and overcome underachievement.

This study reports the attributions obtained from a sample of underachievers relating to their successes and failures at science. Data was collected by using a confidential

questionnaire and a personal interview. According to Dweck (1986) the motivational patterns of students will considerably influence the attributions given by them for their success and failure outcomes from learning. Dweck argues that children with performance goals associated with a 'maladaptive' motivational pattern are more likely to interpret outcomes in terms of their ability, whereas children with an 'adaptive' pattern will generally attribute outcomes to effort (Dweck, 1986). There may be differences associated with different age groups as well as patterns. The causes or reasons for differences in motivational patterns are many and possibly similar to the factors affecting achievement. These factors will be alluded to throughout this thesis but will not be extensively examined.

Appropriate intervention is required to reduce underachievement and may be essential for accountability purposes as well as for professional ethical reasons. Education is Government funded in many countries and recent increases of funding for special education in USA, England and New Zealand have been programmed for 1998 (Marlborough Express, 1998a; Clay, 1998). New Zealand also has given an extra $9(NZ) million funding towards raising the achievement of students in mathematics and science (Marlborough Express, 1998b). Therefore, a certain level of return is expected from the investment, although the required outcome may not be specified precisely. However, certain structures established within the parameters of the various legislative Acts such as the Public Laws (USA)101-476 and 94-142 , the Standards Bill (England and Wales) and the Department of Education Achievement Initiative (NZ) (Ministry of Education, 1991) ensure that some control is exercised over the outcome measurement from such services. This means that not only is a service provided but it must prove to be effective (Chapman, 1994; Clay, 1998).

Without getting into the philosophy behind national qualification organisations, it is very likely that they may eventually monitor more closely the outcomes from schools and educational bodies and require certain standards to be achieved. Legislative

measures taken by the USA, and the provision of special education by other countries such as New Zealand and England for learning problems and disabilities shows the concern that exists to improve learning and to reduce underachievement. Although the emphasis may be related to 'special needs' causes more associated with learning disabilities as shown within the Public Laws 101- 476 and 94-142 intentions. The intent to improve learning is an important first step, but needs to be followed with methods that in some ways are more appropriate to the needs of individual students, such as using teaching and learning styles that improve achievement motivation. Some successful strategies used by this author, based upon achievement and attributional motivation models (e.g. Ames & Archer, 1988; Biggs, 1984, 1991; Weiner undated; Weiner & Kukla, 1970a,b; Weiner, 1984) and strategy and attributional training (e.g. Borkowski, Weyhing & Carr, 1988; Borkowski, Wehing & Turner, 1986; Carr & Borkowski, 1989; Chapin & Dyck, 1976; Cole & Chan, 1990; Duffy & Roehler, 1989; Dweck, 1975; Pintrich & Schrauben, 1992) are discussed fully in Chapter 5.

Underachievement, or lack of achievement, is becoming an increasing issue relating to accountability within educational organisations and is a concern for most students, who want to learn and try to learn (Adelman & Taylor, 1993). Teachers, parents, and others involved with education from time to time often express concern at disappointing levels of achievement gained by students. This is especially so if the students are attending a school that has a record of high achievement. An important point about underachievement is that it does not only occur with students who may have learning disabilities, but also with very able students (Reis, Hebert, Diarz, Maxfield & Ratley, 1997). There may be difficulty in comprehending that gifted children may have a learning disability and therefore they are rarely identified and often poorly served (Brody & Mills, 1997). It is becoming more commonly accepted that high ability and learning disability can both be present in the same individual, although empirical evidence suggests that relatively few students with learning disabilities who are 'gifted' are identified as such or given special services (Brody &

Mills, 1997). A recent conference in New Zealand (February 1998), conducted by the Ministry of Education and Organisation for Economic Cooperation and Development (OECD) was titled 'Combating Failure at School'. Lawton (1998) stated at this conference that 50% of students within the OECD countries leave school without any formal qualification and stated that underachievement was a major problem especially affecting certain ethnic and low socio-economic groups. This is similar to educational sociological views expressed in pre-1980s regarding the groups tending to underachieve. Some attempt will be made within this thesis to deal with other learning problems and their causes, but only as they may be affected by certain factors contained within the limits prescribed for this thesis.

There is evidence to support the view that learning and behaviour problems are closely related (Adelman & Taylor, 1993). Research by Ballard (1978, cited in Cohen, 1981) found that most of the cases of severe misconduct requiring a student to be removed from the classroom occurred in situations where teacher style and student 'type' were mismatched. This may occur when there are differences between the teaching style and student's preferred learning style, or where the progress rate for learning is impeded. A recent case has been highlighted where a student of 15 years of age was told at the age of eight that he had behavioural problems, which continued into his secondary schooling. He has just completed his second year of an engineering degree with A+ grades. According to his parents his behaviour problems centred on him being bored, aggressive and frustrated with the teaching style and not being able to accelerate his learning (Christchurch 'Press', 1998b). Fortunately through the encouragement from his parents and assistance from a Community College the student developed his own learning style preference and overcame the behaviour problem. Examples of this kind may be rare but still exist. Behaviour problems in this context are those type of behaviours that disrupt others within the classroom. A learning problem does not necessarily cause a behaviour problem, but it may provide additional impetus for bad behaviour. It may be difficult to decide the exact cause of a

behaviour problem, but experience, and evidence is available to show that improved achievement from learning has the effect of reducing behaviour problems (Ayllon & Roberts, 1974). A significant linkage can usually be found between learning problems and bad behaviour (Adelman & Taylor, 1993). Within one school used in this study, 100 students (approximately 9-10%) were suspended during 1997 for various acts of misbehaviour (Marlborough Express, 1998c). There is therefore a need to improve achievement from learning and so reduce underachievement and bad behaviour.

This thesis adopts a transactional view of learning by recognising that learning depends on person-environment transactions. The learner for example, brings to a learning situation the accumulated capacities and attitudes that have been gained over time, which may be considered an important part of the students' background, also his or her current state of being and behaviour. These 'person factors' interact with the learning environment, which consists of the instructional processes and content and the physical and social context in which the instruction occurs (Adelman & Taylor, 1993). According to Adelman and Taylor (1993) transactions between the learner and the environment may not only produce positive enhanced learning but also various kinds of deviant or disrupted learning.

Research Questions

The aims of this thesis stated earlier are focussed below in the following research questions relating to individual 'type', attributions used for success and failure, and underachievement:

- Is the Myers-Briggs Type Inventory form of identification of individual 'type' related to underachievement?
- Are statements or attributions given for success and failure related to the individual 'type' of learner?
- Are statements or attributions for success and failure related to underachievement?

- Are there suitable intervention approaches that may reduce or prevent underachievement?

The motivational aspects of this study are mainly related to the level or intensity of achievement motivation, which can be inferred from the written responses given by the students during this study, and statements (attributional motivation) given by the underachieving students for their failures and any previous success by them. There is a relationship between achievement motivation and attributional motivation and this is discussed more fully later in this thesis.

Research Overview

The research was designed to be carried out in three secondary schools within a rural area of New Zealand with similar regional interests, and with a record of good academic results gained from national examinations. This design was used to reduce any possible effects of other outside regional interests, such as differences in social economic factors, which may act as a confounding variable. A rationale behind the population selection used for this research was based upon the writer's experience with senior science students from this area and upon comments made by other teachers regarding the lack of achievement by students, whom they felt should be performing better at science. The number of possible underachievers, based upon an expected 10% if all were available would be a relatively small number, because there were only three colleges within this area available for the study. Unfortunately all the possible students were not available, so only the 37 students available were involved in the study. This was not seen by the writer to be of a great disadvantage because the sample was a 'purposive' sample selecting only those with a specific learning problem causing underachievement (Dixon, Bouma & Atkinson, 1988). Similar small 'purposive' samples can be found among research literature, as shown in the following examples: 'An intensive study of 32 gifted children' (Barrett, 1957); 'A comprehensive study monitoring in learning disabled and average students', was conducted with 40 students' (Bos & Filip, 1984); 'A comparison of 24 students with learning disabilities

to low achieving and higher achieving students on three dimensions of social competence' (Bursuck, 1989); 'Classroom applications of mnemonic instruction: acquisition, maintenance, and generalization, with 19 students' (Scruggs & Mastropieri, 1992).

The population used, were 37 selected sixth-form science students who were underachieving, as shown by their record of past results, or considered by the subject teacher to be acutely underachieving. The interpretation of `acutely underachieving' was left to the subject teacher, but it was suggested that they include any student that had previously gained good results and had subsequently displayed disappointing results and performance. Each of the subject teachers had little trouble identifying their `acute underachievers'. The schools differed from each other in that one was a girls' college, one a boys' college and the other a coeducation college. The number of students studying sixth-form science varied between the schools and some additional science related subject areas were included such as Horticulture and Social Biology. Each school was formally requested to take part in the research and acceptance and full cooperation was gained from the schools and their Science Department staff.

A description of the aims, method, and ethical procedures to be used for the research was supplied to the schools and a personal visit was made by the researcher to explain the research proposal. Students were also advised about the purpose of the research and informed about the confidentiality and privacy of their responses to the questionnaires used. An offer was made by the researcher to provide information, relating to the results of the research, to the staff and students used in the research.

Students were not informed at any stage that they were selected because of their underachievement at science, but told that they were selected as a small sample from their science class to provide data that could be useful to raise the level of achievement of science students. Aspects relating to confidentiality and anonymity of

the information gained from the questionnaires were given to the students by the researcher and this information was gathered only by the researcher.

An idiographic style of research (Garduque, Lerner & Lerner, 1990) was preferred so that the participating students would be encouraged to assess themselves instead of comparing themselves with other students. This form of ipsative analysis aims to assess how much the individuals valued each concern expressed in the questionnaires. In this way, individual repertoires would be obtained that could be used to identify trends within various individual 'types', but still recognising the uniqueness of the individual (Garduque et al.,1990).

Chapter Summary.

Several issues have been mentioned so far regarding the social causes of underachievement; the accountability possibilities that can arise relating to school performance; the motivation levels of underachievers, and the possible effects of individual 'type' on underachievement. A review of these issues is provided in Chapter 2. Chapter 3 contains the research methodology used for this study, including an explanation of the instruments used. Chapter 4 contains the result tables, an analysis of the data, a discussion of the results as well as characteristics identified from the responses made by the different Function Pair combinations. Chapter 4 also includes a profile of the common characteristics of 'individual types' that are likely to underachieve at science. Chapter 5 discusses the implications drawn from with this study and suggests intervention approaches that may be used to reduce or overcome underachievement.

Chapter 2 -

Literature Review

This Chapter contains a selection of literature reviewing some important issues raised within this thesis concerning: accountability and 'special needs', underachievement, causal factors of underachievement, achievement motivation, attributional motivation, individual 'type' and the nature of individuality, and factors relating to the Myers-Briggs Type dimensions. The consequences of underachievement reach beyond the individual student, although it is probably observed initially in the students' performance and may be felt by them first. It has affects upon other areas of society. This is evident in the concern shown by government agencies and legislation enacted to improve achievement, for example the USA Public Laws 101- 476 [Individuals With Disabilities Education Act - IDEA] and 94-142 [Education for All Handicapped Children], the England and Wales Standards Bill, and the New Zealand Achievement Initiative and Qualification Authority.

There is seen to be an increasing awareness within education generally to the outcomes of education, particularly relating to underachievement. The activities of organisations such as Educational Review Offices and the New Zealand Qualification Authority (NZQA), and 'special needs' and remedial programmes in many countries, are examples of educational endeavours to monitor and improve learning outcomes. The NZQA is a crown agency whose role is set out in the 1990 amendment to the Education Act. It is responsible for establishing a framework for secondary schools and post graduate qualifications, and for overseeing and setting standards for those qualifications. The standards are designated learning outcomes endorsed by international bodies such as the World Bank and OECD (New Zealand Qualification Authority, 1998). The Standards Bill in England and Wales appears to have a similar function to the NZQA framework (Christchurch 'Press', 1998a). Therefore, accountability is likely to be a future educational issue and is mentioned briefly within this thesis because it will be related to underachievement and will be important for

educators. Other aspects such as the motivational effects upon achievement and underachievement, with the theoretical coverage of attributional and achievement motivation are included in this Chapter. The nature of the individuality of students is considered important as it relates to motivation and achievement and is discussed in this Chapter also.

Accountability and Special Needs

Accountability within education is becoming an increasingly important issue, particularly in relation to levels of achievement. Questions are being asked by all manner of people, politicians, teachers, parents, students, and teachers regarding the learning outcomes from educational organisations, the purpose for which they are funded. Increased funding in recent years has been directed towards reducing underachievement, as evident from increases for 'special needs'; therefore, it invokes a legitimate concern by providers and users of education to get good value for what is being paid for; this surely is a part of accountability. This concern about learning outcomes has led to the introduction of legislative measures such as the Standards Bill in England and Wales, and the NZQA and Educational Review Office in New Zealand and various Public Laws in the USA.

The tendency within the New Zealand education system at this time of writing is to place a major focus on underachievement or lack of achievement in the schooling process (Chapman, 1994; Lawton, 1998; McAlpine & Reid, 1987). This phenomenon is evident in the disproportionate emphasis and funding given to remedial programmes for underachievers as compared with 'gifted' students or high achievers. There are more specialist teachers and special remedial programmes for underachievers than for 'gifted' students (McAlpine & Reid, 1987). In New Zealand, up to 1987, the number of hours allocated during teacher training for 'special needs' education was small in relation to the need (McAlpine & Reid, 1987). According to that author, only one out of the five secondary teachers' training colleges included compulsory three hour

modules on 'special needs' education, for trainee teachers. This 'special needs' education included topics relating to 'gifted' students and for those with learning problems or difficulties. The remaining four colleges included electives for 'special needs' but in their response to a questionnaire, only a small number of students showed they had taken an elective (McAlpine & Reid, 1987). Massey University College of Education (NZ) has introduced in 1998 for the first time, a compulsory course on special education for the Bachelor of Teaching degree. Until now it was an optional course for second year students, covering a wide range of diverse needs within the regular classroom. The course paper covers special education and children with special abilities and learning disabilities. It includes topics concerning how to cater for learners with either behaviour or learning diversity. There are also advanced level papers and master papers specifically on Gifted and Talented, and Learning Disabilities, but these are optional courses (Carroll-Lind, 1998b). No data is available at the time of writing (1998) regarding other Colleges of Education in New Zealand. It is assumed similar approaches towards 'special needs' training is introduced, because of the increased prominence being given to learning outcomes. The introduction of the Achievement Initiative by the Department of Education in 1991, and the increased funding for 'special needs' and for science and mathematics education in 1998 suggest that more importance be being given to reducing underachievement (Chapman, 1994; Marlborough Express, 1998b). Therefore, programmes that can identify causal factors of underachievement, and provide intervention approaches to reduce underachievement will become essential requirements for educators. This thesis contends and examines two areas; individual 'type', and motivation that are related to underachievement, but also identifies other factors and issues concerning underachievement that are used for this thesis. Some of these issues are given in the literature review in this Chapter.

Special education for students with learning problems and disabilities is becoming more available, with some countries (for example, the USA and England and Wales)

legislating for such programmes. The code of practice contained within the 1997 Amendment to the 1993 Education Act in England and Wales makes provision for the identification of students with special educational needs (SENS) (Special Education Needs Service, 1998). Wales has established a five-stage approach, managed by some special education needs consultant with a professional support team made up of teachers, behaviour specialist and a learning disabilities specialist involved within the field of hearing, visual impairment, speech and language difficulties. Students with special educational needs are referred by school staff and specialist teachers to the Local Educational Authority who may then initiate action through a Special Education Needs Structure (SENS) to provide a package of support through specialist teachers (Special Needs Service, 1998).

Other countries may not have legislated specifically for 'special needs' education but there is evidence, particularly in New Zealand to show that some provision is made for 'special needs'. The New Zealand Government has decided to make a substantial payment of a total of $19.5 (NZ) million for the next three years, starting in 1998 to provide support for preschoolers and infants with special education needs. This is a part of a Special Education 2000 programme. This funding increases by 33% the amount of funding per child, allowing more than 12000 children to receive special education services (Marlborough Express, 1998a). The whole area of learning problems and learning disabilities is vastly unrecognised and under funded and requires more research to find out the best level and mix of services to enable students to get most from their learning. A research programme in Cork, Eire mentioned earlier, set in action and to be completed in 1999, is designed to find out the effectiveness of various schemes for underachievers (Department of Education, Eire, 1998). The amount and type of intervention are debatable, largely because of the vagueness in definition, and because much is expected to be accomplished within the scope of regular classroom teaching combined with the occasional withdrawal of students for special work. Public Law 94-142 [Education for All Handicapped Children] in the

USA includes guidelines for intervention requiring a multi-disciplinary team to prepare individualised education programmes (IEPs) for each student seen as possibly having a learning disability (Adelman & Taylor, 1993).

The greater provision and funding of special education in New Zealand for students with learning problems or learning disabilities support the view that a lack of achievement by the less able may be the more important role for special education (Marlborough Express, 1998a). However, 'gifted' or talented students often underachieve, but may not be so easily identified, particularly if norm-referenced assessment methods are used (Brody & Mills, 1997). The use of different kinds of assessment procedures may show underachievement in different ways (Gronlund, 1981). For example, norm-referenced tests usually show a distribution of scores around the average score. Therefore, a student's performance may be described according to where the score lies in relation to the average. For example a student may be average, below average or above average for a test result. Average scores can be based upon the individual class results, or the total school results from the same test. Both forms of result can be found in use within schools. Various descriptions of the distribution of scores can show the relationship of each student's score with others, and the five grades such as A to E, or 1 to 5 are often given according to the distribution of the score. Sometimes test results may be given based on the student's class or form, or for the entire school sitting the common test. For example, if a high-ability class gains a high class average score for a test, any score below the average for that test appears as underachievement, yet that performance in relation to other classes of lower-ability taking the same test may be satisfactory if a general average score is obtained from all the classes taking the test. The same results for this high-ability class may be seen quite differently if a criterion-referenced test is used, because the assessment is based upon a predetermined required standard of performance and students are assessed from having reached that standard. Therefore, students of the high-ability class who may have been below their class average in the norm-referenced

test could be viewed quite differently regarding achievement because they may have reached the required criterion.

Assessment is important, especially for accountability reasons, because it will reveal discrepancies between the learning outcomes. According to Mercer (1987), it may be difficult to measure 'actual' achievement based on standardised achievement measures, or to assess the expected achievement. It is recognised that care and sensitivity are required in the use of psychometric measurement to make conclusions regarding underachievement (Nash, 1987). Although a trend for underachievement may be revealed in the results regarding a research hypothesis, the cause may not be so easily established. It may however show whether the result obtained is statistically significant or not. Correlation factors are not necessarily the same as causal factors. A factor may show a high correlation but not be a causal factor, but a causal factor may be more easily substantiated by its correlation.

According to Nash (1987), studies in which individual results are obtained in order to make predictions about other possible results, such as the performance of other groups of people, presents several theoretical and methodological issues. First, there may be difficulty in relating the results to other groups. This could be especially so regarding intellectual attainment. For example, a collection of data obtained from one ethnic group may be completely different to that obtained from another ethnic group. In New Zealand past academic performance by Maoris was different to Europeans; therefore, predictions upon European performance based upon Maori figures or vice versa could be misleading (Nash & Harker, 1988). A similar argument could exist for differences in academic performance between other races. Comparisons are best made from samples possessing similar features, unless some specific reason exists to show differences between the two different samples. Similar problems could exist with comparing and using results obtained from one socio-economic class to predict for a different socio-economic class, or from one regional area to another. Second, there

could be difficulty in ascribing differences in intellectual attainment in a population from the results of sampling. It is possible that a group may possess properties that individuals do not possess, yet the information was gained from individuals about that group (Nash, 1987). While it is possible to discover some differences among group means (using data collected from individuals), it may be difficult to say anything about the importance of these measures. This idea will be carefully considered throughout this thesis.

Underachievement

Given the difficulty in defining learning disabilities, as stated earlier, underachievement poses a similar problem. A social consensus can recognise underachievement as a condition affecting many students, but may not so easily accept the causes for it, or describe accurately what underachievement is. For example, if two students were to obtain a similar low score for a test, the reasons for the low result could be completely different. One student, for example may not have the cognitive skills, nor possess the learning experiences necessary to gain a good result, whereas the other student may have the skills but not be interested in sitting the test. Both situations can be considered underachievement if assessed or measured against some standard, but for the first student in the example it is clearly a case of non-achievement because of a lack of cognitive skills or learning experiences. For the second student it would be underachievement because of motivational reasons.

Often it is very likely that students may be classified as underachievers because of their lack of effort or ability, and blame be attributed to them. But if the students had not received adequate learning experiences to develop cognitive skills to improve achievement, then they would not be to blame for lack of achievement. The different reasons given in this example point to the difficulty in providing the means to remedy the problem, and for establishing standards and conditions for assessing underachievement. If an equal opportunity is provided for all students to receive

similar learning experiences, and results are assessed in relation to some criterion, then achievement as well as underachievement can be measured or assessed in relation to the criterion. However, equality of an outcome from learning is rarely equal, even although students may have received similar learning experiences. Therefore, the contributing causal factors of underachievement, such as individual 'type', learning disability, learning problem, or motivation need to be addressed and remedied to make schooling more accountable.

In order to have some definition to operate with, this writer has opted for a usable or workable description for underachievement that can be an 'operational' definition. According to Swanson (1991), an operational definition needs to specify the conditions or procedures by which the construct of underachievement can be recognised or measured. It should give a clear indication of discrepancy showing where the student's achievement does not measure up to his or her potential. Swanson (1991) says that there does not appear to be any evidence to include exclusionary criteria such as other handicapping conditions stated in the NJCLD (see page 4) definition of learning disabilities, which may cause underachievement, within the operational definition (Fletcher & Morris, 1986; Swanson, 1991). The indicators of underachievement may not be as exact as wanted, but still be obvious enough to be recognised. Therefore, within this study, underachievement occurs or exists when a student's performance in some predetermined task is lower than was planned for, or where a student fails to achieve at the level expected. This implies that the operational definition of underachievement is compared with an expected standard. Underachievement differs from non-achievement because at least some achievement may be gained in the former, although it may be below an expected level or of an unsatisfactory standard leading to future non achievement. Non-achievement is a more serious problem for students and schools and may lead to behaviour problems among children. There may be difficulty in determining or distinguishing non-achievement from underachievement, except by the degree of performance of the student in relation

to some specified criterion or condition. Factors causing underachievement can cause non-achievement and these will be discussed later. However, both non-achievement and underachievement are important problems within schools and therefore become increasingly an accountability issue.

The formation and management of differential attainment (Nash, 1987) are complex and will not be dealt with in detail in this thesis. However, there are many factors affecting school achievement that cannot be ignored. For example: the student's socio-economic status (SES) (e.g. Flude, 1974; Lawton, 1998; Nash & Harker, 1988), their ethnicity (e.g. Lawton, 1998; Nash, 1986; Nash & Harker, 1988), their physical conditions and their social class background (e.g. Flude, 1974; Lawton, 1998; Nash, 1988), their motivation (e.g. Ames & Ames, 1984; Atkinson & Raynor, 1974; Biggs, 1984; Deci & Chandler, 1986; Deci & Ryan, 1985; De Charms, 1976; Department of Education, Eire, 1998; Dweck, 1986; Nicholls, 1979, 1984; Weiner, 1984), their learning style (e.g. Biggs, 1979, 1984; Dunn, 1990; Lawton, 1998; Schmeck, 1983, 1988), and their prior knowledge (e.g. Alexander, Schallert & Hare, 1991; Bereiter & Scardamalia, 1989; Biggs, 1991; Bjorklund, 1987, 1990; Chi, 1985; Garner, 1990; Glaser, 1992; Pressley, Borkowski & Schneider, 1987; Shuell, 1986).

According to Flude (1974), and Nash and Harper (1988) pupils from middle-class homes were more likely to succeed at school than were of lower SES pupils because of the differences associated with the quality of their cultural experiences. This has been found in the educational attainment of pupils with a similar measure of ability but from different social backgrounds (Flude, 1974). A Schools' Council Working Paper (1970) entitled 'Cross'd with Adversity' suggests that a theory of educational failure be rooted in notions of social and cultural deprivation. The report states:

> 'So many aspects of the home environment are significant, its physical resources, the beauty or squalor of its setting, its emotional climate, the stimulus and facilities it affords for intellectual, social and emotional

> learning and the degree of awareness of educational and occupational opportunity it affords' (Schools Council Working Paper, 1970; cited in Flude, 1974, p. 21).

Many of these factors cannot be changed by the school, but the effects of them probably can be relieved or overcome by recognising that there are other factors that can be changed. Matching teaching styles to learning styles and motivational strategies can be used by schools to reduce underachievement, by that redressing other causes of underachievement (Cohen, 1981; Marshall, 1990; Zeisset, 1991).

Previous research by this author in 1994, found that individual 'type', as identified by using a derivation of the Myers-Briggs Type Inventory, was related to achievement and to preferences in learning style (Briggs-Myers & Briggs, 1992). This study was conducted with third and fourth-form social studies secondary school students taught by the same teacher. A statistically significant difference ($p. < 0.05$) was found within the study, suggesting that achievement is related to the students' individual 'type', showing that certain types within the study group were likely to achieve higher achievement than others. The student 'types' who preferred the teaching style of the subject teacher had a higher level of achievement motivation and gained higher results from classroom tests (achievement motivation will be discussed later) than students who did not prefer the teaching style. Where a difference was found between students' preferred learning style and the teaching style, a significant difference in achievement was found. The students who gained low achievement were those showing a broad mismatch between learning style preference and teaching style. It is suggested that achievement motivation be affected by a mismatch between preferred learning style and teaching style. Therefore, it is justifiable to assume that the characteristics associated with individual 'type' may also be some factors in underachievement.

Figure1, has been constructed to show factors that may affect both achievement and underachievement, but for this thesis only underachievement will be emphasised. The

rationale behind the model in **Figure 1** has been derived from personal anecdotal experience and research by this author, from the work of Nash (1986) dealing with the formation of differential attainment in education, and from work on the effect of learning styles upon achievement by Dunn (1990) and Biggs (1979, 1984), with the motivation effects upon learning (e.g. Ames & Ames, 1984; Atkinson & Raynor, 1974; Biggs, 1984; Dweck, 1986; Weiner, 1979, 1984, 1985; Weiner & Kukla, 1970; Weiner & Potepan, 1970), and studies on the nature of individual 'type' (Briggs-Myers, 1989, 1992; Lawrence, 1982, 1984; McCaulley, 1990), and factors relating to a student's background (e.g. Biggs, 1991; Bereiter & Scardamalia, 1989; Bjorklund, 1985; Bourdieu, 1971; Chi, 1985; Glaser, 1992; Lawton, 1998; Nash, 1986; Nash & Harker, 1988; Pressley et al., 1987;.Shuell, 1986).

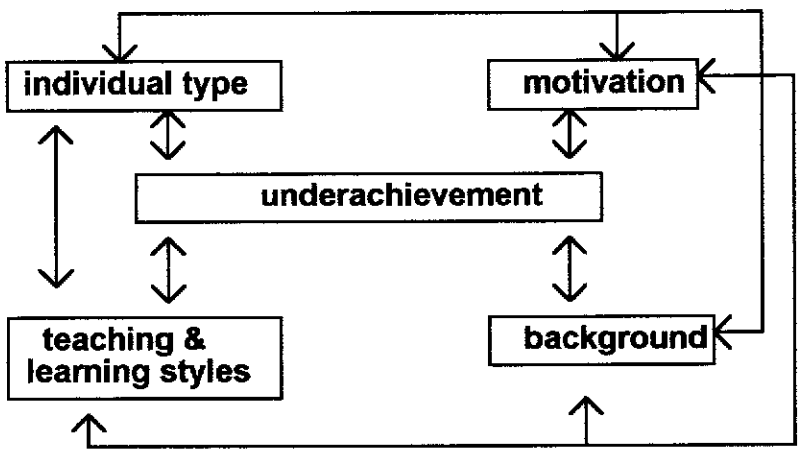

Figure 1. *Factors affecting underachievement.*

The arrows in the model (**Figure 1**) show the interactions that may occur between the factors which are defined on page 31 to directly, or indirectly influence underachievement. Each of these factors may also be affected by underachievement. These factors will be discussed in this thesis as far as they may involve underachievement. The factors of motivation, learning style, teaching style and background, for example, will directly affect underachievement, whereas individual 'type' may be indirectly involved because of its effect upon the other factors. There

are differences in learning style preferences associated with individual 'types', and any mismatch between the teaching style and the preferred learning style can cause underachievement (Cohen, 1981). Therefore, learning style and teaching style may be identified as the direct causal factors because they can be effectively changed to overcome the underachievement, but individual 'type' would be considered an indirect causal factor and could not be changed. Although individual 'type' tends to be seen as an indirect causal factor, it is suggested in this thesis that it be a primary factor because it may strongly influence the other factors. Research by this author mentioned earlier, found a statistically significant difference in achievement between 'type'. A difference in achievement was also found for 'types' where there was a difference between preferred learning styles and teaching style. These results suggest that differences may also be found in the curriculum subject choices preferred by different 'types'. For example, some 'types' may prefer quantitative style subjects such as science, and mathematics, and others may prefer non quantitative ones like art, music, and creative writing. Individual 'type' can therefore be recognised as an important factor relating to underachievement.

An interaction between learning style and motivation is very likely to occur. For example a student with low achievement motivation, using a learning style not preferred by the student, is likely to underachieve and may view failure as caused by a lack of ability. This type of attribution often affects the student's self-concept and further lowers the motivation. Conversely, if achievement is improved the student's motivation may be improved. If students can use a learning style preferred by them then they may subsequently improve their motivation and reduce underachievement. According to Reis et al. (1997) achievement and underachievement are not disparate ideas. Within a study conducted by these researchers with talented students, it was found that students usually experience both periods of underachievement and achievement throughout their school careers. This was the case for many students used in the study for this thesis, who had achieved good results at other school subjects, but

underachieved at science. There are some students who may experience more underachievement than achievement and develop for themselves a history and background of underachievement that may affect their self-concept and future achievement. It is very likely that the personality characteristics associated with individual 'type' play a big part in the way a student responds to different school subjects and different learning and teaching styles, which may lead to underachievement.

The degree to which these factors affect underachievement can vary considerably and The arrows in the model (**Figure 1**) indicate the interactions that may occur between the factors which are defined on page 31 to directly, or indirectly influence underachievement. Each of these factors may also be affected by underachievement. These factors will be discussed in this thesis as far as they may involve underachievement. The factors of motivation, learning style, teaching style and background, for example, will directly affect underachievement, whereas individual 'type' may be indirectly involved because of its effect upon the other factors. There are differences in learning style preferences associated with individual 'types', and any mismatch between the teaching style and the preferred learning style can result in underachievement (Cohen, 1981). Therefore, learning style and teaching style may be identified as the direct causal factors because they can be effectively changed to overcome the underachievement, but individual 'type' would be considered to be an indirect causal factor and not be able to be changed. Although individual 'type' tends to be seen as an indirect causal factor, it is suggested in this thesis that it is a primary factor because it may strongly influence the other factors. Research by this author, stated earlier, found a statistically significant difference between 'type' and achievement. These results suggest that differences may also be found in the curriculum subject choices preferred by different 'types'. For example, some 'types' may prefer quantitative style subjects such as science, and mathematics, and others may

prefer non-quantitative ones like art, music, and creative writing. Individual 'type' can therefore be recognised as an important factor relating to underachievement.

The factors shown in **Figure 1** are likely to interact or combine to cause different effects, both positive or negative, on underachievement. For example, if there is a mismatch between the teaching style and preferred learning style, or between learning style and individual 'type', then motivation is likely to be affected and underachievement will result, but if the learning style is changed to suit the individual 'type', then motivation and achievement will improve. Similarly a student's level of underachievement will affect the student's motivation and contributes towards his or her background experience, and possibly has a cyclic effect upon motivation and underachievement. There are many factors that contribute to a student's background and some of these will be defined on page 40. All the factors shown in **Figure1** may be causal factors of underachievement, but the effect they have will depend upon other factors such as the size of the cause. For example, students with a history or background of low achievement at school may not possess sufficient motivation to rise above their previous performance levels unless specific programmes of intervention are provided. However, a motivation problem for students with a history of success may need to be dealt with differently. It is therefore essential to recognise as many factors as possible that may cause underachievement.

Terms used in **Figure 1** are explained in detail below.

Individual Type : This refers to a personality type as identified by using a Myers-Briggs Type Inventory (MBTI) form of analysis programme. According to McCaulley (1990) the MBTI has become one of the most widely used tools for working with normal populations and correlates well with other tests measuring similar factors. For example, a test by Eysenck for extroversion-introversion correlated at 0.74 level ($p. < .001$) (Steele & Kelly, 1976). The MBTI programme identifies and uses four bipolar scales relating to individuality and classifies 'type' by using four letters

corresponding to personal choices made from a questionnaire about the four scales. The result is described as one of the sixteen possible combinations shown in Table 1A, such as ESTJ. The scales used, show the choices made by a person to questions relating to two distinct poles of preference to decide the relative preference of one trait over the other. For example if a person chooses more responses agreeing with extroversion than introversion, then he or she would be identified as possessing a tendency towards extroversion. The scales represent a continuum between the two poles. Therefore, scores may be found between these two poles, but likely to be more towards one pole than the other, showing the tendency of the person towards a particular trait (McCaulley, 1990). These scales are:

- Extroversion - Introversion
- Sensing - Intuition
- Thinking - Feeling
- Judging - Perceiving

The first scale assesses the direction in which students prefer to direct their energy; for example, they may direct their energy outwards towards the world of action, people or things, or inwards towards ideas and private things. The second scale assesses how a person perceives information; the third scale assesses how decisions are made, and the fourth scale assesses how a person prefers to relate to the world outside or beyond him or her (Briggs-Myers, 1989; Briggs-Myers & Briggs, 1992; Lawrence, 1984; McCaulley, 1990). The four scales are briefly summarised in

Figure 2.

Scale 1	Introversion	-	Extroversion
	Energised by what goes on in the person's inner world. Inwards looking towards ideas and private things.		Energised by what goes on in the person's outer world. Outwards looking towards the world of people and action.
Scale 2.	Sensing	-	Intuition
	Give most attention to facts that come from personal experience. Realistic and practical.		Give most attention to meanings behind the facts. Imaginative and inspirational.
Scale 3.	Thinking	-	Feeling
	Makes decisions by examining the facts.		Makes decisions by paying attention to personal values feelings.
Scale 4.	Judging	-	Perceiving
	Show reactions based upon thinking and feeling. Prefers orderly and structured activities.		Show reactions based upon sensing and intuition. Prefers flexible and spontaneous activities.

Figure 2. *Summary of the Four MBTI Scales of Individual Type.*

An important feature found within the MBTI is that it offers a functional concept of 'type' and the effects of total individuality rather than dealing with discrete traits. This feature is important when considering the results found from separate scales of the MBTI such as for the Extrovert - Introvert scale or for the Functional Pairs, which consists of the perceiving and judging scales. The four categories within these scales that are known as Function Pairs are; Sensing-Thinking (ST), Sensing-Feeling (SF), Intuition-Thinking (NT), and Intuition-Feeling (NF) (Briggs-Myers & Briggs, 1992; McCaulley, 1990). According to Briggs-Myers and Briggs (1992) and McCaulley (1990) the core of the MBTI developmental model is the assumption that one of the four functions denoted by the second and third letter - that is for a ESTJ type, either the 'S' or the 'T' function in the example - will lead or be dominant over the other one. This applies to the way a person obtains information and how they make decisions. In the example given, the 'T' factor, representing 'Thinking' would be the dominant one

for decision making. The other letter, 'S' shows that 'Sensing' will act as an auxiliary function in the preferred way information is perceived by 'type' used in this example.

The Function Pair concept has been applied to a cognitive style approach in a wide range of settings, such as learning style theories, business management and work environment preferences (e.g. Barger & Hoover, 1984; Frisbie, undated; Keen & Bronsema, 1981; Singer, undated; Mitroff, 1983). According to Singer (undated) personality research is a potential resource for revealing significant information about the way students process data in learning situations, therefore making the knowledge and use of the MBTI valuable for education. The Function Pairs ST, SF, NT, and NF can be recognised as representing four cognitive styles because the functions represent mental action in perception and decision making (Frisbie, undated). Other different views and approaches derived from the MBTI, such as Eggins (1979, cited in Lawrence 1984, p.10), Keirsey (1983), and Frisbie (undated) relate particularly to temperament, and appear useful for education (e.g. Hoffman & Betkowski 1981; Hoffman, Waters & Barry, 1981; Frisbie, undated; Nisbet, Ruble & Schurr, 1982; Roberts, 1982). An important difference between the Myers-Briggs concepts, and temperament models, such as Keirsey's (1983), is that the MBTI is based upon Jung's (1971) theory of internal dynamics of psychological functions instead of the external manifestation of emotions, evident in the 'characteristic dispositions arising from emotions...' (Bruno, 1986; Frisbie, undated; McCaulley, 1981). The advantage of one approach over the other will not be argued in this thesis; therefore, consistency will be maintained by keeping to the Myers-Briggs descriptions. More detailed features relating to the Myers- Briggs dimensions are given on page 59.

Teaching and Learning Style: (Refer to **Figure 1**) In recent years the idea of individual learners' preferences has become an important educational topic. Webster (1993) states:

> 'That individual 'type' and style influence not only learning but also what students want to learn and how they want to learn' (p. 259).

Many studies have been made regarding learning styles: De Bello (1990) compared 11 studies and found a variety of definitions. One such definition provided by the National Association of Secondary School Principals' Learning Styles Task Force - USA, (Keefe & Monk, 1986; DeBello, 1990) will be accepted and used within the context of this thesis :

> 'Learning styles are the characteristic cognitive, affective, and psychological behaviours that serve as stable indicators of how learners perceive, interact with, and respond to the learning environment' (De Bello, 1990, p. 203).

There are several principles given by Dunn (1990) regarding learning styles. They are:

- Each individual has a learning style and will learn more when taught with a style that suits the individual.
- Individual differences in style occur across culture, socio-economic levels, and classrooms.
- No learning style is better or worse than another, but may be more, or less effective for an individual depending on the match between style and 'type'.

Dunn, Dunn, and Price (1989) and Dunn (1990) have developed a learning style analysis model consisting of 21 elements within five main categories. These five categories are: environmental, emotional, sociological, physical, and psychological. Students are affected by these elements in varying degrees. The extent to which a student may be affected depends upon any match or mismatch between the student's preference for an element, and the opportunity for the student to apply the preference to his or her learning. For example, within the sociological category, a student's preference may be to work in a group situation and be permitted to talk through

problem tasks with other students; this may not be an acceptable practice for the teacher and therefore, will probably affect the student's learning. Some students may prefer global learning, where he or she needs to see how and why the new aspect of learning relates to the whole picture. This will contrast with the analytic style of another learner who may not be so concerned with the whole picture, but only with a part in much detail. Several students who participated in this study gave, ' change of a teacher or teaching style as necessary to improve their achievement'. Views expressed by Dryden and Vos (1997) and Dunn and Dunn (1988) regarding the amount of information remembered by students from various teaching styles are important. It was found in a study by Dunn and Dunn (1988) that only 30% of students remembered 75% of what they heard during a normal class, and 40% retained 75% of what they had seen or read. A significant relationship between the various elements of the Dunn (1990) model and individual 'type' was found by this researcher, using the ideas contained within the Dunn model. Therefore, this aspect is considered relevant to this thesis because of the effect it may have upon achievement motivation.

Students should be encouraged to develop their own effective learning styles, through guided experience based upon personal choice from different styles offered.
Learning styles probably can be modified by students through the provision of choices that can be included within learning activities. For example, there are some individual 'types' who prefer to work mainly on their own with ideas, and occasionally within a group, whereas other 'types' may prefer mainly working in groups, and occasionally on their own. If these two styles of learning are offered to a class of students within a lesson, then the students can make a choice and therefore modify their own learning conditions. Choices can be offered between doing practical work, which may best suit a 'kinaesthetic' or a 'tactile' learner, or to offer theoretical work suited to an 'auditory', and 'visual' learner A kinaesthetic learner learns best by involving movements of his or her body in the learning situation; a tactile learner by using touch, an auditory learner by hearing, and a visual learner by seeing (Dryden & Vos, 1997). There are many

other ways beyond the examples given in which choices related to learning styles can be incorporated within the classroom to improve learning outcomes. In this way teachers can avoid as much as possible any mismatch between their teaching style and certain individual 'types' and by that improve learning and reduce underachievement. The influence and importance of individual 'type' in relation to achievement are again emphasised.

Biggs (1991) describes three basic approaches to learning which have various effects upon learning and the student and need to be recognised. These are related to learning style, but not necessarily related to the individuality of the learner. Biggs termed these as: a surface approach, a deep approach, and an achieving approach. In the surface approach, a focus is directed towards selected details, which students are required to reproduce accurately. In this approach, motivation appears mainly an extrinsic form, which may not be long lasting but could be appropriate for students to gain initial competency and some basic standard of achievement. The deep approach requires a focus to be upon maximising understanding and to reflect widely upon what is being studied. Motivation for this approach tends to be of an intrinsic form and generally is long lasting. The achieving approach focuses upon gaining high grades and results, from the students being required to organise their own time, effort and use of study skills. Motivation for this approach may result from a combination of extrinsic and intrinsic forms (Biggs, 1991; Deci, 1985). These three approaches are progressively more demanding and require higher levels of cognitive and metacognitive skills by students. According to Biggs (1991), cognitive theory supports the need to develop deeper approaches to learning; these approaches involve both the affective and cognitive domains and may favour a constructivistic environment (Jonassen, 1991). The affective domain concentrates on creating classroom conditions that would develop intrinsic motivation, and specially recognise the individuality of the students. The cognitive domain would use teaching that promoted the integration and learning of procedural knowledge that could lead to a deeper approach to academic tasks. It

follows, that it would be an advantage if students were provided with a choice from different learning styles that are appropriate to their individual preference, to gain the best results from either of these approaches. Any of these approaches could cause a mismatch between the teaching style and learning approach if individuality is not recognised, and be a causal factor in underachievement.

Motivation: (Refer to **Figure 1**) Motivation is a major factor in learning and is a strong cause of underachievement (Adelman & Taylor, 1993). Cognitive models of learning have difficulty explaining why students who seem to have the requisite knowledge and strategies do not activate them for many school tasks, although the failure to begin or transfer appropriate knowledge and strategies may be attributed to purely cognitive factors (e.g., encoding processes, metacognitive and regulatory processes); it seems that motivational components also play a role (Pintrich & Schrauben, 1992). Motivation theory has traditionally focussed on three aspects of individuals motivated behaviour, relating to what activities they choose to become involved in, the level of intensity in which they engage in an activity, and their persistence at the activity.

It is described by Pintrich and Schrauben (1992) that there is a relationship between motivational constructs and students' cognitive engagement in academic tasks. Cognition-only models of learning tend to ignore questions about the students' intentions, purpose, and expectations while engaged in the learning activity (Pintrich, 1990). A common feature of the various forms of motivation is that it is primarily a function of a person's thought processes. Cognitive views on motivation tend to focus either upon the determinants of action, such as causal attributions, or factors such as attitudes, beliefs, and the students' background, which may interact with their cognitive processes (e.g. Ames & Ames, 1984; Ames, 1992; Atkinson & Raynor, 1974; Biggs, 1984, 1991; Dweck, 1986; McClelland, 1955; Pintrich & Schrauben, 1992; Weiner,

1984; Weiner & Kukla, 1970). According to Smith, Neisworth and Greer (1978, cited in Adelman & Taylor, 1993) motivation in various forms:

> 'Does not reside exclusively within the person or within the setting. It depends on a match or interplay between the two' (p. 157).

There are several motivational theories that have some particular value for education and for this thesis. These are achievement motivation (Atkinson & Raynor, 1974; Butkowski & Willows, 1980; Covington, 1987; McClelland, 1955; Weiner, undated) and attributional motivation (Dweck, 1975, 1986; Weiner, undated, 1979, 1984). These will be specifically explained later pages 44 and 49. Another recognised form or view of motivation is 'intrinsic motivation' (Adelman & Taylor, 1993, Biggs, 1991; Deci, 1975, 1985). This form recognises three important psychological needs motivating human activity; 'self determination', which leads a person out of choice to engage in interesting behaviour rather than from obligation or coercion; 'competence', which is the need of a person to be effective; and 'relatedness', the need for warmth from an involvement with others. These needs are motivating forces from within the person leading them to respond to situations in various ways. Much depends upon how the motivational 'needs' of a person are being met. If the learning task is unchallenging for example, a low response to the learning activity may result. Too great, or too difficult a challenge may result in deviant learning or arrested learning (Adelman & Taylor, 1993). Deviant learning is considered:

> 'Behaviour that the teacher judges to be inappropriate for a given time or place' (Charles, 1985, p. 4).

Arrested learning occurs when there is little or no intentional learning taking place. Ideally the learning tasks need to be appropriately challenging for the learner so that an expanded change in capacity and attitude may occur.

'Avoidance motivation' is a negative form that affects learning and may be the result of unsatisfied 'needs' or where the motivation does not match the learner's development and learning (Adelman & Taylor, 1993). Marvel and Marcus (1995, cited in Reis et al.,

1998) argue that an unmotivated student or underachiever with an academic problem is not unmotivated, but in fact is highly motivated to do poorly and get mediocre grades in order to avoid success. Both these aspects of motivation will contribute towards underachievement, but will not be dealt with in this thesis other than to recognise that they exist as causal factors.

Dweck (1986) identifies two distinct motivational patterns depending upon several factors such as the type of learning goal held by learners, the view a learner has about intelligence, and the attributions used by a learner. These two broad patterns used by Dweck (1986) are, 'maladaptive patterns' and 'adaptive patterns'. The adaptive form is characterised by high persistence in the face of difficulty, whereas the maladaptive form is characterised by low persistence and challenge avoidance.

Although various views of motivation have been mentioned in this thesis, no preference or priority is implied other than to suggest that there be a close connection between each form stated. For example, the causes students attribute for their failures and successes can affect their intrinsic and achievement motivation. The positive uses of strategies involving the various forms of motivation could be very effective during learning activities. The advantage of one form over another is not argued in this thesis, rather the recognition that each form may be beneficial. It is the view of the researcher that attributional training may be particularly beneficial for intrinsic motivation because of the effect attributions can have upon a person's view of their competence.

Knowledge and Background: (Refer to **Figure 1**) There are many factors related to a student's background that can both affect achievement and underachievement. These factors can also interact with other factors shown in **Figure 1**, such as learning and teaching style affecting motivation. If, for example, a student has a history of failure under a particular teaching style, then he or she will lack motivation for future success

unless the teaching style or teacher is changed, or a different learning style is allowed. Several students who participated in this study gave 'a change of a teacher or teaching style' as necessary to improve their achievement. Other achievement improving factors can be in the area of values, attitudes, ethnicity, 'cultural capital', health, physical condition, knowledge derived by constructivistic or objectivistic means, previous history of success or failure, and future expectations. The background or prior experiences of students contribute much to their 'cultural capital', and this includes many experiences they gain outside the school, which they carry with them to school. Any of these factors may also be related to socio-economic class (Bordieu, 1971; Flude, 1974; Nash, 1986). Factors such as attitude towards learning, the values placed upon the learning, previous success and failures in learning, and the student's self-concept will affect a student's motivation towards learning and are therefore considered by this researcher to be relevant factors related to underachievement and motivation. Students with a poor record of achievement tend to use external and uncontrollable attributions for success such as, luck, or the task being easy, and are inclined to blame themselves for failure (lack of ability). Further discussions on these aspects of motivation are included in the following sections 'Achievement Motivation' and 'Attributional Motivation' (pages 44 and 49) .

The prior knowledge level held by a student considerably affects the results of learning because it is a part of the accumulated capacity that students take with them into the learning situation (Adelman & Taylor, 1993; Alexander et al., 1991). Contemporary views on cognition are more directed towards how learning occurs rather than what was learned (Biggs, 1991). However, prior knowledge is that which has been learned irrespective of how it was acquired. There are various means by which knowledge can be acquired, and two of these means are briefly described here because they may be a problem for certain individual 'types'. One means of getting knowledge is from a 'constructivistic' learning environment. In this approach, knowledge is assumed to be acquired by the learner from the learners' experience. The reality for the learner is

more in the mind of the learner and is based upon constructs or interpretations made by the learner. This means that from a 'constructivistic' viewpoint, learners may conceive the external world differently to others, based upon their unique experiences (Jonassen, 1991). From current theory there tends to be a preference for an active 'constructivistic' learning style to provide the deep learning approach as suggested by Biggs (1991). In contrast to this approach is the 'objectivistic' environment in which it is assumed that the learner gains the same understanding from what is transmitted. An assumption is that the world is real and can be structured and modelled for the learner. Knowledge may be seen to be stable because the essential properties of objects are knowable and relatively unchanging; therefore, as learners, the goal is to gain this knowledge, and as teachers to transmit it (Jonassen, 1991). The 'objectivistic' learning style tends to be a passive style of learning that may be more suitable for a surface approach. This approach requires students to learn knowledge, selected by the teacher, and be required to reproduce it accurately (Briggs, 1991; Jonassen, 1991), therefore, this form could be useful within a qualification framework such as New Zealand Qualification Authority (NZQA) where assessment of standards is made from some specified criterion.

According to Alexander et al. (1991) prior knowledge includes both cognitive and metacognitive forms of knowledge. Conceptual knowledge, which is a cognitive form, consists of several sub-types such as content knowledge and discourse knowledge. It is the form of knowledge a person may find about his or her physical, social or a mental world, about language, and the means of effective communication. This form may be acquired formally or informally and is the type of knowledge that may be acquired within schools, such as knowledge of the various subjects studied by the students. However, metacognitive forms of knowledge such as the knowledge students have of themselves and the tasks they are involved with and their demands, their planning, selecting learning styles, and personal evaluation of progress, strategy

knowledge and skill, which are essential for learning. Each of these elements is important for learning and motivation, and can affect underachievement.

Failure to learn during a teaching situation is often due to the unsuitableness or inappropriate strategy being used by learner or teacher. This may show in students who devote much effort to their learning tasks, but fail to achieve good results. This type of outcome usually produces an attribution of lack of ability within the student's mind, and affects his or her self-concept. Sometimes students may not attempt to solve a problem because of a lack of a suitable strategy, and may manifest avoidance motivation. Therefore, strategy training is essential for all students, but especially necessary for any student who may suffer from background deficiencies (e.g. Duffy & Roehler, 1989; Pressley, Goodchild, Fleet, Zajchowski & Evans, 1989; Rosenshine & Meister, 1992).

This thesis will concentrate extensively on the factors of individual 'type' and motivation shown in **Figure 1** as they impact upon underachievement. Various terms and kinds of motivation are mentioned within educational literature with emphasis upon individuality or personality differences between students (Webster, 1993). This has given a rise to the development of individual learning styles (e.g. Dunn & Dunn, 1988; Dunn et al., 1989; Dunn, 1990), different approaches for example, Biggs (1991), different learning environments, such as 'constructivistic' or 'objectivistic', and the use of motivational strategies to improve students' motivation. The two specific forms of motivation, which are closely related are achievement motivation and attributional motivation. These two forms can considerably influence each other and therefore become an important factor relating to both underachievement and achievement and will be carefully examined.

Achievement Motivation

The concept of achievement motivation includes the behavioural aspects that cause a person to become activated towards achievement. This can be observed by the amount of interest and desire a student shows towards learning or another achievement outcome. Sometimes a student may be learning something new, or may be performing at a skill to obtain a particular result. Both instances require a personal desire and interest to be motivated towards a successful outcome. Some learning and successful outcomes can result from low achievement motivation and indifferent effort, but it is very likely that underachievement will be evident.

There are a number of causal factors that contribute towards achievement motivation and there have been two overlapping approaches used in the study of psychological causation (Weiner & Kukla, 1970). One approach emphasises the environmental factors that affect the formation of attributions or statements made relating to achievement; for example, if a student is informed by another student, parent or teacher that he or she lacks ability or is lazy, then an attribution may be formed by the student in this example based upon someone else's opinion. This kind of result can be either positive or negative. If a student is told by someone else that the result gained was good because he or she used a good strategy, or by working hard, then it is likely that the student will identify effort and strategy as means of gaining good results. Therefore, achievement motivation is likely to be high towards further success if sufficient effort is given with a suitable strategy. On the other hand if the student is told that his or her failure resulted from a lack of ability, then achievement motivation is very likely to be low towards further success. The second approach focuses upon relationships between individual differences in how students perceive a cause for a success or failure, or other behavioural consequences, and the attributions that are formed from self-perception.

Both these approaches are applicable in providing the determinants of achievement, such as the attitude students have towards learning and their self-concept. However, there has been a shift towards an emphasis upon cognitive mediators, which is how children construe the situation, interpret events in the situation, and process information about the situation (e.g Borkowski et al., 1986; Cole & Chan, 1990; Dweck, 1975, 1986; Weiner & Kukla, 1970). It is assumed that a high level of achievement motivation directed towards school achievement will cause a person to strive for achievement because of the factors that are involved with this form of motivation. Some of these factors are; the student's interest and value in what is to be achieved, the student's expectation of success from the learning, and the affect on self-concept through the accomplishment of learning (Chapman, 1994; Adelman & Taylor, 1993; Pintrich and Schrauben, 1992). However if the motivation is not related to school subjects, but is motivated towards avoidance rather than performance, then school achievement will be affected (Adelman & Taylor, 1993; Reis et al., 1998).

Butkowski and Willows (1980) supported by the research of Kukla (1972) argue that there are a variety of achievement-related cognitions and behaviours, including expectancies of success, persistence in the face of difficulty, need achievement and affect that are related to the achievement behaviours contributing towards student achievement motivation. According to Heider (1958) it is assumed in simple terms that there are at least two factors that in part decide the outcome of an event. One is the personal characteristics of the student such as intelligence, ability, and the student's value in what is being attempted. The second determinant is the action of trying. If the student does not perceive that he or she has the ability or intelligence to attain the desired outcome then very little effort in trying will be given, although some reasonable results may still be obtained. This is often experienced within learning situations where a student may not consider that he or she has the necessary ability for a particular task, or has high interest in the result but performs to a satisfactory standard because of other factors such as the coaching and assistance given by the

teacher or others. The self-perception of ability may reflect in the student's expectation of success, for effort given towards a task, and in the causal attributions used for success and failure. Pintrich and Schrauben (1992) state three general components of students' motivational beliefs that are similar to views expressed by others such as Adelman and Taylor (1993) and Chapman (1994). These components are; expectancy, value, and affect. Affective responses are more a consequence of performance rather than anticipatory affect, and may considerably influence the attributions associated with the performance. Kukla (1972) suggests that an analysis of research relating causal attributions to achievement behaviours leads to several predictions about the causal perceptions of success and failure of students who have experienced varying proportions of success and failure outcomes. First, students who experience repeated failures are more likely to see themselves, and be seen by others as lacking in ability, and the resulting self-perception may be reflected in the students' expectations by that affecting achievement motivation. Second, good and average students perceive themselves, and seen by others, as having expended less effort than those who succeed. In addition, success following a series of failures, or a series of failures following successes is likely to be in part attributed to a lack of effort expenditure (Butkowski & Willows, 1980; Frieze, 1976; Frieze & Weiner,1971).

Achievement motivation is largely influenced by the attributions used by students and becomes the basis behind a theory of attributional retraining (e.g. Borkowski et al., 1988; Cole & Chan, 1990; Dweck, 1975; Weiner & Kukla, 1970). One of the questions for this thesis was to find out whether the attributions used by the student sample were related to underachievement. In a previous study by this author (1993), students' achievement was found related to their level of achievement motivation. Weiner and Kukla (1970) argue that achievement motivation is related to the causal attributions or statements used for success and failure. Therefore, these causal attributes become central components of thought and action in relation to various aspects of behaviour such as learning, and become important components of

achievement motivation. The 'achievement needs' or achievement motivation of individuals varies considerably and are formed because of complex interactions between such factors as home and school environment, age, cognitive development, values, goals, and affectations of individuals (e.g. Ames & Ames, 1984; Ames & Archer, 1988; Chapman, 1994).

Two important factors that contribute towards higher achievement motivation are: one, recognising that something is worthwhile, and two, that success can be expected from what one learns (Adelman & Taylor, 1993; Pintrich & Schrauben, 1992). Both factors may be affected by the thought processes and attitudes held by a person. Evidence shows that the pattern of thought processes involved can be changed by the attributions used by a person, but may require persistence to provide improved achievement (Borkowski et al., 1988). It is suggested that attributions may more easily change the thought processes than for the thought processes to change the attributions. An implication from this theory, is that verbal attributions can be very effective in changing what a person believes and thinks about them. This may have an influence on their performance by affecting their task selection and by that improve their learning (Chapman, 1994; Fyans & Maehr, 1979). It is possible that words spoken intentionally and consciously will have an effect upon the subconscious mind that in turns can influence the conscious mind (Murphy, 1963). Therefore, attributional training could be also useful to improve a person's self-concept. By learning to use internal controllable attributions relating to effort and strategy, students probably can change their attitude about ability, task difficulty, and luck.

Chapman (1994) argues that the factors of self-concept, self-efficacy, and causal attributions are also key components of motivation with the factors of value and expectation stated by Adelman and Taylor (1993). Self-concept can be considered to include each of the following parts of the self-system, comprising: self-efficacy, self-

esteem, and attributions (Wong, 1991). According to Craven, Marsh and Debus (1991, p. 535)

> 'Self-concept is frequently posited as a mediating variable that facilitates the attainment of other desired outcomes such as academic achievement'.

It is possible that self-concept is linked into a network of relationships that include achievement and self-attributions. Therefore, the part that a person's self-concept plays relating to attributions and achievement is important. This can be inferred by the differences in attributions shown and used by high achieving students compared with those used by students with learning difficulties. Butkowski and Willows (1980) state:

> 'There is an impressive amount of literature to show that achievement related cognitions and behaviour are related to the attributions held by the learner' (p. 409).

Low achievers tend to attribute their success to uncontrollable causes such as luck, or ease of task, and attribute failure to low ability or task difficulty, whereas average to high achievers tend to attribute failure to lack of effort, and success to ability. The variation of attributions used by underachievers is likely to be affected by the differences contained within personality types also by their background experiences. This is suggested by Briggs-Myers and Briggs (1992) and Lawrence (1982) who argue that a person's action and mental habits are associated with their personality or individual 'type'. Achievement motivation is important for reducing underachievement and is considered by Weiner (1979, 1984, undated) to be strongly based upon attributional causes given for success and failure and therefore is closely associated with attributional motivation. However, it may be debatable about whether achievement motivation determines the attributional motivation, or vice versa. Several researchers (e.g. Borkowski et al.,1986; Borkowski et al.,1988; Borkowski et al.,1990; Carr & Borkowski, 1989; Covington, 1987; Dweck, 1975; Weiner,1984) suggest that achievement motivation is changed by attributional motivation, and this is the basis behind attributional training

Attributional Motivation

An attribution theory of motivation is based upon attributions, or statements made by students or others, on the causality for success and failures. Attribution theorists investigate the perception of causality, or the judgment of why a particular event occurred, with the belief that by identifying the dimensions of causality it may be possible to find out psychological consequences from the underlying properties associated with the dimensions (Weiner, 1979). These causal dimensions appear in **Figure 3**, and can be either internal and directly relating to the student, or external to the student within the learning environment, They will be discussed later.

Internal	External
Abilty	Task Difficulty
Effort	Teacher bias
Strategy	Luck
Mood and Attitude	Help from others
Health - frequent problems	Sickness - temporary

Figure 3. *Causal attributions relating to locus dimension.*

According to Weiner (1979) a principle behind attributional motivation is:

> 'Individuals may search for understanding and seek to discover why an event has occurred, particularly if an unexpected outcome occurs such as a failure when success was expected' (p. 3).

The 'spring of action' response by a student is a central assumption behind the attributional theory of motivation. Folkes (1978) and Weiner (1979) argue that students are more likely to ask 'why' questions regarding failure than for success, although unexpected events are also more likely to lead to a 'why' question than for an expected event. It is also likely that students with a history of underachievement may not automatically ask 'why' questions and may not be concerned about the future possibility of success. This type of deviant behaviour can result from either a proactive or a reactive response to the learning situation and may be a form of avoidance motivation (Adelman & Taylor, 1993).

Short and Weissberg-Benchell (1989) and Covington (1987) have identified a multifaceted nature within the heterogeneity of attributional profiles obtained from skilled and learning disabled populations. Several subtypes have been identified based upon performance outcomes: two successful subtypes and two failure subtypes. In the first of the successful subtypes, success was accomplished with little or no effort, leading to beliefs of high ability. The second subtype, success is accomplished with great effort, which lead to beliefs of self-doubt and academic failure. The two failure subtypes fail either despite effort or because of lack of effort, which leads to a belief of lack of ability.

The psychological causation attributed for the result gained from any learning task varies as suggested by the nature of the two subtypes stated earlier, and may be different between individual 'types'. Some individual 'types', such as introverts, may see themselves as the cause behind underachievement, putting it down to a lack of ability or not having worked hard enough, whereas others may see the causes as due to circumstances beyond their control. Both views could be correct. The different characteristics associated with the individual 'types' (identified by MBTI) tend to invoke different reactions to similar circumstances and are likely to be related to underachievement. Therefore, it is likely for differences to be seen in the causes given for success or failure, or the degree by which the causes are recognised. Any causal attribution formed consequently from either environmental factors or stimulus conditions may act as a determinant for future achievement related activity depending upon the dimensions of causality of the attribution. Several researchers, (e.g. Borkowski et al., 1988; Borkowski et al., 1986; Carr & Borkowski, 1989; Chapmin & Dyck, 1976; Clifford, 1986; Dweck, 1975; Sparta, 1978; Weiner, 1980; cited in Clifford, 1986; Zoeller, 1979) suggest that attributional training can be used by underachievers to aid their metacognitive development and by that improve achievement.

Attributional Training

Chapman (1994), Carr and Borkowski (1989) and Cullen (1985, 1991) argue that attributional beliefs may be an important aspect of metacognitive development because of the effect they have on the self-system, which empowers the metacognitive system by involving aspects of social cognition (e.g. self-concept, self- attributions) to the development of cognitive strategies. Research by Reid and Borkowski (1987) also supports the argument that attributional training contributes towards metacognitive development. They found long term performance gains with learning-disabled and hyperactive students when attributional training was combined with self-regulation and strategy training.

According to Carr and Borkowski (1989) self-attributions are correlated with school performance and therefore should be encouraged and used with attributional training for underachievers. During training students would be required to ask 'why' questions regarding their performance. At the heart of the attributional theory of motivation are three central causal dimensions: locus, stability, and control. These three dimensions are linked with expectancy change, esteem-related emotions, and interpersonal judgments and therefore are pertinent to aspects of achievement motivation (Weiner, 1979, 1984). There are a number of varying factors within the locus dimension that may have different affects depending on how they relate to a student. The locus of the cause may be seen by a student as either an internal, or an external one; but it is likely that the interpretation of the locus may vary, either by circumstances, or by the way an individual may perceive a situation. For example, help given by others, may be seen by one student as the reason for their success from learning. Another student may see from the same situation, temporary effort, as the cause. In both cases, increased effort may have resulted to cause the student to succeed, but the attributional dimensions used, were different. In the first example given, the dimensions are; external, unstable,

and uncontrollable, and for the second it was, internal, unstable, and controllable. **Figure 3** shows the causal attributions and locus dimensions provided by Weiner (1979)

The personal or internal causes as listed in **Figure 3** are not invariant over time or between people, but will depend upon the way a student views the cause. For example, a student may perceive health as an internal problem, if they are regularly sick, but as an external problem if they may be suffering from an occasional cold. Weiner (1979) argues that the taxonomic placement of a cause depends upon its subjective meaning, although there is usually general agreement when distinguishing the locus as internal or external. One might ask the question, "Does it matter which attribution is given for success or failure?" It is argued that there are advantages to be gained by using internal and controllable attributions as compared with external uncontrollable ones. Further discussion will be given to this factor in the section on 'Intervention Approaches' (page 135).

The stability dimension for each cause given will vary from high to low. The level of stability also will be affected by the degree of control a student may have over the causes of success or failure. For example, students may attribute blame for their failures either on a lack of 'typical effort', which is a stable and controllable form; or a lack of 'temporary effort', which is an unstable and controllable form, rather than perceive themselves as not having ability (Weiner, 1979). These forms of attributions can be changed by using attributional training.

A tendency for students to blame some uncontrollable cause, such as poor teaching or difficult task, seems very likely and may vary between different age levels and between different individual 'types'. For example, a mood may change much depending upon the acceptability of the learning programme and the teaching style. Any mismatch between an individual's preferred learning style and teaching style is likely to considerably affect the mood and attitude of certain individual 'types'.

The stability dimension and its related internal attributions have broad behavioural and affective consequences. Any expectancy for future success tends to be low when failure is attributed to a stable cause; i.e. lack of ability, and high when attributed to unstable causes, i.e. lack of effort (Clifford, 1986; Dweck, 1975; Fontaine, 1974; McMahan, 1973; Weiner et al., 1976; Weiner, 1979). The dimension of stability defines causes on a stable versus an unstable continuum and may vary depending upon the attributions used by the student, or the situation. Ability and typical effort would be considered stable whereas temporary effort, attention, and mood are unstable. Effort may increase or decrease from one situation to another, while a mood is considered a temporary state. Task difficulty may vary considerably from one student to another - some students may experience continual difficulty with learning tasks and therefore may consider this as a stable cause; for others it may just be an occasional causal factor (Weiner, 1979).

The third causal dimension relates to whether the cause is controllable or uncontrollable. Among the internal causes, ability may be considered stable and uncontrollable; typical effort is stable and controllable; mood, fatigue and illness are unstable and uncontrollable; temporary effort is unstable and controllable (Weiner, 1979). This controllable dimension can be viewed differently: for example, a student may obtain assistance from a friend to complete some learning task, therefore the cause for success could be attributed to external and controllable dimensions. Occasionally the student may not be able to obtain assistance and the cause may be uncontrollable. There may be some doubt about the amount of control that can be given to external factors, but it will depend on how far back in the causal chain one chooses to go. For example, a teacher bias may be controllable from the vantage point of the teacher, but not from the perspective of the student. The recognition of the attributions used by underachieving students is more important than the classification of the type of attribution, particularly in relation to attributional retraining. Clearly the

students use a range of attributions depending on many factors, which may sometimes defy logic, yet the effect of the attributions upon subsequent learning infers that performance is affected by them (Butkowski & Willows, 1980). It is highly probable that causal attributions influence performance by affecting the students' task selection and task persistence (Butkowski & Willows, 1980; Fyans & Maehr, 1979).

The way in which attributions affect learning is not completely clear, although their affect upon motivation is well accepted and documented (e.g. Borkowski et al., 1988; Butkowski & Willows, 1980; Chapman, 1994; Dweck, 1986; Weiner, undated). It seems that certain statements continually made by persons, or ideas held by them, can affect their attitude, their thinking, and subsequently their achievement. This idea is implied within the statement '... for as a man thinketh in his heart so is he' (Bible, Pr: 23. 7), which suggests that mental thought processes are involved, and are likely to cause either good or bad results. If students are encouraged to use certain kinds of attributions then they are likely to increase the amount of their mental thought towards their learning in a way that can improve their achievements. This is the basis behind attributional training. Some examples of kinds of attributions used by the writer, which can be used for attributional training are given in the section on 'Attributional and Strategy Training' in Chapter 5.

Both the achievement and attributional form of motivation mentioned so far in this thesis require energy to sustain them. It is argued by Hebb (1955, cited in De Cecco & Crawford, 1974) that when a person is in a motivated state, internal energy is released within a person to start, sustain or stop some action. Therefore, the degree and amount of energy released may be critical as to the effect it has upon an individual. Too high a level of motivation may produce anxiety that reduces performance rather than increase it, and too low a level of motivation may not cause a student to start or continue with a task (Hebb, 1955, cited in De Cecco & Crawford, 1974). Underachievers may suffer from a lack of motivation, or a lack of energy, or a

combination of both. Whichever of these, may best be decided from the level of performance and statements made by the student.

The Nature of Individual Type

The distinctive nature of individual 'type' is considered by this researcher to be an important factor related to learning and underachievement and therefore is a pivotal factor for this thesis. The nature of personality type includes the characteristic traits by which a person perceives and responds to stimuli received by that person. Briggs-Myers and Briggs (1992), by means of the Myers-Briggs Type Inventory, assessed the nature of individual 'type' based on assessment from four scales of individuality, given earlier in this thesis. If our actions and mental habits are strongly associated with our 'type', as suggested by Lawrence (1982) and Briggs-Myers and Briggs, (1992), then it is likely that our learning styles and preferences will vary considerably between 'types' and possibly allow some 'types' to be disadvantaged from some teaching styles and others to be advantaged. Individual 'type' is not to be confused with individualism. Schools may seek to develop 'individualism' by attempting to develop the potential of each student, but not be able to greatly influence individual 'type'. Therefore, it is suggested that this may be more easily done by first identifying 'type'. If individualism becomes the aim of schools without individual 'type' being considered, then underachievement is still highly probable, because of a likely mismatch between 'type' and teaching style. A distinction between individual 'types' and individualism is seen by this researcher to be important, particularly in respect to implications from this research and so therefore is relevant to be included in this study.

There are several features of individual 'type' that are related to each other; among these are individualism and individuality. These two features may affect each other differently from person to person. Sometimes, factors relating to individuality may have a strong influence upon a person's individualism. For example, according to the MBTI, an introvert type of person tends to relate more easily to the world of ideas

than to the outer world of people and things. Extrovert types tend to prefer the opposite of the introverts; the world of people and action instead of ideas (e.g. Briggs-Myers & Briggs, 1992; Eysenck & Eysenck, 1985; Lawrence, 1982; McCaulley, 1981; Morris, 1979).

Occasionally within a school learning situation students of an introvert type may be directed away from their natural inclination of ideas, and directed towards people or things. This is often seen when an introvert student is required to speak in front of a class of students, or join in with group work. They usually feel uncomfortable and do not act well. It is not to say that introvert types are not able to focus on people or actions, or that they should always deal with ideas, but any mismatch between their natural preference and the learning situation will not produce the best results for them and is likely to affect their achievement motivation. Results from any mismatch can be improved when the reasons for it are understood and appreciated by the student. Where there is a requirement for a student to respond to a teaching style that is not agreeable to his or her natural preference or learning style, then underachievement, learning problems and behaviour problems are highly probable. Evidence found by this author (1994), suggests that a mismatch between preferred learning style and teaching style, was related to achievement levels among the sample of secondary school students used in the 1994 study.

The Nature of Individuality

According to Webster (1993) individuality consists of all the traits of personality, physical attributes, emotions, and ability that a person possesses. Therefore, a personality trait theory of individuality is likely to consider similarities and differences between people. Although this may be valid in identifying aspects of individuality, deciding the exact effect of environmental influences (such as learning) upon the differences and similarities between people is another matter.

It is more than likely that individuality is shaped by environmental experiences. However, the amount of change and cause of change may not easily be determined and these factors make it difficult to predict the effect of similar learning experiences upon different individual 'types'. The differences in achievement obtained from similar learning experiences by different 'types' show the effect environmental experience can have upon different 'types' in relation to learning. This view may tend to over simplify a complex position in relation to achievement, because other factors as well as 'type' are involved. But this author suggests that the preferences associated with 'type' are important for learning and these can be favourably influenced by using appropriate learning activities and approaches related to 'type'. It is also very likely that other aspects of personality such as emotions and self-concept are affected differently by environmental experiences. There are therefore, other factors that relate to individuality beyond the environmental experiences. It is suggested that the recognition of individual styles and differences in thinking available to individuals, point to the different patterns or aspects of individuality that exist among people (Hullfish & Smith, undated, cited in Webster, 1993).

There have been many ideas and empirical ways in which individual 'type' has been assessed, such as temperament styles (Keirsey, 1983), personality type (Jung, 1971), personality differences (Eysenck & Eysenck, 1985), personality type and cognitive styles (Ferguson & Fletcher, 1987), cognitive styles (Frisbie, undated), learning patterns and temperamental styles (Golay, 1982), and psychological type (Meisgeier, Murphy & Swank, 1987). The principles contained within the Myers-Briggs Type Inventory offer a functional concept of 'type' and the effects of total individuality rather than dealing with discrete traits. Mendlesohn (1970), who initially was not ready to accept a theoretically-based personality measure rather than an empirically-derived one, stated: '...few instruments appear to provide as much information as can be derived from the MBTI' (p. 127).

One of the important principles of the MBTI is that besides recognising the trait differences of 'types' upon external reality and inner ideas, it also recognises the preference differences in observing immediate physical reality. A sensory functional type tends to prefer to perceive information mediated through their senses, whereas an intuition type may prefer to mediate abstract images and ideas conveyed by their intuition (Newman, 1990). The MBTI identifies important individual differences that provide an advantage especially for educators because it can make a difference to the choice of learning activities offered, or style, or approach used, and by that avoid the possibility of any mismatch between the teaching style and preferred learning style.

There are differences in preference that individuals have towards how they gain knowledge and information, and with the processes and style used in their decision making; these are recognised within the MBTI dimensions and add to its educational value (Hoffman & Betkowski, 1981; McCaulley, 1990; Newman, 1990). The Myers-Briggs Type Inventory is based on Jung's general principles for direction of conscious mental activity, and tested in his clinical work. The MBTI was created and developed over a long period with much attention to Jung's theory of psychological types, enabling it to be interpreted and applied to everyday life (Jung, 1971; Newman, 1990; McCaulley, 1990). The MBTI has been used for many years and has been accepted by various professional bodies in a number of countries, psychology departments of major universities, and the American Psychological Type Association (Newman, 1990; McCaulley, 1990). A shorter and modified form of inventory constructed by Lawrence (1982) follows closely the principles of the MBTI and was used for the research in this thesis.

There are various sub-groups of two factor variables that can be derived from the MBTI other than the Function Pairs mentioned earlier in Chapter 3, such as those formed by combining perception factors with attitude factors, forming the sub-groups SP, SJ, NP, and NJ (Lawrence,1984). These and other possible combinations were not

preferred by Myers-Briggs, and may not have as much benefit for education as have the Function Pairs. Therefore, this study is limited to the Function Pair combinations involving perception (S - N scale) and decision making (T - F scale) functions used by Myers-Briggs.

Features Relating to the Myers-Briggs Type Dimensions

According to Lawrence (1982), the way a person acts or reacts to circumstances is affected by the various patterns or combination of mental habits that can be associated with their personality type. The various dimensions related to personality contained within the MBTI interact in various ways to cause different responses by different 'types' to similar circumstances. For example, one student may perceive the cause of a learning problem as within him or her self, yet another student in the same class may see the cause of the problem as a lack of suitable strategies being taught. Both causes may be correct to some measure, but some 'types' are more inclined to attribute the cause of their failure to factors beyond their control.

A complete MBTI type is designated by using four-letters such as ESTJ, which can be identified from the responses given to the four scales contained within the Lawrence Type Inventory (Appendix A). An ESTJ for example, represents an Extrovert-Sensing-Thinking-Judging type. Table 1A (page 77) gives the number of students involved in this study, and the code letters of the 16 possible 'types' obtained from their response to the Lawrence Type Inventory..

Interactions between the various dimensions of the MBTI, described later, can be attributed to the different responses obtained from similar situations by different 'types', and may be a factor that affects attributional motivation. According to Briggs-Myers & Briggs (1992) and McCaulley (1990), the Function Pairs, involving the scales of Sensing - Intuition and Thinking - Feeling are involved with the perception of information and experiences, and the decision making resulting from the perception

processes. A SF type (high in 'Sensing' and 'Feeling' attributes) for example, would generally react differently to that of a ST type (high in 'Sensing' and 'Thinking' attributes). In the example given, a person high in the `Sensing' preference would tend to work with known facts rather than look for possibilities and relationships; this could be similar for both these types, but the effect of the other function would make the difference between them.

The Sensing preference tends to work with what is 'given' in the here-and-now and are usually realistic and practical. They tend to be good at remembering and working with many facts. Whereas a person high on the alternative factor to 'Sensing' , namely 'Intuition' would rather look for possibilities and relationships than work with facts. This preference tends to go beyond the information gained from the senses and look towards the total picture to grasp essential patterns. They tend to be good at seeing new possibilities and new ways of doing things, and value imagination and inspirational activities. The tendency associated with the 'Thinking' preference is to base one's judgments more on impersonal analysis and logic than on personal values. There will be a tendency within this preference type for decisions to be made objectively based on cause and effect, and to make decisions by analysing and weighing the evidence. Students with this preference generally seek an objective standard of truth, and are good at analysing problems (Lawrence, 1982). The 'Feeling' preference is characterised by the tendency of a person to base judgments more on personal values than on impersonal analysis and logic. This preference type tends to like dealing with people, become sympathetic, appreciative and tactful. It is important to recognise that the preference 'type' suggests the preferred manner in which a person may react to information and experiences; it does not mean that they cannot function differently, but a person tends to function according to established mental habits, which are associated with various patterns and combinations related to their preferences (Lawrence, 1982).

According to McCaulley (1990) one core feature of the MBTI is the assumption that one of the four functions (Sensing, Intuition, Thinking, or Feeling) will lead or be dominant over the others, and a second function will provide balance as an auxiliary. A person's preferred way of doing things, for example displayed, by their perception and judgment functions, is influenced by the dominant functions within the 'type' combination. One of the preferences will act as a dominant or 'favourite' function for dealing effectively with the world outside the student and will take the lead, the other will help. For example if the dominant preference is one of the judging functions (thinking or feeling), then the auxiliary function supplies perception (sensing or intuition). Both functions complement each other (Briggs-Myers, 1989; Briggs-Myers & Briggs, 1992; Lawrence, 1982; McCaulley, 1990). A person needs both functions to deal effectively with the world. It is not argued that one combination of function pairs is better than another, such as SF to that of ST.

The preference behaviour from students of different pairs can be expected to be different because of the different ways they may perceive information, but different responses may be seen in students with similar function pairs, such as two students with ST but with different E - I and J - P preferences. Each of these two pairs may have different preferences acting as the dominant function. This apparent contradiction is here briefly explained. The bipolar scales of Extrovert - Introvert (E - I) and Judging - Perceiving (J - P) are assumed to determine the dominant process. According to Briggs-Myers and Briggs (1992), and McCaulley (1990), an Extrovert type with high Judgment attributes, such as ESTJ (indicated by 'E' and 'J' in code) will tend towards using the attributes associated with the Thinking - Feeling scale. This would mean for this example, 'thinking' would be the dominant function and 'sensing' the auxiliary one. In a Perception type, such as ESTP the dominant function would be associated with the Sensing - Intuition scale and for this example it would be 'sensing', and 'thinking' the auxiliary one. The Judging - Perceiving preference is used to determine the dominant function as indicated above, but there are

exceptions. The dominant function does not show out in quite the same way for Introvert types as it does for the Extroverts. For example, if the Introvert type ends with a 'Judging' preference, example ISTJ, the dominant function would be from the Sensing-Intuition scale with the 'Sensing' preference acting as dominant and the 'Thinking' preference would function as an auxiliary one. If the 'type' ends with a 'Perceiving' preference, example ISTP, the dominant function would be the 'Thinking' preference from the Thinking-Feeling scale and 'Sensing' would act as the auxiliary function (Briggs-Myers & Briggs, 1992; McCaulley, 1990). Therefore, identification of the complete individual type coding such as ISFJ, as shown in Table 1A, is necessary to recognise the dominant preference of the 'type', because of the differences in preferences that can be expected from the various combinations. An ISFJ type may respond quite differently to that of an ISFP type.

The description of the personality types used in the Myers- Briggs Type Inventory and Lawrence Type Inventory have been outlined in this section with an explanation of the perceptive and judging functions of the Function Pairs. The Lawrence Type Inventory used for this study, which is based upon the MBTI, provides a useful means of describing individual 'type' and showing differences in function that may lead to underachievement. Therefore, it is important and relevant for this study to be able to identify differences in 'type', and to identify those that may have difficulty in learning and be prone to underachieve.

Chapter Summary

This Chapter has covered selected literature on some important issues relating to the complex nature associated with educational underachievement. It has included some various legislative actions taken in USA, England and Wales, and other measures taken by New Zealand to reduce underachievement. It also has shown the concern of world bodies such as OECD, expressed by Lawton (1998), on the problems facing schools and the inference that schools need to be more accountable for what they are

purposed and funded for. A workable definition of underachievement constructed by this author, derived from ideas stated by Swanson (1991) is given. A distinction is given between learning problems and learning disabilities.

Other issues concerning accountability such as, the establishment in New Zealand of the Qualification Authority (NZQA) in 1990, the NZ Achievement Initiative, changes in England and Wales to the Standards Bill within the Education Act and amendments to Public Law in the USA have been detailed in this Chapter.

Causal factors of underachievement have been described as well as a definition and distinction between achievement and attributional motivation made. Literature from Ames and Ames, (1984, 1992); Biggs, (1984, 1991); Weiner, (1979, 1984); Dweck, (1975, 1986), contribute much towards describing the concepts related to attributional motivation. Other literature contributions concerning motivation and acknowledged here include: Adelman & Taylor (1993); Chapman (1994); Covington (1987); De Charms (1976); Deci & Chandler (1986); Deci & Ryan (1985); Frieze (1976); Fryans & Maehr (1979); Pintrich & Schrauben (1992); Reid & Borkowski (1987); and Short & Weissberg-Benchell (1989). Individual 'type' and the nature of individuality, and factors and principles relating to the Myers-Briggs Type Inventory are covered by the literature of Briggs-Myers (1992): Fourqurean, Meisgeier & Swank (undated); Jung (1970); Hoffman & Betkowski (1981); Lawrence (1984); McCaulley (1990); Mendlesohn (1970); Nisbet et al. (1981). This is especially relevant to underachievement and individual 'type'.

Literature relating to learning styles and teaching styles by Biggs (1991), DeBello (1990), and Dunn (1990), is included and used with strategy and attributional training literature by Borkowski et al. (1986), Borkowski et al. (1988), Carr & Borkowski (1989), Clifford (1986), Cole & Chan (1990), Duffy & Roehler (1989a, 1989b), Golay (1982), Palincsar (1986), Pressley et al. (1989), Rosenshine & Meister (1992),

Schmeck (1983), and Webster (1993). This aspect of the thesis points to various strategies that can be used for intervention approaches to reduce underachievement.

In Chapter 3 the method and instruments used for this study are described. Also, a description of the sample population, features of the area from which the colleges providing the sample population are situated, and the criteria used to identify underachievers. Aspects concerning validity and reliability are discussed with a description of the idiographic features of the study. A detailed description of the statistical procedure used is provided.

Chapter 3 -

Research Methodology

Preview.

This Chapter describes in detail the methods used to accomplish the aims of the thesis stated in Chapter 1. Within the research overview on page 15, information is given about the area and schools in which the research was conducted. It was a rural area in the Marlborough province of New Zealand, with schools of similar regional interests, with a record of good academic results, with a similar mix of different ethnic groups, and with similar socio-economic features. A rationale behind the sample selections, and an explanation justifying the size was also given. The samples, consisting of 37 6th-form students comprising of two sub-populations of secondary school science students, possessed some similar features in that they were underachieving at science within their schools. One sub-population was identified as 'Category 1' and the other as 'Category 2': details of theses categories are given below.

The intention of this design was to find relationships and causal factors that may be associated with the student's underachievement. Therefore, a 'purposive' sample comprising of two sub-populations of students with some similar feature were selected (Dixon et al., 1988; Myers & Grossen, 1978). The specific feature common to all the students involved in the study was that they were underachieving, according to the criteria used by the writer for identifying an underachiever. By using this strategy, confounding results from students who were achieving would be avoided. For example, if a large random sample was chosen the chances of having many underachievers within the sample would be small, because 90% of the students, according to the criteria used by the writer would not be identified as underachievers. Therefore the number of underachievers may be smaller than the number obtained in this study by selecting only from approximately 10% of the students. An additional advantage for the researcher was that the schools were in the area in which the

researcher taught and therefore he was known by the schools. An empirical type of study was carried out using the selected 'purposive' target population of underachievers from three different colleges during normal school lessons

The Samples

Thirty-seven students from the 6th-form (grade 11) were selected from three secondary colleges in the Blenheim and Picton towns in Marlborough, New Zealand (see Table 1). One was an all boys' college, one an all girls, and the other coeducation. The samples were chosen from one of two criteria. Criterion '1' were those students whose results from tests and examinations were in the lower 10th percentile (identified as Category '1'), and criterion two were those students selected by the subject teacher as 'acute' underachievers (identified as Category '2'). Acute underachievers were considered those students who had displayed a sound level of ability earlier in their schooling but were currently well below the level expected from them. Fourteen students were available for sample 1, from using criterion 1, and 23 students for sample 2, from using criterion 2.

Table 1
Number of Students by Colleges for Science Subjects

COLLEGE	Biology	Physics	Chemistry	Other	Total
College 'A' (Boys)	3	6	4	2	15
College 'B' (Girls)	3	3	7	1	14
College 'C' (Boys and Girls)	2	3	2	1	8
Totals	8	12	13	4	37

Many students could be classified as underachievers, but for this research only those 37 students that were well below an expected level of achievement, and/or those whose performances were satisfactory earlier in the year, but had deteriorated in standard during the year, were available and chosen. The purposes for using what may be two sub-populations of students was because the term 'underachiever' has been used, for example in school reports to describe students from both categories. It is

very likely that the cause or causes of underachievement may be different between these two categories of underachievers and it is possible that some students from Category '2' may not be aware of their underachievement because they were identified by their subject teacher, whereas Category '1' students were chosen because of their low results from tests. There may also be similarities between these two categories that relate to' type' and motivation; therefore, both categories of students were included in the study. Approximately 10% of students from each of the science classes had been expected to participate in the research survey. This expectation was generally realised, although circumstances on the day in which the survey was conducted caused some minor fluctuation in numbers. For example a number of students from one college were required for a drama production rehearsal, and several students from the coeducation college declined to be involved in the study.

Each boys' and girls' colleges had approximately 1000 students on their roll, but the coeducation college was considerably smaller with 350 students. There was no withdrawals or unwillingness to participate from among the boys' and girls' colleges but several students from the coeducation college declined. It was stated by a teacher from the coeducation college that some potential sample members " were not sufficiently motivated to take part in the survey - this also being a characteristic of their learning as well." However, those who participated stated, "they found the exercise interesting and useful." The reasons for the research were explained to the students and an option to allow them to withdraw was made. The students were informed that the information was confidential and only applied to them individually, and that privacy of results would be maintained. It was explained that generalisations from the results that could be beneficial to the contributing colleges were to be made available, but the individual student's identities would remain confidential. All participating students were cooperative and applied themselves seriously to the research questionnaires.

Instruments Used

A Lawrence (1984) inventories form of a questionnaire (Appendix A) was used to identify Individual Type, as categorised according to Myers-Briggs' (1992) dimensions. This was followed by a two-part questionnaire (Appendices B and C) constructed to identify motivational features that were related to each student's achievements at science. Part 1 of the questionnaire involved 10 multiple-choice items, while Part 2 comprising 15 statements was of a Likert format requiring students to respond with a numerical value associated with their agreement, disagreement or uncertainty with each question statement. Each of these instruments had been trialed earlier with other students and shown to several science teachers to assess for any difficulties that may arise from misunderstanding or with comprehension of the text.

The three ipsative questionnaires reproduced in Appendices A, B and C were used during the survey sessions for each of the three colleges. College C students were surveyed together within a science laboratory during a routine science period. This allowed for the survey to be completed by the participating students as a routine part of the school programme. College B students were grouped together within a team teaching lecture room, and College A permitted selected students to be withdrawn form their routine science classes to answer the questionnaires confidentially within a resource room. In each type of situation, students were relaxed and under no excessive tension. Explanations were given to each group of students regarding the aims of the research, and they were advised that they might expect some benefit from reflecting upon their own performance in science.

Individuality Instrument: The Lawrence Inventory Questionnaire (Appendix A), required the students to make a choice between statements that were based upon the four bi-polar preference scales used by Myers-Briggs. The four scales are: Extroversion attitude (E) or Introversion attitude (I); Sensing perception (S) or Intuitive perception (N); Thinking judgment (T) or Feeling judgment (F); and

Judgment (J) or Perception (P) (e.g. Lawrence, 1982; McCaulley, 1990; Newman, 1990). This condensed form of a questionnaire, using 22 paired items, provided a quick and effective approximation of personality type according to the criteria used by Myers-Briggs (Briggs-Myers, 1989; Briggs-Myers & Briggs, 1992). No attempt was made to quantify differences between 'type' and dimensions but simply to identify different 'types' according to the category preferences used by Myers-Briggs, although it is acknowledged that quantitative differences between similar 'types' may affect their responses. According to Webster (1993), the Lawrence Inventory has been widely used. It is a concise form of a questionnaire and therefore was selected for this research study. No information regarding reliability of the inventory could be obtained by this writer, but on personal experience using this inventory satisfying test-retest results were obtained.

Motivation Questionnaires: The second instrument (Appendix B) constructed by the author consisted of 10 multiple-choice questions relating to personal achievement at science. The questions were related to various aspects of motivation such as attributional causes for success or failure, attitudes and values relating to science, and motivational patterns relating to persistence and avoidance of problems in learning. It was presumed by the author that the answers given by the students would provide a broad identification of their ideas about their own performance at science. This would reveal consistency, also any inconsistency within their answers. Some inconsistency was anticipated because the author felt that students of this age group involved in the study may adopt a defensive position when required to reflect on their own performance and lack of achievement.

The Part 2 (Appendix C) questionnaire was administered with Part 1 and was expected to be completed in the order in which they were supplied. The purpose of Part 2 was to find out the strength of agreement, disagreement or uncertainty the students showed towards attributional statements, motivation factors, and teaching and learning style

statements relating to their success and/or failures at science. A summary of these statements is given below. The Part 2 questionnaire was used to identify if there were common trends among individual types regarding their attributes used for success and failure (see Aims of Thesis, page 10) and to find out features of their motivation and preferences relating to teaching and learning style.

Examples of Attributional, Motivational Factors and Learning Style Statements in Questionnaire - Part 2: The following questions were used;

Ability Attribution Statements:

Question 1. 'Any success I have at science is due mainly to my ability'.

Question 3. 'Ability is more responsible for success at science for me than is effort'.

Effort Attribution Statement:

Question 2. 'Better results are obtained when I work hard'.

Motivation Factor Statements:

Question 7. 'My interest in science is important in order to gain good results'.

Question 11. 'I seldom expect good results from my science tests'.

Question 15. 'My achievement at science is related to how motivated I am'.

Learning Style Statements:

Question 9. 'A choice from different ways of learning, such as learning by doing practical work, would enable me to gain better results'.

Question 10. 'The teaching method has a large affect upon my results'.

Question 14. 'I would gain better results if I were able to have more time to study my science work'.

A classification and description of the motivational features contained within Part 2 are given in Appendix G. The students generally completed the questionnaire items in sequence, with the occasional student going back over a question that may have been earlier left unanswered. The questionnaires were required to be completed within the normal subject period time, which was adequate. Sufficient time was available for the

students to reflect upon their answers if they so needed. The questionnaires were completed in approximately 20 minutes.

Interview procedure: An interview protocol was devised by this researcher (Appendix D) and used with the students at the completion of the written exercise. Students were interviewed individually and were encouraged to ask questions relating to the oral questions and then were required to write their answers in brief form on a separate sheet of paper. Students were again informed that the answers supplied by them were confidential and their source would not be identified. It was considered important that confidence and confidentiality be maintained between the author and the students; therefore a tape recorder was not used during the interview in case students may have thought that they could be identified more easily by others from their voices than from their written responses. The purpose of this questionnaire was to see if there were any inconsistencies between the answers given and the other two written questionnaires, and to provide the students with an opportunity to express their own views on achievement at science besides the answers they gave to the author's statements.

Validity and Reliability

The question of validity and reliability arises concerning the questionnaires constructed by this author. Although these are important research factors, strict statistical measures of validity or reliability were not considered by the author to be essential because of the ipsative nature of the research (explained in the research methodology). However, face validity was established for the questionnaires. The questions were only intended to obtain a confidential response from the students at the time of asking, and therefore the answers could be expected to vary over time, because underachieving students do not necessarily need to remain as underachievers and therefore, differences in response might be expected. This data would be useful and relevant at the time of collection because it would relate directly to the statements

made by underachievers at their time or condition of underachievement, and by that reflect upon factors associated with the students' performance. It would therefore be assumed that these questions should not have high test-retest reliability over a long period between tests, because underachievement may be reversed by improved intervention, and the reasons given by the students for success may change. However, the questionnaires possessed an acceptable construct form of face validity for the author because the questions were based upon accepted empirical aspects of attributional motivation (Weiner & Kukla, 1970; Weiner & Potepan, 1970: Weiner, 1979), motivational patterns (Dweck, 1986) and choices concerning learning styles (Biggs, 1979, 1984; Dunn et al., 1989; Dunn, 1990), and were viewed by the supervisor for this thesis. The questionnaires were also shown to several science teachers and tried with other students not involved with this study before being used with the students. Some minor adjustments were made based on the teachers' suggestions. The general impression gained was that the questions used were appropriate and would be useful in finding out various attitudes of the students regarding their achievement at science.

The idiographic nature of the questionnaires implies that the results were reliable at the time of answering the questions, because the questionnaires were personal to the students. They were not to be used to compare their performance with others, as is done with academic tests. Underachieving students need not remain as underachievers and so answers to similar questions at a future time could be expected to be different to those given during the study, particularly if suitable intervention is made. An important point within this study sample is that the students involved were underachievers, or considered by teachers to be so, and therefore most would be aware that their standards of achievement could be better and so could be expected to be consistent with their responses at the time of answering the questionnaires. The degree of interest and cooperation shown by the students suggested a high degree of consistency and accuracy with their response and would very likely to have a high

level of reliability with a test-retest within a short interval. It was not felt to be beneficial to the students to have involved them with a second test to decide test-retest reliability in the short term. The reliability of the results may not be high over an extended period, but this was not considered by this author to be a critical requirement, because of the factors implicit in this form of research, such as changes in the students' attitudes that may result from subsequent improvement in achievement. Gronlund (1981) says;

> "The stability of reliability may be considerably affected over a period when using a test-retest method of finding out reliability" (pp. 96-97).

Generally, the longer the interval between test and retest, the more results are influenced by changes in the students' characteristics being measured. A reason for this as it relates to this research is that a student may have improved in achievement or have received further training and therefore ascribe a different attribution for the improved performance. Similarly if achievement is lower, a change in the attribution used by a student may result. It is very likely that results could be expected to be different over a period, especially if attributional and motivational enhancement training are used with underachievers. Therefore, stability over time need not be, and was not considered, a critical requirement of reliability for this study.

The various constructs used (Appendices F and G) are related to the causal attributes given for success and failure, choices of learning style, achievement motivation factors and motivational patterns. The content of the questions was designed to explore the students' ideas about their performance at science, which included questions relating to learning styles and motivation. The style of questions was based upon the personal experience of the author and anecdotal evidence obtained from underachieving students. Questions regarding attributional motivation were constructed from the dimensions used by Weiner and Kukla (1970) and Weiner (1979) because this aspect concerning motivation was important to establish whether there exists a relationship

between individual type, and the attributions used by underachievers (see Aims of Thesis, page 10).

Statistical Procedures Used

All data from the questionnaires were collected and processed by this author to form various Tables of Results presented in this chapter, Chapter 4, and in Appendix M. Other analytical material is contained within Appendices E, F, G, H, I, J, K, & L. Several statistical procedures were used to describe the results obtained from this study (Hinkle, Wiersma & Jurs, 1979; Horowitz, 1974; Mendenhall & Ott, 1980). The data conformed mainly to a nominal scale of measurement; therefore, a descriptive statistical method was used to describe differences between the modal responses for questionnaires 1 and 2, and a nonparametric test of significance (Chi Square [χ^2] distribution - one-sample case) was used for assessing whether there was any significance, that is 'whether or not the observed frequencies are a 'good fit' to the expected frequencies' between the numbers of individual types given in Table 3, and between the Function Pairs, in Table 3A (Hinkle et al., 1979, p. 338; Horowitz, 1974, pp. 380-385). A critical value for the 'χ^2' distribution score was calculated and this is given in Tables 3 and 3A. The modal response (most frequent response) for questionnaires 1 and 2 were used whenever possible to find if there were any differences between the various groups such as 'types' and Function Pairs, or whether there were any similar trends within the results. Differences between groups were decided by comparing the percentages of similar modal responses of individual types and Function Pairs. Statistical difference between a similar modal response was calculated as a percentage.

The importance of finding whether or not the observed frequencies of individual 'types'; are a 'good fit'; to the expected frequencies between the individual 'types' is recognised within this thesis; therefore, a critical value for χ^2 at 0.05 level for 15 degrees of freedom were used for the data analysis for both Tables 3 and 3A. This

means that a significant result will be one that is larger than the critical value, and is probably due to the factors involved in the test, such as the predominance of some individual 'types'. The probability of making an α error for the various statistical tests used is 5%; therefore a satisfactory level of confidence can be placed on conclusions made from the results (Hinkle et al., 1979; Horowitz, 1974; Mendenhall & Ott, 1980). The importance of statistical significance is recognised within this thesis, although a significant χ^2 value computed over all categories, does not specify which categories have caused the statistical significance, but point to categories that are large contributors to the computed χ^2 value (Hinkle et al., 1979; Horowitz, 1974)

Conclusion of Survey

At the completion of the survey the students were thanked for their cooperation and informed that some general opinions concerning the results would be given to them, particularly those that could be useful to improve science achievement. All the students in the research took part seriously and some expressed their interest in the questions contained in the questionnaires. Most of the students considered they had gained something by being caused to reflect on aspects related to their learning, and therefore, suggests the value of metacognitive skills in learning: This aspect will be discussed later in Chapter 5 regarding intervention approaches for underachievers.

Chapter Summary

This Chapter has described the methods used in this empirical study to obtain data from a selected 'purposive' sample of two sub-populations of underachieving senior science students. The data relates to the characteristics and identification of individual type, the attributions used for success and failure, and essential factors of motivation. A description of the categories of underachievers available for this study was given; also, the instruments used. A description of the statistical methods used for dealing with the data obtained from the study is included within this chapter. Chapter 4 gives details of the results and analysis of data gained from the study.

Chapter 4 -

Results and Analysis

Preview

This Chapter includes Tables 1A, 3, 3A, 3B, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, and a summary of the results relating to data collected from the written and interview questionnaires. A wide of range of data including results of total individual 'type' - that is, using the four dimensions such as ESTJ - and the Function Pair groups, as explained earlier, are contained within these tables. An analysis of the response characteristics for the Function Pairs is given in order to find common trends between 'type' and underachievement. A description of the attributional and motivational factors implicit within Questionnaire Part 2 is also summarised.

Summary of Research Questions

The reader is reminded of the research questions formulated for this thesis, and a brief summary of results to these questions follow. These will be covered in detail fully later.

- *Is the Myers-Briggs Type Inventory individual type related to underachievement?*

  The result of this study demonstrate that there is a relationship between the ESFJ and ISFJ 'types', and underachievement among the students participating in this study.

- *Are attributions given for success and failure related to the individual type of a learner?*

  No differences were found between the attributions used by the students in this study relating to 'type'.

- *Are attributions for success and failure related to underachievement?*

  Most of the students indicated that a 'lack of effort' was the major cause of their underachievement, and their own ability was given as a cause of

previous success. Students reported that insufficient motivation was the reason for their lack of effort.

- *Are there suitable intervention approaches that may reduce or prevent underachievement?*

  A number of suitable approaches relating to strategy and attributional training with motivational enhancement suggestions were developed as a result of this study, and these are decribed in Chapter 5.

The results presented show the various individual types and some derivations, such as Function Pairs, which can be obtained by using the Myers-Briggs Type Inventory. Table 1A gives the number of students involved in the study, the code letters of their 'type' obtained from their response to the Lawrence Type Inventory, and their science orientation defined on page 66.

Table 1A
Number of Students by MBTI Individual Type and Science Subject.

Type*	Biology	Physics	Chemistry	Other	Totals
ISTJ	0	1	1	0	2
ISTP	0	0	0	0	0
INTJ	0	0	0	0	0
INTP	0	1	0	0	1
ISFJ	1	1	3	1	6
ISFP	0	0	2	0	2
INFJ	1	0	0	0	1
INFP	0	0	0	1	1
ESTJ	0	0	2	0	2
ESTP	0	1	0	0	1
ENTJ	0	0	1	0	1
ENTP	0	3	0	0	3
ESFJ	3	2	2	0	7
ESFP	2	1	2	0	5
ENFJ	0	2	0	0	2
ENFP	1	0	0	2	3
Totals	**8**	**12**	**13**	**4**	**37**

Abbreviations: *Code Letters used in MBTI Type.

I - Introvert S - Sensing T - Thinking J - Judging

E - Extrovert N - Intuition F - Feeling P - Perceiving

Statistics: Several statistical methods were used for analysing the results and these have been described in Chapter 3. A nonparametric one-sample case for nominal data was used for Table 3 [Individual MBTI Types Chi Square Distribution by Numbers] and for Table 3A [MBTI Function Pairs Chi Square Distribution by Numbers]. A two-sample case using a 2 x 4 contingency table was used to determine if there was any statistical significant difference between the two underachiever categories used within this study. For most result tables the percentage for the modal response was calculated and comparisons made between 'types' or Function Pairs by comparing the percentages of similar modal responses. Differences can be identified either from the description of the modal response, (e.g. A - E or 1 - 3) or by the percentage of a similar response. It was unlikely that many of the responses to the questionnaires would be different for similar 'types' or Function Pairs because of the selection sample used for the study, but differences were expected from different 'types', possibly due to personality differences associated with those different 'types'. A number of differences did eventuate, and these will be discussed later in the discussion section. The percentages included within the tables show the strength or popularity of choice by the various categories of 'type'. Table 3 gives the number of each of the 16 possible 'types' located within the sample together with the result of a one-case Chi Square test. Table 3A gives the possible Function Pairs together with a one-case Chi Square test result.

Table 3

Individual MBTI Type Chi Square Distribution of Students

[Calculation of χ^2 for one-sample case]

Type	O	E	(O -E)	(O-E)2	(O-E)/E
ISTJ	2	2.3	-0.3	0.09	0.04
ISTP	0	2.3	-2.3	5.29	2.3
ISFJ	6	2.3	3.7	13.69	5.95
ISFP	2	2.3	-0.3	0.09	0.04
ESTJ	2	2.3	-0.3	0.09	0.04
ESTP	1	2.3	-1.3	1.69	0.73
ESFJ	7	2.3	4.7	22.09	9.6
ESFP	5	2.3	2.7	7.29	3.2
INTJ	0	2.3	-2.3	5.29	2.3
INTP	1	2.3	-1.3	1.69	0.73
INFJ	1	2.3	-1.3	1.69	0.73
INFP	1	2.3	-1.3	1.69	0.73
ENTJ	1	2.3	-1.3	1.69	0.73
ENTP	3	2.3	0.7	0.49	0.21
ENFJ	2	2.3	0.3	0.09	0.04
ENFP	3	2.3	0.7	0.49	0.21
Total	37				27.58

Critical value χ^2 = 24.996 at 0.05 df. 15

Summary: A nonparametric one-sample case for nominal data was used for Table 3 [Individual MBTI Types Chi Square Distribution by Numbers] and for Table 3A. The null hypothesis (H_o) tested for Table 3 was that the expected number for each of the 16 'types' would not exceed 2.3; this being 6.25% of 37 subjects in the sample. The percentage expected would be the same for each of the 16 'types', therefore the total 100% / 16 = 6.25%. The Chi Square χ^2 distribution, using an $\alpha = 0.05$ level of significance and a degree of freedom = 15 was used for Table 3 to determine whether or not the difference in numbers between the 'types' is too great to be attributed to sampling fluctuation (Hinkle et al., 1979). The calculated χ^2 value is 27.58, which is greater than the critical value of 24.996 for a 0.05 level of significance with 15 degrees of freedom. Therefore the null hypothesis was rejected and it was concluded that the difference between the observed (O) and expected (E) frequencies was too great to be attributed to sampling fluctuation. There were three 'types' which had a higher than expected expected frequency; these are the ESFJ, ISFJ and ESFP 'types'.

Table 3A

MBTI Function Pairs Chi Square Distribution by Numbers

F.Pair	O	E	(O-E)	$(O-E)^2$	$(O-E)^2/E$
ST	5	9.25	-4.25	18.06	1.95
SF	20	9.25	10.75	115.56	12.49
NT	5	9.25	-4.25	18.06	1.95
NF	7	9.25	-2.25	5.06	0.55
Total	37				16.94

Critical value $\chi^2 = 7.815$ at 0.05 df. 3

Summary: The null hypothesis (H_o) for Table 3A [MBTI Function Pairs Chi Square Distribution by Numbers] was that the expected number(E) for each of the four Function Pairs would not exceed 9.25; this being 25% of the 37 Function Pairs in the sample. The percentage expected would be the same for each of the four Function Pairs; therefore the total 100% / 4 = 25%. The Chi Square χ^2 distribution, using an α = 0.05 level of significance and three degrees of freedom was used. The calculated χ^2 value is 16.94, which is greater than the critical value of 7.915 for a 0.05 level of significance with three degrees of freedom. Therefore the null hypothesis was rejected and it was concluded that the difference between the observed (O) and expected (E) frequencies was too great to be attributed to sampling fluctuation (Hinkle et al., 1979). The Function Pair contributing a large value to the calculated χ^2 value was SF. Table 3B shows 54% of the sample were SF with the 'Sensing' function (55%) acting as the dominant one of the pair. The percentage of females (60%) was highest for the SF Function Pair.

Table 3B

Function Pairs by Percentage and Dominant Preference

F.Pair	No.	%	Preference	Male	Female
ST	5	13	S 3 T 2	4	1
SF	20	54	S 11 F 9	8	12
NT	5	13	N 3 T 2	5	0
NF	7	19	N 4 F 3	4	3

Abbreviations:

ST - Sensing-Thinking. SF - Sensing-Feeling. NT - Intuition-Thinking NF - Intuition-

S - Sensing. N - Intuition. T - Thinking. F - Feeling.

Tables 4A and 4B

These tables show the raw data results from Questionnaires Part 1 and Part 2 (Appendix B & C). Table 4A shows the 'letter' (e.g. A, B...) answer responses given by each of the students to each of the 10 multiple-choice questions in Questionnaire Part 1, and Table 4B shows the 'numerical' (e.g. 1, 2...) responses to the statements used in the Questionnaire Part 2. The numerical response indicates the strength of agreement or disagreement expressed by the students with the statements used in the questionnaire: 1 represents strongly agree; 2, agree; 3, uncertain; 4, disagree; 5, strongly disagree. There were no instances of questions being unanswered. Additional data is included within these tables.They include the students' number which was to used to identify and coordinate results from the three questionnaires, the schools from where the studentscame, students' sexual orientation, their science subject from which they were mainly underachieving, and their category relating to underachievement (as described in Chapter 3). This extra information gained from the questionnaires enabled specific schools to be identified in order that findings from the study could be attributed to the three contributing schools.

Table 4A
Record of Individual Responses by MBTI Type: Questionnaire - Part 1.

						QUESTIONS									
St.	TYPE	Sch.	Sex	Sub.	Cat.	1	2	3	4	5	6	7	8	9	10
1	ISTJ	A	M	CH	2	B	C	D	C	C	B	B	B	C	B
2	ENTJ	A	M	CH	1	B	C	B	C	B	C	B	A	B	B
3	ESFJ	A	M	BIO	2	C	C	D	E	D	B	B	B	A	B
4	ESFP	A	M	PHY	2	A	C	D	C	C	B	B	B	D	B
5	ENFJ	A	M	PHY	2	B	C	B	C	C	C	C	B	D	B
6	ENFJ	B	F	PHY	2	B	C	B	C	E	C	B	B	B	B
7	ISFJ	B	F	CH	2	B	C	D	B	B	C	B	D	D	B
8	ESFP	B	F	CH	2	B	C	B	B	C	B	B	B	B	B
9	ISFP	B	F	CH	1	B	C	C	C	E	C	B	B	A	B
10	ESFJ	B	F	PHY	2	E	C	D	B	B	B	C	A	D	B
11	ISFP	B	F	CH	2	B	C	C	C	D	C	B	B	A	B
12	ESFJ	B	F	CH	2	B	C	C	B	D	C	B	B	A	B
13	ISFJ	B	F	BIO	1	B	C	B	D	A	A	C	A	B	C
14	ISFJ	B	F	CH	2	C	E	D	E	E	D	D	C	A	B
15	ENFP	B	F	BIO	2	E	C	B	C	B	C	B	B	D	B
16	ISFJ	B	F	CH	1	B	C	C	E	D	B	C	B	C	B
17	ESFJ	B	F	BIO	1	C	E	B	D	D	D	B	C	A	B
18	ENFP	B	F	S.B	1	B	B	D	C	E	D	A	C	A	A
19	ESFJ	B	F	PHY	2	E	C	B	C	E	C	B	B	A	B
20	ESFP	A	M	CH	2	B	C	D	C	E	C	C	B	D	D
21	ESFJ	A	M	CH	1	B	C	B	A	C	C	B	B	D	B
22	ESFJ	A	M	BIO	1	B	C	B	C	E	B	B	C	C	B
23	ESFP	A	M	BIO	2	A	C	B	C	D	C	B	B	D	B
24	ENTP	A	M	PHY	2	A	C	A	C	C	C	A	B	B	B
25	INTP	A	M	PHY	2	A	E	A	C	E	B	B	B	B	A
26	ESTP	A	M	PHY	1	A	C	B	C	A	C	B	B	A	A
27	ISFJ	A	M	PHY	1	D	A	B	C	D	D	A	A	B	A
28	ENFP	A	M	HOR	2	A	C	A	C	B	A	A	B	D	A
29	ISFJ	A	M	HOR	1	B	A	C	E	D	C	A	A	C	D
30	INFJ	C	M	BIO	2	B	C	C	C	E	C	B	B	D	D
31	ESFP	C	F	BIO	1	E	A	B	D	D	A	B	C	C	B
32	ISTJ	C	F	PHY	2	E	C	B	C	D	A	B	D	A	B
33	ENTP	C	M	PHY	2	B	C	B	B	E	C	D	C	A	B
34	INFP	C	M	GS	1	C	C	B	E	A	A	D	C	D	B
35	ESTJ	C	M	CH	2	D	B	C	C	A	B	B	B	A	D
36	ESTJ	C	M	CH	1	E	E	C	E	B	D	C	C	C	B
37	ENTP	C	M	PHY	2	A	C	B	C	B	C	B	B	B	B

Abbreviations:

BIO - Biology. CH - Chemistry. GS - General Science. PHY - Physics.

HOR - Horticulture. S.B - Social Biology. Cat. - Category of Underachiever.

Sch. - School. Sub. - Subject.

Table 4B

Record of Individual Responses by MBTI Type: Questionnaire - Part 2.

			QUESTIONS														
St	Type	S.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	ISTJ	C	2	1	3	4	4	2	1	1	2	3	3	1	2	2	3
2	ENTJ	C	2	2	4	5	5	3	2	2	2	3	3	4	4	4	2
3	ESFJ	B	2	1	1	4	4	2	1	1	1	2	3	2	2	4	1
4	ESFP	P	2	2	1	3	2	3	2	2	3	3	3	3	3	3	1
5	ENFJ	P	3	1	3	5	2	4	2	2	2	2	4	2	3	4	2
6	ENFJ	P	2	1	3	4	2	4	2	1	2	2	2	2	4	3	1
7	ISFJ	C	2	2	4	4	2	3	1	1	2	2	2	2	3	1	2
8	ESFP	C	3	2	4	3	2	4	2	1	1	2	3	2	4	2	1
9	ISFP	C	2	2	5	5	3	1	2	1	2	2	2	3	3	1	1
10	ESFJ	P	2	4	2	4	4	2	2	2	1	1	4	3	2	2	2
11	ISFP	C	2	1	4	5	2	3	2	1	2	3	2	2	4	3	1
12	ESFJ	C	2	1	2	3	4	2	2	1	2	1	1	1	4	2	1
13	ISFJ	B	2	2	4	5	3	2	3	2	3	2	4	2	3	3	4
14	ISFJ	C	3	3	4	4	3	2	1	2	2	3	2	2	3	2	1
15	ENFP	B	1	1	3	5	4	4	2	2	2	1	4	2	3	2	1
16	ISFJ	C	2	1	2	5	3	3	3	1	1	1	1	3	4	2	1
17	ESFJ	B	3	1	3	4	1	2	1	1	2	1	2	2	2	2	1
18	ENFP	S.B	2	2	4	5	2	2	2	1	2	2	2	2	2	2	2
19	ESFJ	P	3	1	5	5	3	2	2	1	1	2	4	2	5	2	1
20	ESFP	C	2	1	4	4	2	4	2	2	2	2	3	2	5	2	1
21	ESFJ	C	4	1	4	5	1	3	2	2	2	3	4	1	5	3	1
22	ESFJ	B	1	2	3	5	4	2	1	2	1	1	4	3	3	3	1
23	ESFP	B	2	2	2	4	2	4	3	2	2	2	3	3	3	3	2
24	ENTP	P	1	1	1	5	3	5	1	4	3	5	5	1	2	1	1
25	INTP	P	1	1	1	5	3	5	1	4	1	1	5	4	1	5	5
26	ESTP	P	2	1	2	2	1	1	3	2	3	2	2	2	2	1	1
27	ISFJ	P	3	2	3	2	5	1	5	1	3	1	1	1	1	1	1
28	ENFP	H	3	3	2	5	3	2	2	2	2	2	3	2	2	3	4
29	ISFJ	H	3	3	2	5	3	2	2	2	2	2	3	2	2	3	4
30	INFJ	B	2	1	3	4	2	3	1	1	2	2	2	2	3	1	1
31	ESFP	B	1	1	3	2	3	4	1	2	3	1	2	1	3	1	1
32	ISTJ	P	2	2	4	4	5	2	3	1	2	2	2	4	4	2	2
33	ENTP	P	1	1	1	5	1	1	1	1	1	1	3	1	2	1	1
34	INFP	GS	3	1	4	2	2	2	1	2	1	2	3	2	4	2	1
35	ESTJ	C	2	2	4	5	4	4	3	2	3	2	2	2	4	3	1
36	ESTJ	C	4	1	4	4	3	2	2	3	2	1	3	2	4	2	1
37	ENTP	P	1	1	1	3	3	4	3	1	2	2	4	2	5	2	1

Abbreviations & Legend:

B - Biology. C - Chemistry. GS - General Science. P - Physics. H - Horticulture.

S.B - Social Biology. St - Student number. S - Subject.

1 - Strongly agree. 2 - Agree. 3 - Uncertain. 4 - Disagree. 5 - Strongly disagree.

Refer to Table 4A for Individual Category and Sex.

Tables 5A and 5B

The responses given by the Function Pairs are shown in Tables 5A and 5B. These Tables also show the modal response (the response that occurred most often in the set of selected responses) given by each of the Function Pair groups to each question answered respectively from Questionnaires Part 1 and Part 2. A numerical descriptive measure, using the percentage for each Function Pair group selecting the modal response (M%) is also given (Mendenhall & Ott, 1980). This enables the nominal data to be compared when the modal response for the Function Pairs is similar in form but differs in percentage.

Similar form of modal responses were made by each of the Function Pairs to questions 2, 3, 4, 7, 8, and 10 in Table 5A and for questions 2, 9, and 15 in Table 5B, but the percentage of each Function Pair selecting the modal response in Table 5A for question 4 shows a wide range (40% - 85%) between the pairs, with the SF group gaining the lower percentage. The modal response given to question 4:

'Results from science could be improved by working harder',

indicate a general approval by all the Function Pairs with this attribution relating to their performance at science, with the SF group being the least certain about this attribution. The NF group gained the lower percentage for question 7, from the range of (43% - 80%). The modal response for question 7:

'Working harder at the subject',

was considered to be the most important factor that would help them to gain good results at science. This modal result is similar to question 4 with all the Function Pairs supporting effort as being important for good results; however, the NF group did not show quite the same amount of support for this attribution.

The results in Table 5B show that the NT 'type' for question 3 were high in agreement with the statement:

'Ability is more responsible for success than is effort'.

But for questions 4 and 11 they disagreed with the statements:

'Luck is a big factor in the results gained from science'.

'Seldom expect good results from science tests'.

In question 1 there was complete agreement, compared with 80% for ST, 65% for SF, and 57% for NF. For question 3, also relating to 'ability', the NT agreement score was 80%, compared to 20% for ST, 15% for SF and 14% for NF. The NT 'type' showed a consistency of choice within both questionnaires regarding 'ability' being important for success. The SF 'type' also indicated by their responses to question 1 that their tendency to accept the attribution of ability was more important for success than is effort with 65% agreeing, 30% unsure and 5% disagreeing with the statement Students were unsure that their results could be improved by working harder (question 4, Table 5A), and strongly considered that ability is more important to improve their results at science (question 3, Table 5B).

Table 5A
Responses by Function Pairs: Questionnaire - Part 1.

	QUESTIONS												
Function Pair	1	2	3	4	5	6	7	8	9	10	St.	D	Sex
ST	B	C	D	C	C	B	B	B	C	B	1	S	M
ST	A	C	B	C	A	C	B	B	A	A	26	S	M
ST	E	C	B	C	D	A	B	D	A	B	32	S	F
ST	D	B	C	C	A	B	B	B	A	D	35	T	M
ST	E	E	C	E	B	D	C	C	C	B	36	T	M
Md.	E	C	B	C	A	B	B	B	A	B		S	M
M%	40	60	40	80	40	40	80	60	60	60			
SF	C	C	D	E	D	B	B	B	A	B	3	F	M
SF	A	C	D	C	C	B	B	B	D	B	4	S	M
SF	B	C	D	B	B	C	B	D	D	B	7	S	F
SF	B	C	B	B	C	B	B	B	B	B	8	S	F
SF	B	C	C	C	E	C	B	B	A	B	9	F	F
SF	E	C	D	B	B	B	C	A	D	B	10	F	F
SF	B	C	C	C	D	C	B	B	A	B	11	F	F
SF	B	C	C	B	D	C	B	B	A	B	12	F	F
SF	B	C	B	D	A	A	C	A	B	C	13	S	F
SF	C	E	D	E	E	D	D	C	A	B	14	S	F
SF	B	C	C	E	D	B	C	B	C	B	16	S	F
SF	C	E	B	D	D	D	B	C	A	B	17	F	F
SF	E	C	B	C	E	C	B	B	A	B	19	F	F
SF	B	C	D	C	E	C	C	B	D	D	20	S	M
SF	B	C	B	A	C	C	B	B	D	B	21	F	M
SF	B	C	B	C	E	B	B	C	C	B	22	F	M
SF	A	C	B	C	D	C	B	B	D	B	23	S	M
SF	D	A	B	C	D	D	A	A	B	A	27	S	M
SF	B	A	C	E	D	C	A	A	C	D	29	F	M
SF	E	A	B	D	D	A	B	C	C	B	31	S	F
Md.	B	C	B	C	D	C	B	B	A	B		S	F
M%	55	75	45	40	45	45	65	55	35	80			
NT	B	C	B	C	B	C	B	A	B	B	2	T	M
NT	A	C	A	C	C	C	A	B	B	B	24	N	M
NT	A	E	A	C	E	B	B	B	B	A	25	T	M
NT	B	C	B	B	E	C	D	C	A	B	33	N	M
NT	A	C	B	C	B	C	B	B	B	B	37	N	M
Md.	A	C	B	C	BE	C	B	B	B	B		N	M
M%	60	80	60	80	40	80	60	60	80	80			
NF	B	C	B	C	C	C	C	B	D	B	5	F	M
NF	B	C	B	C	E	C	B	B	B	B	6	F	F
NF	E	C	B	C	B	C	B	B	D	B	15	N	F
NF	B	B	D	C	E	D	A	C	A	A	18	N	F
NF	B	C	C	C	E	C	B	B	D	D	30	N	M
NF	A	C	A	C	B	A	A	B	D	A	28	N	M
NF	C	C	B	E	A	A	D	C	D	B	34	F	M
Md.	B	C	B	C	E	C	B	B	D	B		N	M
M%	57	86	57	85	43	57	43	71	71	57			

Abbreviations:
Md. - Modal responses for question by Function Pair group. D - Dominant preference.
M% - Percentage of Function Pair group selecting the modal response.

Table 5A (i)
Summary of Modal Results by Function Pairs: Questionnaire - Part 1.

		QUESTIONS									
F.Pair	No.	1*	2	3	4	5*	6*	7	8	9*	10
ST	5	E	C	B	C	A	B	B	B	A*	B
SF	20	B*	C	B	C	D	C*	B	B	A*	B
NT	5	A	C	B	C	B/E*	C*	B	B	D	B
NF	7	B*	C	B	C	E*	C*	B	B	D	B

Abbreviation: * = Highest total letter response for the question (i.e. B for question 1).

Summary: Table 5A (i) indicates the modal response given by the Function Pair groups for each of the questions. An asterisk (*) indicates the highest total 'letter' response from all the groups where there was a difference of modal response by other Function Pair groups. This can be found in the following questions 1, 5, 6, and 9, with the respective modal response by each of the groups.

Question 1. Do you think that any success by you at Science is due to...?

ST (40%) - 'The teaching style'. SF (55%) - 'Your effort'.

NT (60%) - 'Your ability'. NF (57%) - 'Your effort'.

Question 5. If you receive a disappointing Science result, do you...?

ST (40%) - 'Put it down to a chance event'. SF (45%) - 'Consider the task beyond your ability'.

NT (40%) - 'Treat it as a learning task and want another go at it', equal with, 'Decide to give much more effort at your Science work'.

NF (43%) - 'Decide to give much more effort at your Science'.

Question 6. Do you consider that Science as a subject for you is...?

ST (40%) - 'Just another subject within the school curriculum for you to do'.

SF (45%), NT (80%), and NF (57%) - 'Essential, only as a means to gain future qualifications'.

Question 9. When faced with a challenging or difficult problem in Science, do you...?

ST (60%) and SF (35%) - 'Give up without trying too much'.

NT (80%) - 'Persist in spite of any failures until you achieve a satisfactory result'.

NF (71%) - 'Try to find out about the best strategy to use to solve the problem'.

There was a bi-modal response for B and E by the NT group for question 5, with E gaining the overall highest selection from all groups. Similar modal responses were selected for questions 2, 3, 4, 7, 8, and 10 by all groups.

Table 5B

Responses by Function Pairs: Questionnaire - Part 2.

	QUESTIONS																
Function Pair	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	S	D
ST	2	1	3	4	4	2	1	1	2	3	3	1	2	2	3	1	S
ST	2	1	2	2	1	1	3	2	3	2	2	2	2	1	1	26	S
ST	2	2	4	4	5	2	3	1	2	2	2	4	4	2	2	32	S
ST	2	2	4	5	4	4	3	2	3	2	2	2	4	3	1	35	T
ST	4	1	4	4	3	2	2	3	2	1	3	2	4	2	1	36	T
Md.	2	1	4	4	4	2	3	1.2	2	2	2	2	4	2	1		S
M%	80	60	60	60	40	60	60	40	60	60	60	60	60	60	60		
SF	2	1	1	4	4	2	1	1	1	2	3	2	2	4	1	3	F
SF	2	2	1	3	2	3	2	2	3	3	3	3	3	3	1	4	S
SF	2	2	4	4	2	3	1	1	2	2	2	2	3	1	2	7	S
SF	3	2	4	3	2	4	2	1	1	2	3	2	4	2	1	8	S
SF	2	2	5	5	3	1	2	1	2	2	2	3	3	1	1	9	F
SF	2	4	2	4	4	2	2	2	1	1	4	3	2	2	2	10	F
SF	2	1	4	5	2	3	2	1	2	3	2	2	4	3	1	11	F
SF	2	1	2	3	4	2	2	1	2	1	1	1	4	2	1	12	F
SF	2	2	4	5	3	2	3	2	3	2	4	2	3	3	4	13	S
SF	3	3	4	4	3	2	1	2	2	3	2	2	3	2	1	14	S
SF	2	1	2	5	3	3	3	1	1	1	1	3	4	2	1	16	S
SF	3	1	3	4	1	2	1	1	2	1	2	2	2	2	1	17	F
SF	3	1	5	5	3	2	2	1	1	2	4	2	5	2	1	19	F
SF	2	1	4	4	2	4	2	2	2	2	3	2	5	2	1	20	S
SF	4	1	4	5	1	3	2	2	2	3	4	1	5	3	1	21	F
SF	1	2	3	5	4	2	1	2	1	1	4	3	3	3	1	22	F
SF	2	2	2	4	2	4	3	2	2	2	3	3	3	3	2	23	S
SF	3	2	3	2	5	1	5	1	3	1	1	1	1	1	1	27	S
SF	3	3	2	5	3	2	2	2	2	2	3	2	2	3	4	29	F
SF	1	1	3	2	3	4	1	2	3	1	2	1	3	1	1	31	S
Md	2	1	4	5	3	2	2	1.2	2	2	2.3	2	3	2	1		
M%	55	45	35	40	35	45	50	50	50	45	30	50	40	40	75		
NT	2	2	4	5	5	3	2	2	2	3	3	4	4	4	2	2	T
NT	1	1	1	5	3	5	1	4	3	5	5	1	2	1	1	24	N
NT	1	1	1	5	3	5	1	4	1	1	5	4	1	5	5	25	T
NT	1	1	1	3	3	4	3	1	2	2	4	2	5	2	1	37	N
NT	1	1	1	5	1	1	1	1	1	1	3	1	2	1	1	33	N
Md	1	1	1	5	3	5	1	1.4	2	1	3.5	1.4	2	1	1		N
M%	80	80	80	80	60	40	60	40	40	40	40	40	40	40	60		
NF	3	1	3	5	2	4	2	2	2	2	4	2	3	4	2	5	F
NF	2	1	3	4	2	4	2	1	2	2	2	2	4	3	1	6	F
NF	1	1	3	5	4	4	2	2	2	1	4	2	3	2	1	15	N
NF	2	2	4	5	2	2	2	1	2	2	2	2	2	2	2	18	N
NF	3	3	2	5	3	2	2	2	2	2	3	2	2	3	4	28	N
NF	3	1	4	2	2	2	1	2	1	2	3	2	4	2	1	34	F
NF	2	1	3	4	2	3	1	1	2	2	2	2	3	1	1	30	N
Md	2	1	3	5	2	2.4	2	2	2	2	2	2	3	2	1		N
M%	43	70	57	57	70	43	70	57	86	86	43	100	43	43	57		

Abbreviations: D - Dominant dimension. Md - Modal response by group for question.

S - Student number. M% - Percentage of Function Pair group selecting the modal response.

1 - Strongly agree. 2 - Agree. 3 - Uncertain. 4 - Disagree. 5 - Strongly disagree.

Summary: Table 5B (i) show results of scores less than 3 indicating agreement with the question statement. Results show strong agreement by the groups for the following statements;

Question 2. 'Better results are obtained from hard work'. (89%)

Question 8. 'Results could be better'. (89%)

Question 9. 'A choice from different learning styles would gain me better results'. (81%)

Question 10. 'The teaching method has a large affect upon my results'. (84%)

Question 15. 'Achievement is related to their motivation'. (86%)

Table 5B - (i)
Summary of Results by Function Pairs: Questionnaire - Part 2.

Function Pair & No.	Questions														
ST(5)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
< 3	4	5	1	1	1	4	2	4	3	4	3	4	2	4	4
percent	80	100	20	20	20	80	40	80	60	80	60	80	40	80	80
SF(20)															
< 3	13	17	7	2	8	11	16	20	16	16	9	14	5	12	18
percent	65	85	35	15	40	55	80	100	80	80	45	70	25	60	90
NT(5)															
< 3	5	5	4	0	1	1	4	3	4	3	0	3	3	3	4
percent	100	100	80	0	20	20	80	60	80	60	0	60	60	80	80
NF(7)															
< 3	4	6	1	1	5	3	7	7	7	7	3	7	2	4	6
percent	57	86	14	14	71	43	100	100	100	100	43	100	28	57	86
Total No< 3	26	33	14	5	14	19	29	33	30	31	15	27	12	23	32
percent	70	89	38	13	39	51	78	89	81	84	40	73	32	62	86

Abbreviations: Numbers for each Function Pair group is in brackets. < 3 == less than 3. Less than 3 represents agreement with the question statement.

Summary: Table 5B (ii) shows the percentage of disagreement with the question statements. The strongest disagreement was for:

Question 4. 'Luck is a big factor in the results obtained from tests'. (76%)

Question 3. 'Ability is more responsible for success at sciences than is effort'. (38%)

Question 13. 'Intelligence is a fixed mental ability that determines the results obtained from science'. (38%)

Both the Function Pair groups with a 'T' function (ST and NT) were more in 'agreement' with question 13 than with 'disagreement', but 35% of the SF group 'disagreed' and 25% 'agreed' with the statement. The NF were equally divided between agreement and disagreement.

Table 5B - (ii)
Summary of Results by Function Pairs: Questionnaire - Part 2.

Function Pair & No.	Questions														
ST(5)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
>3	1	0	3	4	3	1	0	0	0	0	0	1	3	0	0
percent	20	0	60	80	60	20	0	0	0	0	0	20	30	0	0
SF(20)															
>3	1	1	9	15	5	4	1	0	0	0	5	0	7	1	2
percent	5	5	45	75	25	20	5	0	0	0	25	0	35	5	10
NT(5)															
>3	0	0	1	4	1	3	0	2	0	1	3	2	2	2	1
percent	0	0	20	80	20	60	0	40	0	20	60	40	40	40	20
NF(7)															
>3	0	0	2	6	1	3	0	0	0	0	2	0	2	1	1
percent	0	0	28	86	14	43	0	0	0	0	28	0	28	14	14
Total No. >3	2	1	14	28	13	13	1	2	0	1	10	3	14	3	4
percent	5	2	38	76	35	35	2	5	0	2	27	8	38	8	11

.Abbreviations: Numbers for each Function Pair group is in brackets. > 3 == more than 3. Greater than 3 represents disagreement with the question statement.

Statistics for 5A and 5B: The percentages were calculated for the modal responses given by each of the Function Pair groups to the question statements in Questionnaire Parts 1 and 2. Differences in percentage between the Function Pair groups selecting the same modal response shown in Tables 5A and 5B were calculated and analysed on the basis of their percentage result. For example, in Table 5A a 45% difference was found for the SF (40%) and NF (85%) 'types' for question 4:

'Results from science can be improved by working harder'.

and a 43% difference between NF (43%) and ST (80%) for question 7:

'The most important factor to improve results is to work harder'.

The SF % for question 4 is well below the % of the other Function Pairs, and the NF response for question 8 is above the % of the other Function Pairs. The responses for questions 2, 3, 4, 7, 8, and 10 in Table 5A, by each of the Function Pair types were similar, but random differences were found for the other answers. ST and SF types for question 9 indicated:

'Low persistence when faced with a challenging or difficult problem in science'.

Whereas the NT and NF types indicated high persistence by:

'When faced with a difficult problem, they would try to find the best strategy to solve the problem'.

Strong areas of agreement between the Function Pairs is evident by the modal responses for questions 2, 8, 10, and 15, with a range of 84% - 89%. Questions 1, 7, 9, and 12 also had responses greater than 70% in agreement.

Tables 6A and 6B

Tables; 6A, and 6B give the results for the Function Pairs for the two different categories of underachievers. The reader is reminded of the two categories of underachievers as stated in the Research Methodology (page 65): Category '1' are students whose test results were in the lower 10th percentile, and Category '2' are students who were selected by the subject teacher as being acute underachievers

because they had displayed a sound level of ability earlier in their schooling, but were currently well below the level expected of them. Table 6A shows the modal response for each Function Pair type for its respective category, together with the percentage for each question in Questionnaire Part 1. Table 6B similarly shows the modal response relating to Questionnaire Part 2.

A nonparametric two-sample case using a 2 x 4 Chi Square χ^2 contingency table (two categories of underachievers x four Function Pair groups) was used to test the null hypothesis H_o that the function pairs within the two categories of underachievers are similar in distribution (Hinkle et al., 1979). The critical value of the Chi Square χ^2 distribution, using an $\alpha = 0.05$ level of significance with three degrees of freedom is 7.814. The calculated value of χ^2 is 1.38, therefore the null hypothesis was accepted, and it was concluded that the distribution of Function Pairs within the two categories of underachievers used in this study are similar.

Table 6A

Response of Function Pairs By Category: Questionnaire - Part 1.

					QUESTIONS			Category '1'					
F.Pair.	1	2	3	4	5	6	7	8	9	10	D	St.	Sex
ST	A	C	B	C	A	C	B	B	A	A	S	26	M
ST	E	E	C	E	B	D	C	C	C	B	T	36	M
SF	B	C	C	C	E	C	B	B	A	B	F	9	F
SF	B	C	B	D	A	A	C	A	B	C	S	13	F
SF	B	C	C	E	D	B	C	B	C	B	S	16	F
SF	C	E	B	D	D	D	B	C	A	B	F	17	F
SF	B	C	B	A	C	C	B	B	D	B	F	21	M
SF	B	C	B	C	E	B	B	C	C	B	F	22	M
SF	D	A	B	C	D	D	A	A	B	A	S	27	M
SF	B	A	C	E	D	C	A	A	C	D	F	29	M
SF	E	A	B	D	D	A	B	C	C	B	S	31	F
Md.	B6	C5	B6	C.D	D5	C3	B5	ABC	C4	B6	F5		
M%	67	56	67	33	56	33	56	33	44	67	56		
NT	B	C	B	C	B	C	B	A	B	B	T	2	M
NF	B	B	D	C	E	D	A	C	A	A	N	18	F
NF	C	C	B	E	A	A	D	C	D	B	N	34	M
								Category '2'					
ST	B	C	D	C	C	B	B	B	C	B	S	1	M
ST	E	C	B	C	D	A	B	D	A	B	S	32	F
ST	D	B	C	C	A	B	B	B	A	D	T	35	M
SF	C	C	D	E	D	B	B	B	A	B	F	3	M
SF	A	C	D	C	C	B	B	B	D	B	S	4	M
SF	B	C	D	B	B	C	B	D	D	B	S	7	F
SF	B	C	B	B	C	B	B	B	B	B	S	8	F
SF	E	C	D	B	B	B	C	A	D	B	F	10	F
SF	B	C	C	C	D	C	B	B	A	B	F	11	F
SF	B	C	C	B	D	C	B	B	A	B	F	12	F
SF	C	E	D	E	E	D	D	C	A	B	S	14	F
SF	E	C	B	C	E	C	B	B	A	B	F	19	F
SF	B	C	D	C	E	C	C	B	D	D	S	20	M
SF	A	C	B	C	D	C	B	B	D	B	S	23	M
Md.	B5	C10	D6	C5	D4	C6	B8	B8	AD5	B10	S6		
M%	45	90	54	45	36	54	73	73	45	91	54		
NT	A	C	A	C	C	C	A	B	B	B	N	24	M
NT	A	E	A	C	E	B	B	B	B	A	T	25	M
NT	B	C	B	B	E	C	D	C	A	B	N	33	M
NT	A	C	B	C	B	C	B	B	B	B	N	37	M
Md.	A3	C3	AB2	C3	E2	C3	B2	B3	B3	B4	N		
M%	75	75	50	75	50	75	50	75	75	75	75		
NF	B	C	B	C	C	C	C	B	D	B	F	5	M
NF	B	C	B	C	E	C	B	B	B	B	F	6	F
NF	E	C	B	C	B	C	B	B	D	B	N	15	F
NF	A	C	A	C	B	A	A	B	D	A	N	28	M
NF	B	C	C	C	E	C	B	B	D	D	N	30	M
Md.	B3	C5	B3	C5	B.E2	C4	B3	B5	D4	B3	N		
M%	60	100	60	100	40	80	60	100	80	60	60		

Abbreviations: Md - Mode preference and number or responses. M% - Mode percentage.

Statistical Summary: A difference in attributional preference was found within the Function Pair groups shown in Table 6A for questions 1, 3, 5, and 9 for Category '2'. The NT group differed from NF and SF groups for questions 1 and 9, and from the SF group for question 3 and 5. For question 1, the NT (75%) modal response was:

'Ability being the cause for their previous success',

whereas NF (60%) and SF (45%) chose:

'Effort as their cause for their previous success',

and for question 9:

'Persist in spite of any failures until they receive a satisfactory result',

whereas NF (80%) and SF (45%) groups chose:

'Try to find the best strategy to use to solve problems'.

For question 3, SF (54%) chose:

'Consider the task beyond their ability, when faced with a disappointing result from their science work',

whereas NT (50%) and NF (60%) chose;

'Treat it as a learning task and want another go at it'.

A difference was found between the SF (56%) group and other groups within Table 6A, Category '1' for question 5:

'When receiving a disappointing science result - they consider the task was beyond their ability'.

This was the only response not found within either of the other groups; however, it may only be a random event and not be a significant difference between the groups, because of the small numbers within each of the Function Pair groups.

Differences between the two categories for the SF groups were found for the modal response for questions 3 and 9 in Table 6A; 67 % of Category '1' chose;

'Take the results from science tests as they come',

for question 3, whereas the modal response for Category '2' was 54% for;

'Varied in their expectation of results depending upon how they were feeling'.

For question 9, 44 % of Category '1' chose;

'Consider the problem beyond their ability, and not try again',

and Category '2' had an equal number of cases (45 %) choosing;

'Give up without trying, and try to find the best strategy to use to solve the problem'.

Both questions 3 and 9 within Table 6A relate to the motivational factors of expectation and persistence, and although there were differences between these SF categories of underachievers, motivation is indicated as being a problem that could affect achievement.

Table 6B

Response of Function Pairs By Category: Questionnaire - Part 2.

	QUESTIONS										Category '1'					
Function Pair	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	S.
ST	2	1	2	2	1	1	3	2	3	2	2	2	2	1	1	26
ST	2	1	4	4	3	2	2	3	2	1	3	2	4	2	1	36
SF	2	2	5	5	3	1	2	1	2	2	2	3	3	1	1	9
SF	2	2	4	5	3	2	3	2	3	2	4	2	3	3	4	13
SF	2	1	2	5	3	3	3	1	1	1	1	3	4	2	1	16
SF	3	1	3	4	1	2	1	1	2	1	2	2	2	2	1	17
SF	4	1	4	5	1	3	2	2	2	3	4	1	5	3	1	21
SF	1	2	3	5	4	2	1	2	1	1	4	3	3	3	1	22
SF	3	2	3	2	5	1	5	1	3	1	1	1	1	1	1	27
SF	3	3	2	5	3	2	2	2	2	2	3	2	2	3	4	29
SF	1	1	3	2	3	4	1	2	3	1	2	1	3	1	1	31
Md.	2.3	1.2	3	5	3	2	1.2	2	2	1	2.4	1.2.3	3	3	1	
M%	33	50	44	67	56	44	33	56	44	56	33	33	44	44	78	
NT	2	2	4	5	5	3	2	2	2	3	3	4	4	4	2	2
NF	2	2	4	5	2	2	2	1	2	2	2	2	2	2	2	18
NF	3	1	4	2	2	2	1	2	1	2	3	2	4	2	1	34
											Category '2'					
FPr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	S
ST	2	1	3	4	4	2	1	1	2	3	3	1	2	2	3	1
ST	2	2	4	4	5	2	3	1	2	2	2	4	4	2	2	32
ST	2	2	4	5	4	4	3	2	3	2	2	2	4	3	1	35
Md.	2	2	4	4	4	2	3	1	2	2	2	2	4	2	2	
M%	100	67	67	67	67	67	67	67	67	67	67	33	67	67	33	
SF	2	1	1	4	4	2	1	1	1	2	3	2	2	4	1	3
SF	2	2	1	3	2	3	2	2	3	3	3	3	3	3	1	4
SF	2	2	4	4	2	3	1	1	2	2	2	2	3	1	2	7
SF	3	2	4	3	2	4	2	1	1	2	3	2	4	2	1	8
SF	2	4	2	4	4	2	2	2	1	1	4	3	2	2	2	10
SF	2	1	4	5	2	3	2	1	2	3	2	2	4	3	1	11
SF	2	1	2	3	4	2	2	1	2	1	1	1	4	2	1	12
SF	3	3	4	4	3	2	1	2	2	3	2	2	3	2	1	14
SF	3	1	5	5	3	2	2	1	1	2	4	2	5	2	1	19
SF	2	1	4	4	2	4	2	2	2	2	3	2	5	2	1	20
SF	2	2	2	4	2	4	3	2	2	2	3	3	3	3	2	23
Md.	2	1	4	4	2	2	2	1	2	2	3	2	3	2	1	
M%	73	45	45	54	54	45	64	54	54	54	45	64	36	54	73	
NT	1	1	1	5	3	5	1	4	3	5	5	1	2	1	1	24
NT	1	1	1	5	3	5	1	4	1	1	5	4	1	5	5	25
NT	1	1	1	5	1	1	1	1	1	1	3	1	2	1	1	33
NT	1	1	1	3	3	4	3	1	2	2	4	2	5	2	1	37
Md.	1	1	1	5	3	5	1	1.4	1	1	5	1	2	1	1	
M%	100	100	100	75	75	50	75	50	50	50	50	50	50	50	75	
NF	3	1	3	5	2	4	2	2	2	2	4	2	3	4	2	5
NF	2	1	3	4	2	4	2	1	2	2	2	2	4	3	1	6
NF	1	1	3	5	4	4	2	2	2	1	4	2	3	2	1	15
NF	3	3	2	5	3	2	2	2	2	2	3	2	2	3	4	28
NF	2	1	3	4	2	3	1	1	2	2	2	2	3	1	1	30
Md.	2.3	1	3	5	2	4	2	2	2	2	2.4	2	3	3	1	
M%	40	80	80	60	60	60	80	60	100	80	40	100	60	40	60	

Legend: 1 - Strongly agree. 2 - Agree. 3 - Uncertain. 4 - Disagree. 5 - Strongly disagree.

Statistical Summary: The modal response shown in Tables 6B and 6B (i) for questions 3 and 4;

'Ability is more responsible for success than is effort'.

'Luck is a big factor in the results gained from tests',

shows that both categories disagreed with the question statement; this also was the case for each of the Function Pair groups. Category '1' had the higher percentage of disagreement of the two categories for both questions; 43 % compared to 30% for question 3 and 57% compared to 39 % for question 4.

Table 6B - (i)
Summary of Percentage Results for Highest Total Response by Category for Table 6B.

	QUESTIONS														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mode.	**2**	**1**	**4**	**5**	**3**	**2**	**2**	**1**	**2**	**2**	**2.3**	**2**	**3**	**2**	**1**
Category '1' %	50	50	43	57	43	50	43	57	50	43	36	50	29	36	71
Category '2' %	57	61	30	39	26	35	48	52	61	57	35	61	30	43	65
Total Mode %	54	56	37	48	35	43	46	55	56	50	36	56	30	40	68

The highest percentage (68%) of agreement shown by the responses to the questionnaire statements was shown for question 15 (achievement motivation factor):

'My achievement at science is related to how motivated I am'.

Category '1' had 86% agreeing with the statement and 2% (SF group) disagreeing, whereas Category '2' had 87% agreeing, 14% (NT and NF groups) disagreeing and 0,04 % (ST) uncertain. This result indicates that most of the students used in this study considered motivation as being an important factor in learning.

For question 5 (attribution motivation factor),there was a difference between categories for the SF groups; Category '1', (56%) were uncertain but Category '2', (54%) agreed with the statement:

'The harder I work the luckier I seem to be with gaining good results'. Uncertainty was also shown by the response of both Categories to question 13 (motivation factor):

'Intelligence is a fixed mental ability that determines the results I gain from science'.

The SF group within Category '1' had 44% of the group uncertain, whereas within Category '2', the SF group had 17% uncertain. The total of uncertain responses for question 13 for each category was respectively, Category '1', 29% and Category '2', 30%.

Tables 7A and 7B

Tables 7A and 7B show the percentages of each Function Pair group who gave the modal response to Questionnaire Part 1 and Part 2, as well as the percentage for each category. The mode letter, or number (the response gaining the most frequent response) represents the modal response of both categories of underachievers.

Table 7A

Percentage for Function Pairs by Most Frequent Response: Questionnaire - Part 1.

Function Pair & No.	QUESTIONS 1	2	3	4	5	6	7	8	9	10
								Category '1'		
Mode.	B	C	B	C	D	C	B	B	A	B
ST(2)	0	50	50	50	0	50	50	50	50	50
SF(9)	67	56	67	33	56	33	56	33	22	67
NT(1)	100	100	100	100	0	100	100	0	0	100
NF(2)	50	50	50	50	0	0	0	0	50	50
Category Mode %	57	57	64	43	35	36	50	29	29	64
								Category '2'		
ST(3)	33	67	33	100	33	0	100	67	67	67
SF(11)	45	91	27	45	36	54	73	73	45	91
NT(4)	25	75	50	75	0	75	50	75	25	75
NF(5)	60	100	60	100	0	80	60	100	0	60
Category Mode%	43	87	39	69	22	56	69	78	35	78

Statistical Summary: Differences between the two categories of underachievers can be seen in the different percentages from each category who chose the modal response. Category '2' had a higher percentage of modal response for questions 2, 4, 6,

7, 8, 9, and 10. It is difficult to compare the Function pair groups of each category because of the small number of cases; however, the SF group percentage for Category '2' was higher for questions 2, 4, 6, 7, 8, 9, and 10 between the categories. The following are the modal response statements chosen by the SF groups relating to the above questions. The motivation feature associated with each question is shown in brackets;

Question 2. What do you think is the main cause of any failure or underachievement you may have experienced? [Attributional factor for failure]

Response - 'Did not work hard enough'.

Question 4. Do you think you could improve your results from Science by...? [Learning style factor]

Response - 'By Working harder'.

Question 6. Do you consider that Science as a subject for you is...? [Motivation factor - value]

Response - 'Essential, only as a means to gain future qualifications'.

Question 7. Which do you think is the most important factor that would help you to gain good results at Science'? [Attributional factor for success]

Response - 'Working harder at the subject'.

Question 8. Do you consider that...? [Attributional factor for ability or effort]

Response - 'You have a good level of ability, but do not always work hard enough'.

Question 9. When faced with a challenging or difficult problem in Science, do you...? [Motivational factor - persistence or avoidance]

Response - 'Give up without trying too much'.

Question 10. Do you think that intelligence is...? [Motivation factor - pattern]

Response - 'A flexible mental ability that can be improved with learning'.

Table 7B

Percentage for Function Pairs By Most Frequent Response: Questionnaire - Part 2.

	QUESTIONS									Category '1'					
Function Pair	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mode	**2**	**1**	**4**	**5**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**1**
ST	100	100	50	0	50	50	50	50	50	50	50	100	0	50	100
SF	33	44	22	67	56	44	33	56	44	33	33	33	44	22	78
NT	100	0	100	100	0	0	100	100	100	0	0	0	0	0	0
NF	50	50	100	50	0	100	50	50	50	100	50	100	0	100	50
Mode %	50	50	43	57	43	50	43	57	50	43	36	50	21	36	71
										Category '2'					
ST	100	33	67	0	0	67	0	33	67	67	67	33	0	67	33
SF	73	45	45	54	18	45	64	46	55	55	27	64	36	55	73
NT	0	100	0	75	75	0	0	0	33	25	0	25	0	25	75
NF	40	80	0	75	20	20	80	60	100	80	40	100	60	20	60
Mode %	56	61	30	39	26	35	48	40	61	57	30	61	30	43	65

Statistical Summary: The highest percentage of similar responses by both categories is shown in Table 7B for question 15 (achievement motivational factor),

'My achievement at science is related to how motivated I am'.

Each of the Function Pair groups with the exception of NT in Category '1' strongly agreed that motivation was an important factor for their achievement.

Only two questions, (3 and 4), which relate to attributions for success or failure, showed a disagreement modal response, with the higher percentage found within Category '1' for both questions. The SF group in Category '2' had 45% (Table 7B) disagreeing and 0.09% (Table 6B) strongly disagreeing, giving a total 54% with no uncertain responses for the statement:

'Ability is more responsible for success at science for me than is effort',

compared with Category '1', 22% (Table 7B) disagreeing and 0.1% (Table 6B) strongly disagreeing, giving a total of 33% with 44% uncertain responses. For question 4, the SF group in Category '1' had the higher percentage with a 67% disagreement modal response from Table 7B and 0.1% (Table 6B) strong disagreement, giving a total of 78%, with no uncertain responses but Category '2' had 54% disagreement and 18% strong disagreement, giving a total of 73%, with 27% uncertain with the statement:

'Luck is a big factor in the results I gain from tests'.

Uncertain modal responses were obtained for questions 5 and 13 with the NT group in Category '2' gaining the higher percentage (75%) for question 5:

'The harder I work the luckier I seem to be with gaining good test result',

but the NF group had the higher percentage for question 13:

'Intelligence is a fixed mental ability that determines the results I get from science'.

The SF group in Category '1' showed the higher uncertainty for both questions 5 and 13 compared to the SF group in Category '2'.

Results from Oral Questionnaire

Appendix E shows the number and kind of responses obtained from oral questions (listed in Appendix D) given to the students on their completion of the written questionnaires, relating to the Function Pairs. Some questions were answered with more than one response, such as for question 1, 'How do you think your achievements or results at science could be improved'? Answers have been categorised either as a motivational attribution, a teaching or learning style factor, a metacognitive factor, or as a motivational factor: these are given in Appendix E. A brief summary of features concerning the results is given below;

Question 1: The attributional factors relating to effort, and changes of teaching style were the main responses given. Improved motivation as a factor was given by the ST and SF 'types'.

Question 2: The motivation factor relating to the importance and value of gaining a good science result was agreed to by 67% of the students, with 65% of the SF 'types' agreeing with its importance. Thirty percent of the students did not agree with it.

Question 3: The metacognitive factor relating to memory, shows the SF, NT, and NF 'types' agreeing that a good memory was essential to gain good science results, but most students were of the view that they did not practice any memory skills, or that they were not encouraged to use them.

Question 4: All groups said that they generally did not use planning strategies for their learning tasks. The SF 'type' had the highest number, eight stating they used planning for their learning strategies, but 25 (67%) of the sample did not do much planning.

Question 5: The response given for the metacognitive factor relating to self-evaluation shows that each 'type' considered that they were capable of better science results. However, only the SF and NF 'types' had any students saying they were not capable of better results. No reasons for their evaluations were sought.

Profile Description of Function Pairs

The following profile of modal responses given by the Function Pairs to the questions in Questionnaires Part 1 and Part 2 (Appendix B) is shown in Tables 5A and 5B. The modal response is the response that occurred most often in the set of selected responses given by the Function Pair 'types'.

Characteristics common to the four Function Pairs have been identified from the selected modal response, these are;

Students tend to:

- Consider their failures are due to not having worked hard enough.
- Take their results as they come.
- Believe they could improve their results by working harder
- Consider the most important factor to gain better results is to work harder.
- Consider themselves to have reasonable ability but do not work hard enough.
- Consider intelligence is a flexible mental ability and can be improved with learning.
- Consider their previous success is mainly due to ability.
- Consider better results are obtained when they work hard.
- Disagree that luck is a big factor in the results gained from science.
- Agree that a choice of learning style would improve results.
- Seldom expect good results from science.
- Agree that better results could be obtained with wider knowledge of suitable strategies.
- Consider better results would be possible if more time for study was provided.
- Strongly agree that motivation is important to improve their achievement at science.

The following characteristics were also identified from the selected modal responses by the following Function Pair 'types'.

The **ST** 'type' tend to:

- Consider their success is due to the teaching style.
- Attribute bad luck as the cause for a disappointing result.
- Have low persistence to challenging or difficult problems.
- Consider science is a worthwhile subject, which has value for everyday living.
- Are uncertain that interest in science is important to gain good results.
- Disagree that intelligence is a fixed mental ability that determines their science results.

The **SF** 'type' tend to:

- Consider that success at science is due to their own effort.
- Attribute their lack of ability as a cause for a disappointing result.
- Attribute their failure to a lack of knowledge.
- Consider that an interest in science is important for good results.
- Have low persistence to challenging or difficult problems.

The **NT** 'type' tend to:

- Attribute their success is due to their ability.
- Consider ability is more responsible for success than is effort.
- Disagree that failure at science is due to a lack of knowledge.
- Are undecided about whether their results could have been better.
- Believe that intelligence is a fixed mental ability that determines their science results.
- Consider that an interest in science is important for good results.
- Have high persistence in dealing with challenging and difficult problems.

The **NF** 'type' tend to:

- Be uncertain that ability is more responsible for success than is effort.
- Agree luck is a factor related to hard work and good science results.
- Be uncertain that failure at science is due to a lack of knowledge.
- Consider that an interest in science is important for good results.
- Have high persistence in dealing with challenging and difficult problems

A detailed profile of characteristics for each of the Function Pairs is given in Appendices I, J, K and L.

Discussion

The various factors that can cause underachievement were mentioned earlier in this thesis. This discussion will therefore be confined to the results relating to the study's research questions:

- Is there a significant relationship between individual 'type' and underachievement?
- Are the attributions for success and failure related to underachievement and 'type'?
- What intervention approaches could be used reduce or prevent underachievement?

Results given in Tables 3 and 3A show that the ISFJ and ESFJ 'types', and the SF Function Pair 'type' are more common than other types amongst the underachievers from the three colleges used in this study. The Chi Square χ^2 distribution, using an $\alpha = 0.05$ level, indicates that the number of ISFJ and ESFJ 'types', and the number of SF Function Pairs found within the sample population, is too great to be attributed to sample fluctuation, and therefore suggests that there may be a significant association

between 'type' and underachievement within the sample population (Hinkle et al., 1979; Mendenhall & Ott, 1980).

It was also found that the attributions given for success and failure by underachieving senior students are in agreement with similar findings by Butkowski and Willows (1980), namely, attributing a lack of effort as a main causal factor for failure, and ability as a causal factor in success (question 2, Questionnaire - Part 1 and question 3 - Part 2). However, some differences in choices were found between the Function Pairs, as shown in Table 5A for question 1, relating 'type' with the attributions for success. For question 1, the SF and NF Function Pairs modal response agreed that 'success at science is due to effort' (effort attribution) whereas ST chose 'teaching style' and NT chose 'ability'. The attributional causal response for failure for question 2; 'did not work hard enough', was agreed upon by each Function Pair group, with the NT and NF groups showing the highest percentage of agreement, possibly because students in this sample were all underachievers and differences between 'types' may not be evident in such a sample. The attributions used by this sample were very similar and therefore may be typical of senior underachieving students, irrespective of 'type'. Senior students may be more defensive about their self-concept relating to their ability than for their lack of effort, and this may account for the agreement (70%) of all Function Pair groups that,

> 'Any success that they have at science is due to my ability', (question 1, Questionnaire - Part 2).

This was supported by the strong agreement (89%) shown for,

> 'Better results are obtained when I work hard', (question 2, Questionnaire - Part 2).

Each of the Function Pair groups agreed with the attributional factors contained within questions 1 and 2, (Questionnaire - Part 2); namely,

'Any success at science is mainly due to my ability, and better results are obtained when I work hard'.

There was disagreement by each of the groups with the statement for question 4,

'Luck is a big factor in the results gained from tests'.

The responses given for questions 8, 9, 10, 12, 14, and 15 in Questionnaire - Part 2; relating to motivation and choices from different teaching and learning styles being necessary to improve their results, were also strongly agreed to by all Function Pair groups. The effect of the common characteristics associated with 'type' upon other causes of underachievement, such as preferences in learning styles, and achievement motivation evident from these results is considered by this researcher important for remedial intervention purposes A number of principles and suggestions for intervention approaches for underachievers are given in Chapter 5.

Factors affecting a student's underachievement, such as a lack of motivation and a lack of a suitable learning strategy, usually interact with each other and make it difficult to identify a single 'cause' of underachievement. But the relationship between 'type' and underachievement supported by the findings in this study given in Tables 3 and 3A make it an essential matter to be considered before attempting any remediation with the student. Some of these factors, such as individual 'type' or learning style, may affect individuals differently because of the different preferences found within the 'types'. There are some 'types' for example who prefer to work alone and with ideas, whereas others prefer to work with other people and with action (e.g. Biggs, 1984; Dunn & Dunn, 1988; Dunn, 1990; Ferguson & Fletcher,1987; Golay,1982; Hoffman & Betkowski, 1981; Nisbet, Rubie & Schuff, 1981).

A mismatch between the preferred way of doing things and the teaching style is very likely to affect motivation and achievement. This factor was found to be associated

with underachievement in this study, as shown by the modal response by the ST Function Pair group to question 1 (Questionnaire - Part 1), and by SF, NT, NF groups to the interview responses shown in Appendix E. The difficulty of relating the cause directly to individual 'type', or to the learning style is not considered by the author to be as important as to that of accepting that an interaction between causes involving 'type' is highly probable. It is therefore more important to accept and identify that a relationship can exist between the factors that can cause underachievement. The different effect of interactions between the causal factors of underachievement may even vary from day to day, because of changes that may occur in a student's physical and psychological state.

A relationship between the number of individual MBTI 'types' and underachievers (Tables 3 and 3A) found in this study suggests that there may be a relationship between 'type' and underachievement - this being one of the research questions - although this may be specific for this study only. Many of the attributional statements given by the students and which relate to the research questions for this study, are supported by the results obtained. Therefore, it is important for accountability purposes that teachers take appropriate action to prevent or overcome underachievement possibly resulting from causes upon which they have some influence. A number of principles and methods used by this author, and provided by other referenced sources for intervention, are given in Chapter 5.

This research study has concentrated upon several aspects related to individual 'type' (Briggs-Myers & Briggs, 1992; Lawrence, 1982; Newman, 1990; McCaulley, 1990) . One of these is the response given by the Function Pairs, as identified by Briggs-Myers (1982), Lawrence (1982), and McCaulley (1990). This aspect of 'type' has been included because of the effect Function Pairs have upon the perception of information and decision making processes of an individual. The responses of the Function Pairs are examined relating to various aspects of motivation, and the causal attributions

given for success and failure at science. The questions about success and failure were not given to respondents after a success or failure and therefore may only reflect the students' ideal response to a hypothetical situation instead of the response they would give in an actual situation. It is likely to be the response made by senior students than for juniors because they may be more self-conscious about their performance, particularly if their performance is below the standard expected from them. However, some consistency and inconsistency do show out within the results of the questionnaires and this may be because of differences between the 'ideal' and 'real' responses given.

In previous studies by Butkowski and Willows (1980) it was found that high achievers tend to attribute their success to ability, and failure to lack of effort. Conversely, learning disabled students tend to attribute their success to luck, or to the task being easy, and failure to lack of ability or to the difficulty of the task. Dweck (1986) also found different tendencies between 'maladaptive' and 'adaptive' motivational patterns for the attributions given for success. The senior students involved in this research were not considered high achievers, neither were they learning disabled. But it is reasonable to assume they would rather blame themselves for not working hard enough (attribution of effort) than to admit a lack of ability for any failure.

Although the attribution 'lack of effort' reflects upon the individual when given by a teacher, some external reason can usually be given by students to support their lack of effort, such as blaming the teaching style, or lack of motivation. A 'lack of ability' attribution would reflect upon students' self-concept; and may be embarrassing for them, and so generally not used by them. This finding is similar to that of Butkowski and Willows (1980) and Weiner and Kukla (1970). The attribute of 'lack of effort' was the common response given by the students as a reason for their failures, as shown in Table 5A, question 2.

Response Characteristics of Function Pairs : The results show that all 'types' attributed their failures to not having worked hard enough, and that they believed they could improve their future results by working harder. This view is consistent with those of Butkowski and Willows (1980) and Dweck (1986). The realisation that they could have done better, but did not work hard enough, shows strongly that the students were lacking in motivation to achieve better results. This is also supported by their strong agreement that motivation is important for them to improve their achievements at science, as shown by statements made by the ST and SF groups for question 1, and by the ST, SF, NT,and NF groups for question 2 during the interview (Appendix E), and for the response to question 15, Questionnaire - Part 2 (Table 7B). All student 'types' involved in this survey stated they had reasonable ability, and believed that their previous success at science was due to their ability. This again supports their view that they had not worked hard enough, but does not say why they had not done so.

It is suggested by this author, based upon the literature cited, that the manner by which students perceive information and make judgments based on their perception are critical factors related to achievement (Briggs-Myers, 1989; Briggs-Myers & Briggs, 1992; Lawrence, 1984; McCaulley, 1990). This implies that the effect from certain teaching and learning styles can be crucial for some individual 'types' as far as learning is concerned. For example, the Sensing preference 'types', namely SF and ST, are usually interested in what is real, immediate, practical and observable by the senses. The Intuitive preference 'types', NF and NT, usually show more interest in future possibilities, implicit meaning, and symbolic or theoretical patterns suggested by insight (Briggs-Myers, & Briggs, 1992; Forqurean, Meisgeier & Swank, undated; Jung, 1971; Lawrence, 1982; McCaulley, 1990). All students involved in this study answered that, 'a choice from different learning styles' would have probably improved their achievements (Table 5B), and 73% considered this factor as being important to

improve achievement (Appendix E). The ST 'type' attributed their previous success at science to the teaching style they had received (Table 5A, question 1).

The number of 'types' with the SF preference, such as ESFJ (7), ISFJ (6), ESFP (5), and ISFP(2) within the sample population show a difference in the number of cases observed to those which could be expected from the total number of Function pairs contained in this study (Tables 3 and 3A). Therefore, it may be that SF preferences in particular, and possibly in combination with the 'J' preference, contain personality characteristics that may affect students of these 'types', and result in underachievement at science, unless some provision is made to accommodate the particular preferences. Some suggestions as to possible reasons for underachievement by this group of Function Pairs will be discussed later.

No significant difference was found between the Function Pairs of both categories of underachievers shown in Table 6A and 6B, but evidence to support the reasons contributing towards underachievement is apparent. The result for question 15 in Questionnaire - Part 2 shows that students in both categories were strongly of the opinion that their achievement was related to their motivation. The mean agreement response by both categories was 87% and the mean disagreement of 12%. Fourteen percent of Category '1' disagreed with the questionnaire statement and 9% respectively for Category '2'. These views are consistent with the effort attribution given by many of the students for their lack of success. Their subsequent answers relating to motivation may justify their 'lack of effort' attribution.

There is some indication from the responses given to questions 9 and 10 in Questionnaire - Part 2 that the students may see motivation as something for which the school should be largely responsible. This is a justifiable assumption, and will not be argued at this stage, although intervention approaches suggested later in this thesis

imply that schools should use motivation enhancement strategies to raise the students' motivation levels. The students' answers agreeing with,

'Choices from different learning styles, and the teaching method has a large effect upon their result',

suggest that their current experiences, in their view, had not been sufficiently motivating for them to gain good results. Therefore they could justify their lack of effort, and transfer blame to causes other than themselves, such as blaming the teaching style, or that they were not motivated sufficiently by the subject or teacher. This result is further evidence to support the use of motivational enhancement strategies as a part of the normal teaching programme.

There were a number of individual differences in the responses made by the two categories of students, particularly for the SF 'type', which appear to relate to the students' previous history of achievement. These are found for questions 3 and 9 in Questionnaire - Part 1 (Table 6A). The low level of persistence suggested by the response given by Category '1' SF 'type' students for question 9 in Questionnaire - Part 1 is different to Category '2', and may be related to their background and experience. Both Categories have indicated that any previous success was due to their efforts, yet Category '1' students, when faced with a difficult problem, chose,

'Consider the problem beyond their ability and not try again'.

This suggests that they may consider a lack of ability as a cause of failure. Students in the Category '1' have experienced low achievement and may have a history of underachievement, whereas Category '2' students were selected because they did not appear to be reaching the level expected from them, but had previously achieved better results. For Category '2' students', a motivational problem was suggested by 50% of them choosing the response, '

'Not trying much when faced with a difficult problem'.

The rest of the SF 'type' chose,

'They would try to find the best strategy to use when faced with a difficult problem'.

Therefore, it is suggested that both categories of underachievers would benefit, from strategy and attributional retraining. Although no significant differences were found between the two categories for Questionnaire - Part 2, this could be expected because of the type of sample used. However, there were some useful differences found, which identify variations between the two categories. This fact could be useful for teachers to consider when planning intervention strategies for these two category types of underachievers.

Differences in response choices were found between the two categories shown in Table 6B and in the 'Summary of Percentage Results by Category for Questionnaire - Part 2' (pages 97 and 98). The differences were generally between 'agreeing', 'disagreeing', or being 'unsure' with the statement. The responses for question 3,

'Ability is more responsible for success for me than is effort',

were answered with a 50% 'disagree' response by Category '1' students and 43% 'agree' response by Category '2'. Question 5,

'The harder I work the luckier I seem to be with gaining good test results'

gained an 43% 'unsure' response for Category '1', whereas 43% of Category '2' 'agreed' with the statement, and for question 6, 71% of Category '1' 'agreed' and 43% of Category '2' 'disagreed' with the statement,

'My failures are due to my lack of knowledge'.

It is very likely that any differences between the two categories regarding previous success and failure could be responsible for the differences in responses given to the questionnaire statements.

A comparable significant result was obtained by this author in a previous study of Social Studies, showing that achievement was related to 'type', with NT and NF types

gaining higher levels of achievement. It is asserted that 'type' theory predicts that persons of the Introvert-Intuitive (IN) 'type' will show a greater academic aptitude than persons of the Extrovert-Sensing (ES) 'type' (Fourqurean et al., undated; Myers & McCaulley, 1985). Table 3 shows that 16 (43%) of this sample possessed ES preferences, and only three (8%) were of the IN 'type'. The findings by Fourqurean et al. (undated) suggest that the S-N scale relates to achievement similarly for adults and children. But it appears that while extroverts are superior to introverts in the preschool and junior school level in relation to academic aptitude, a change occurs at the secondary level to show introverts superior to extroverts (Morris, 1979; Fourqurean et al., undated). The view of Morris is supported by this research in that introverts did not feature largely in the sample. There were only 13 (35%) introvert types identified by teachers within the sample and of these 10 were IS and 3 IN 'types'. Higher academic aptitude scores and higher achievement scores are usually gained by Introvert-Intuitive (IN) 'types'. This may be attributed to the fact that most measures of academic aptitude and achievement rely upon the ability to derive meanings from written words. McCaulley (1977) and Fourqurean et al. (undated), assert that 'intuitives' excel in tasks requiring the manipulation of symbols or verbal fluency. This suggests the 'N' preference either as a dominant or auxiliary preference is advantageous for achievement. This also supports the small percentage of NT and NF types (32%) found within this research sample. It suggests they are less likely to underachieve, particularly at science, within conventional school settings than are SF (54%) and ST (14%) types. No female NT 'types' were found in this research sample.

The dominant Function Pair preference as identified by the Myers-Briggs criteria is mentioned and considered important for this thesis because of the different characteristics associated with each individual preference (Briggs-Myers, 1989; Briggs-Myers & Briggs, 1992; McCaulley, 1990; Newman, 1990). Evidence to support this view is shown in the different responses given to questions 5 and 9 in Questionnaire - Part 1 for the 'N' and 'S' pairs (Table 5A). These differences appear

related to the characteristics associated with the perception preferences. For example, the 'N' 'types' modal response for question 5,

'Receiving a disappointing science result',

showed a high persistence to failure, by choosing,

'Treating it as a learning task and wanting to have another go at it', and

'Decide to give much more effort to their science work'.

The 'S' 'types' however were quite different, indicating low persistence to failure by their use of the attributions of luck and task difficulty, or the lack of ability as causes for their failures. The responses by the 'N' and 'S' 'types' to question 9 also showed contrasting differences for persistence when facing difficult or challenging problems in science: the 'N' 'types' indicated high persistence and 'S' 'types' low. This result suggests the need for the use of different approaches to remediation.

The dominant preference according to Briggs-Myers and Briggs (1992) and McCaulley (1990), described earlier, depends upon the E-I and J-P scales. For example, student number 15 (Table 4A), with an ENFP 'type', has a dominant 'intuition' (N) preference and an auxiliary 'feeling' (F) preference, whereas student 34, with INFP, has a dominant 'feeling' preference and an auxiliary intuition preference. These preferences are likely to manifest themselves at times quite differently to each other. The dominant 'feeling' preference tends to cause decisions to be made by weighing carefully the consequences of the decision based on competing alternatives, such as the effect any decision may have upon other people, whereas a dominant 'intuition' preference tends to respond to future possibilities and implicit meanings or theoretical patterns suggested by insight (McCaulley, 1990). Therefore, responses to the questionnaires could be expected to show variation, although certain of the pair preferences may be similar.

Individual Types (MBTI) that are likely to Underachieve.

Although there are various factors, already stated throughout this thesis, which can affect achievement, it appears that there are preferences found within the profiles of the ESFJ and ISFJ 'types' that may affect the attitude of some individuals of these 'types' towards science and result in underachievement. However, this does not mean that these two 'types' cannot achieve, but if they are given appropriate learning conditions suitable to their 'type' then they should be able to achieve as well as other 'types'. There are some features associated with learning that are essential for most 'types' in order for them to achieve. These come through in items such as: 'Is the work interesting enough for the student'?, and 'Does the student see value in learning the particular skill or item of knowledge'? It is suggested that students may see these essentials for learning differently depending upon their 'type' preferences.

Learning styles are important for optimal learning, but also important is the interest the student holds with the curriculum subject area. A student using an appropriate learning style in an uninteresting subject area may still underachieve, yet given an inappropriate learning style but with an interesting subject area a student may achieve good results. One of the vagaries of learning is that many students have been known to achieve good results from a poor standard of teaching and others have underachieved from generally accepted 'good' teaching. The influence of 'type' may be the crucial factor involved here.

This research study has identified two MBTI 'types' that were more common than other types in the number of cases identified to those of other 'types' among the population used for this study. These 'types' are ESFJ and ISFJ, comprising of the SF Function Pairs. The following profiles have been developed from statements used by Myers-Briggs for these two 'types', which may be useful in understanding why these 'types' are significant underachievers and are the likely 'types' to underachieve at science unless intervention approaches are made to prevent underachievement.

ESFJ Profile: These Myers-Briggs Type Inventory 'types' tend to:

- Relate more easily to the outer world of people and things. May be talkative and work best with encouragement and praise.
- Rather work with known facts than look for possibilities and relationships.
- Base their judgments more on personal values than on impersonal analysis and logic.
- Be mainly interested in things that directly and visibly affect other people.
- Show little interest in abstract thinking or technical subjects.
- Show a preference for a planned, decided, orderly way of work more than a flexible, spontaneous way. They work best when they can plan their work and follow their own plan.

ISFJ Profile: These Myers-Briggs Type Inventory 'types' tend to:

- Relate more easily to the inner world of ideas than to the outer world of people and things. May take time to master technical subjects.
- Be patient with detail and routine and require adequate time to complete their tasks and work best when they can plan their work and follow their own plan.
- Generally show concern about how other people feel and therefore may be concerned about the effect that their learning can have on others.
- Be inclined to base their judgments on what is real, immediate, practical and observable by the senses.

It is not intended to analyse these profile statements in great detail but to simply identify some of characteristics identified within the results of this study, which may cause learning problems for both ESFJ and ISFJ 'types' in curriculum subjects such as science. Both of these 'types' tend to prefer activities that involve other people's feelings and the effects that their learning can have upon people. Science tends to consist of impersonal and abstract subjects and therefore may be uninteresting for both of these 'types'. Some of the students used in this study had stated that science

was not very interesting for them and attributed underachievement to this cause. Both 'types' also tend to prefer to have more time to plan and direct their own work programmes in order to assimilate the subject material. This is not always possible within conventional lessons or timetables.

Attributions for Success

All 'types' used in this study generally agreed that any of their previous success at science was due mainly to their ability (Question 1. Table 6B) . According to Butkowski and Willow (1980) this kind of response can be expected from senior students. The students' responses appeared to relate effort with ability because they all agreed that their underachievement was due to a lack of motivation, which imply that failure is surmountable through increased effort (Dweck & Reppucci, 1973). It is possible they were not able to distinguish differences between effort and ability - a characteristic that may be found in younger students, because of the conceptual difficulties in identifying differences between the two concepts. Nicholls (1979) argues that adolescents tend to perceive ability as intellectual capacity and therefore are inclined to link concentrated effort with a lack of capacity or low ability. They may perceive any instruction given to them to work harder as an indication of a lack of ability. In contrast, young children tend to perceive high effort with high ability because it may appear reasonable to them that to be able to give a high effort requires a high level of ability. All 'types' agreed that if they had worked harder they would have gained better results. By not working hard they could conceal deficiencies in their ability. According to Adelman and Taylor (1993) this is a typical avoidance motivation strategy. The attribute of ability is an internal one that cannot be controlled by the student and generally is very stable and, as revealed in this study, is susceptible to avoidance motivation. The attribution of temporary effort, an unstable and controllable form, is also linked with ability as far as success is concerned because most of the students considered they could gain better results by working harder. This

unstable form of attribution can be greatly affected by motivation because it is controllable and internal to the student.

The NT 'type' agreed that their previous successes at science were due to their ability, similar to the other 'types', but differed from other 'types' in responding that ability was more important than effort to gain success. This form of attribution tends to lower expectations and affect motivation, particularly for those with a record of underachievement (Fontaine, 1974; McMahan, 1973; Weiner et al., 1976, cited in Clifford, 1986). For NT 'types' with a record of achievement, this form of attribution is advantageous and tends to improve achievement, but this type of attribution may have adversely affected underachieving students.

The ST 'type' tend to agree with the attribution of 'teaching bias' relating to the teaching style used, as well as 'ability' being the reason for their previous success. The teacher bias form of attribution is external, unstable and generally uncontrollable by the student but probably can be modified depending upon factors of cooperation between teacher and student. For example, if the teacher was to offer a range of teaching or learning styles, then the attribution would be controllable by the student.

Attributions for Failure

It is assumed the response 'did not work hard enough' , which is the common attribute given for failure, refers to typical effort rather than temporary effort as defined by Weiner (1979). Typical effort is an internal, stable and controllable form of attribution and is defined by Weiner (1979) to be 'the effort required to complete a routine task of learning within the normal classroom' (p. 7). Temporary effort is unstable and controllable and is the effort that may be given beyond that which could normally be expected for a task, such as additional study and revision work being done by the student.

The ST 'type' gave 'lack of effort as the main cause of failure', and 'luck as a cause of a disappointing result'. It is assumed that the 'lack of effort' response refers to typical effort, although differences between the two 'types' mentioned earlier are mainly related to stability. Both typical and temporary efforts are internal and controllable forms, but the temporary form is less stable than the typical. However, luck is an external, unstable and uncontrollable form and although this attribution may temporarily raise expectation levels for success, it may not be sustained long enough to greatly affect motivation. However all 'types' disagreed that luck was a big factor in their results.

The SF 'type' indicate that a lack of knowledge, and effort, as causes of failure, but indirectly associate any disappointing results with their ability. According to Weiner (1979) the attribution of knowledge is internal, stable and generally a controllable form, but ability is internal, stable and uncontrollable. Knowledge may be seen by a student as uncontrollable and external, particularly if they do not have access to knowledge or the necessary skills to get knowledge. However, if these forms are uncontrollable from the student's viewpoint, then their achievement motivation will be affected. Specific strategy knowledge and attributional training, therefore could be very useful for SF 'types'.

Attributions of Learning Style

A common response made by all 'types' was that they agreed 'a choice from different learning styles would improve their results'. This response result infers either they were generally disappointed with the style they were required to use, or they were attributing and justifying their low achievements to an external cause. Only the ST 'type' gave a modal response that 'success was due to the teaching style'. This kind of response seems agreeable with the ST 'type' characteristics, of being 'practical and rational through the logical analysis of cause and effect' (McCaulley, 1990). The ST

'type' also agreed that if a choice from different learning styles was permitted it would improve their results.

The choice from different learning styles is an important strategy that can be used to improve learning and reduce underachievement (Biggs, 1984, 1991; Dunn & Dunn, 1988; Dunn, 1990). One result from this study shows there is strong support by students to be allowed to choose their own learning style, particularly when they consider it would improve their results. De Charms (1972), McCombs (1986), Pressley, Goodchild, Fleet, Zajchowski, and Evans (1989) argue it is very likely that improved achievement motivation would result from students being allowed to make choices regarding their learning. This also would improve intrinsic motivation by permitting 'self-determination' by the students (Adelman & Taylor, 1993; Deci, 1975, 1980; Deci & Chandler, 1986; Deci & Ryan, 1985). Ames (1992) argues that if students are given a choice in their method of learning, or pace of learning, a greater sense of responsibility is imparted to the students, and this is also likely to improve their achievement motivation. Unfortunately the learning style attribution is an external and generally uncontrollable form and is unstable, but could be changed into a controllable form by changing the teaching style.

Summary of Differences Between the Dimensions of Motivation Attributes.

The following list briefly summarises the causality dimensions of location, stability, controllability, and differences between the 'Weiner' causal attributions (in italics) and their effect upon motivation (Butkowsky & Willows, 1980; Weiner, 1979; Weiner & Potepan, 1970). Learning style is not specifically mentioned by Weiner, but because earlier studies by this researcher (1994) found significant differences in learning style preferences between individual 'types', it justifies inclusion in this summary. Each of these forms of attribution was found within the students' responses to the questionnaires.

Attributions for Success:

Ability: internal - stable - uncontrollable - motivates the high achiever.

Typical Effort: internal - stable - controllable - motivates the high and low achiever.

Temporary Effort: internal - unstable - controllable - motivates the high and low achiever.

Learning Style: external - unstable - uncontrollable - motivates the high and low achiever if style is suitable to individual type.

Teacher Bias - external - unstable - uncontrollable - motivates some achievers.

Luck- external - unstable - uncontrollable - motivates the low achiever.

Attributions for Failure:

Ability - internal - stable - uncontrollable - demotivates the low achiever.

Typical Effort - internal -stable - controllable - demotivates the high and low achievers.

Temporary Effort- internal - unstable - controllable - demotivates low achievers.

Teacher Bias - external - unstable - uncontrollable - demotivates low achievers.

Learning Style - external - unstable - uncontrollable - demotivates low achievers.

The following general comments obtained from this study about the low achievers included in Category '1' were consistent with previous research on attributional motivation by Weiner (undated). Also, the Category '2' underachievers within this study used attributional statements similar to those found by Weiner. They are;

- High achievers tend to blame their failures on lack of effort and attribute their success to their ability.
- Low achievers tend to blame their failures on lack of ability and attribute their success to luck, effort, or ease of task.

Implications from this research strongly suggest the need for attributional retraining for underachievers with due consideration being given to individual type differences. A more detailed description of intervention approaches that can be used for underachievers is given in Chapter 5.

Motivation Factors

All 'types' agreed that, 'motivation is important to improve their achievements at science' but most students were unaware of key factors relating to motivation. The response made by the students to the questionnaires and interview generally showed they lacked motivation: they considered they had reasonable ability but had not worked hard enough. Also, the students were lacking in the essential factors to sustain a high level of motivation. Most of the Function Pairs, except ST, agreed that 'an interest in science is important to gain good results'. The ST group were uncertain about whether an interest in science was important. This result is consistent with the ST group generally attributing their successes to the teaching style, and to the perceptual and judgmental characteristics associated with their type. ST 'types' tend to make rational decisions by means of logical analysis based largely upon observable phenomena. A common response by all 'types' was that they, 'take the results as they come', suggesting a low level of expectation of success. A low expectation factor was

confirmed by the response, 'seldom expect good results from science' by all Function Pairs.

A second important factor is related to how the students value or perceive science as worthwhile. ST 'type' considered, 'science a worthwhile subject that has value for everyday living'. Other 'types' considered science 'essential, only as a means to gain future qualifications'. The degree of value attributed to science by each student may vary considerably, although they may have chosen a similar response to the question. Therefore, it is difficult to assume from the results that any one response may have a greater motivational effect than others. However it may be assumed that although most students selected the response 'science was essential, only as a means to gain future qualifications', their lack of effort generally was considered their cause of underachievement. Therefore, this motivation factor may not have been strong enough or sufficient for the students to have worked harder to have gained better results. According to Adelman and Taylor (1993), the two factors of value and expectation of success are interdependent and must be present in order for motivation levels to be raised or sustained. Many students involved in this survey were lacking in one or both factors, by that contributing towards their low achievement motivation.

The motivational patterns as stated by Dweck (1986) common to most of the groups appeared 'adaptive' because they generally considered 'intelligence as a flexible mental ability, which can be improved with learning'. However the ST and SF 'types' tend to have low persistence 'when faced with a difficult or challenging problem', whereas NT and NF have high persistence. The SF 'types' displayed features of a 'maladaptive' motivational pattern with their low persistence, and attitude towards intelligence. For question 13 in Questionnaire - Part 2, 65% of the SF 'type' were unsure, or agreed that, 'intelligence is a fixed mental ability that determines the results they get from science'.

Metacognitive Factors

There are various views that come under the rubric of metacognition, for example, metacognitive knowledge and executive control processes that may be used in learning. Both aspects are seen as related and impacting each other, although each may be conceptually distinct (St.George, 1993). These views will not be discussed at length in this thesis other than to recognise the use or lack of use by the students of certain metacognitive strategies described in this research.

The interview questions 3, 4 and 5 (Appendix D) relate to the executive control processes that can be used for learning. They involve the students' use of planning of learning strategies, self-evaluation and the use of memory strategies (e.g. Alexander, et al., 1991; Biggs, 1984; Chi, 1985). Seventy-four percent of the students' responses said that they did not plan their own learning strategies. This was shown among all 'types', with most students of each 'type' not planning their own learning strategies, but relying on passive learning. The SF 'type' had the highest percent of students that did some regular planning of their own learning strategies with three students (15% of 'type') who spent much time, and five (25% of 'type') students spent a small amount of time, compared with 12 (60% of 'type') students who spent no time planning their own learning. There may be a relationship between the ability attribution for failure held by SF 'types', and their tendency to want to plan their own learning as a means to improve their ability. All 'types' used in the research generally did very little planning of their own learning strategies and were generally unfamiliar with how to plan their own learning.

Most of the students answered the interview question, "Do you think that you are capable of better results from science?" with a 'yes', and only one SF 'type' and one NF 'type' answered 'no', and one SF 'type' was unsure (Appendix D). It is likely that the students who considered they were not capable may be using an ability attribution for success and failure, and through that would have a low level of achievement

motivation. This appears consistent with some other answers given by them, but is not consistent with a similar question 8 in Questionnaire - Part 2 in which only two NT 'type' students (40% of 'type') stated they were not capable. The ST, SF, and NF 'types' generally agreed that, 'any previous success at science was due mainly to their ability' but disagreed or were unsure about whether 'ability is more responsible for success than is effort' (Table 5B and Appendix C). However, these three 'types' showed variation to this response for question 1 in Questionnaire - Part 1. All of the NT 'type' students attributed success to an ability attribution, and 80% considered ability more important for success than effort. Therefore, it is very likely that any previous record of underachievement, particularly for the NT 'types' would have affected their achievement motivation because of their use of an ability attribution. Twenty-seven (73%) of the sample said that, 'a good memory was important to gain good results from science learning'. Twelve students (44%) did not practice any memory skills. Ten students (27%) did not think that a good memory was important for them to improve their science results. Of these 10 students, eight were from the ST and SF pairs and two from the NT and NF pairs. Most of the students did not know much about memory skills, other than rote forms of learning, and required examples of some memory skills to answer the question during the interview.

The results from the interview questions generally showed that the students were lacking in metacognitive knowledge, and this may be a factor contributing towards their low level of achievement motivation. During the interview, the students showed interest in such ideas as planning their own learning strategies and improving their memory, but were not familiar with the processes required. The use of intervention approaches with metacognitive training combined with cognitive and motivation enhancement programmes could be very beneficial for the students used in this research and for all underachieving students.

Chapter Summary

This Chapter contains the result tables, and summaries containing statistics relating to the results. In the discussion section, comments associated with the results are given as well as common features of the Function Pairs. Also, a profile description of them as indicated by the modal answers given to the questionnaires, and the oral interview. In addition, the individual 'types' (MBTI) identified within this study who may be likely to underachieve at science, and profiles of them are given. Also, the attributions for success, failure, learning style, motivation factors, and metacognitive factors relating to the sample population have been examined. The results show a relationship between 'type' with underachievement, and show that there are similar attributions associated with underachievers, as well as those that differ, because of characteristics associated with the different 'types'. These results from this study suggest the need for intervention procedures to be preferably based upon features relating to individual 'type', choices in learning style, the use of metacognitive strategies, and enhancement in motivation in order to prevent or overcome underachievement.

Chapter 5 will describe implications associated with this study, namely that underachievement was found associated with certain 'at risk' individual 'types', and motivation. There are several limitations contained within the study, which prevent wider generalisations being made from the results, but should not greatly affect the value that can be derived from this study. Accountability issues relating to the school's responsibility to reduce underachievement are covered, with suggested principles and examples of intervention approaches that can be used. The main approaches centre upon the identification of individual 'type', and the use of attributional and strategy training for underachievers. The need for motivational enhancement to be included within science teaching has been found within this study; therefore, some elements of motivational and instructional strategies are described.

Conclusions and recommendations relating to this study are given, as well as dealing with the wider issue of underachievement.The results from the interview questions generally showed that the students were lacking in metacognitive knowledge, and this may be a factor contributing towards their low level of achievement motivation. During the interview, the students showed interest in such ideas as planning their own learning strategies and improving their memory, but were not familiar with the processes required. The use of intervention approaches with metacognitive training combined with cognitive and motivation enhancement programmes could be very beneficial for the students used in this research and for all underachieving students.

Chapter 5 -

Implications, Limitations, Recommendations, and Conclusions,

This Chapter examines some important implications associated with this study and suggests some positive intervention approaches which have been used by this author and contained within the literature cited in this thesis, to overcome underachievement. Not all causal factors related to underachievement have been examined within the scope of this study, therefore only factors contained within the context of the research questions and aims of the thesis as they relate to underachievement are dealt with. There are a number of limitations associated with this study, and recommendations for further research are addressed and are discussed within this Chapter.

Implications from this Study

The results of this study suggest that the factors relating to individual 'type', and motivation were related to underachievement within the sample of underachievers For example, the number of ESFJ and ISFJ 'types' and SF Function Pairs observed within this study were too large to be attributed to sample fluctuation, and therefore, suggest that these particular 'types' may be more likely to be found among underachievers at science than other 'types' (Hinkle et al., 1979; Mendenhall & Ott, 1980). Although there were also other 'types' within this population of underachievers, the results suggest that personality characteristics of 'types' containing the SF Function Pair may make them more likely, or be 'at risk', to underachieve at science than other 'types'. This is because of the typical personal preferences and characteristics stated earlier, which tend to be found within these 'types', and which affect their attitudes towards learning science (Briggs-Myers & Briggs, 1992; McCaulley, 1990). Motivation was also found to be a factor affecting most students within this study, and was strongly supported to by each of the Function Pairs as being important for them to achieve at science. (Appendices I, J, K, & L). These causal factors of underachievement identified within this study are factors that can be influenced by a teacher within the

learning environment, to either reduce or increase underachievement, depending upon the attention given to them. Intervention approaches given later will focus upon these two aspects, and suggestions are given that may reduce underachievement.

The other 'types' featured within this study as underachievers, suggest that other causal factors of underachievement described on page 29 could be involved. Some of these factors may not be within the scope of the school, or teacher, such as socio-economic and cultural factors (e.g. Bordieu, 1971; Flude, 1974; Lawton, 1998; Nash, 1986, 1987; Nash & Harker, 1988). But there are several areas in which a teacher may counter the influence of some of the causal factors of underachievement within the learning environment and reverse or reduce the effects of underachievement. Two of these; teaching and learning style, and motivation are affected by 'type' and may be acted upon by schools and teachers to prevent or overcome underachievement (Biggs, 1984, 1991).

Different learning styles are now being used in schools and universities in New Zealand but they are not necessarily linked with individual 'type'. This study and earlier studies by this author show that 'type' is related to underachievement, achievement, and learning style. Therefore, in order to derive the most effective use from learning styles, it may be important to identify the students' 'type' before planning and presenting choices from learning style elements, otherwise underachievement may not be reduced but may even increase. If the reason for giving students a choice from different learning styles is to improve their motivation then this may work, but available choices must be agreeable with the student's 'type' or it may produce a mismatch between 'type' and learning style. In some cases, motivation may be improved at the commencement of learning because of the use of choice by the students, but it may only remain effective if the style suits the students' 'type'. The problem often arises where the choices of learning styles available do not meet the student's 'type' and underachievement continues. If there is a mismatch between learning style and

individual 'type' then it will very likely cause underachievement, whereas the provision of a choice from a range of learning styles may prevent a mismatch and improve a student's attitude towards learning and reduce underachievement (Ballard, 1978; Cohen,1981).

Accountability has been mentioned as an issue that is becoming important within schools both as a concern for professionals and politicians. Government education agencies in Britain, USA, and New Zealand and other OECD countries are monitoring educational outcomes (Clay, 1998: Department of Education, Eire, 1998; Lawton, 1998; Marlborough Express, 1998d; Special Education Needs Service, (UK), 1998). In New Zealand, the Educational Review Office (ERO) carries out annual accountability reviews on schools (Marlborough Express, 1998d). Therefore, an important implication is that schools are being required to become more accountable for learning, and to reduce or prevent underachievement as far as possible. This may mean considering causes of underachievement that originate within the school environment and learning 'climate' (Barrett, undated; Zeisset, 1991). Students are expected to achieve within schools, but some factors causing underachievement may be related more to the conditions within the school than in society. The effects of underachievement nevertheless show out among the students and thereby tend to show the students themselves as being the cause of their underachievement, which may not be the case. Any valid procedure or method which can identify causal factors of underachievement, and suggest strategies of remediation can be of great value for schools, and it is for this purpose that intervention strategies relating to 'type' and motivation are included in this thesis. Later in this Chapter some intervention approaches used by this researcher, and suggested by others cited, such as; Ames (1992), Adelman & Taylor (1993), Biggs (1984, 1991), Borkowski et al. (1986, 1988), Chapman (1994), Cole & Chan (1990), Covington (1987), and Dunn & Dunn (1988), are presented that can redress and reduce underachievement, and are, therefore, an important part of this study.

Limitations of the Study

A number of limitations contained within this study are acknowledged by this author. These may prevent the results from being used to make wider generalisations about them than is recommended because of the following factors: the sample size; the limited population of underachievers used, and the use of questionnaires relating to hypothetical situations concerning success and failure.

This study was restricted to only three schools from a rural area in New Zealand, and therefore the results may be affected by the learning environment, such as the equipment and facilities available, the range of curriculum options, and the experience of the teachers which may be different to that found in many urban schools. The latter factor could be either an advantage or disadvantage for learning, depending upon other factors such as the socio-economic status of the area, available educational facilities, scholastic reputation of the school, and the educational resources available to the school. However, the specific results gained from this study can be used to consider the aspects of underachievement identified within the context of this study, and to encourage the use of intervention approaches to reduce underachievement.

There is a tendency for urban schools in high socio-economic status areas to have high achievement results and not appear to have problems of underachievement, whereas schools in low socio-economic areas may not achieve the same levels of success and consequently their students' self-esteem could be lower (Bordieu, 1971; Flude, 1974; Lawton, 1998; Nash & Harker, 1988, 1998). Therefore, the attributions used by students for success and failure are likely to be different between the two different areas. Some of the sociological reasons pertaining to the effects of socio-economic status on educational attainment have been stated earlier and will not be dealt with here in detail except to emphasise that these differences could have a significant affect upon attitude and motivation. It is a practice in some countries to publish results from external examinations showing the grades and numbers of students passing, and in

some cases give ratings for schools. One reason suggested by this researcher, based upon personal experience, is for schools to use the results as a marketing tool to attract future students. In England and New Zealand, to name just two countries, it is possible to compare one schools' examination performance with another and thereby make some value assessment of the effectiveness of schools from different socio-economic areas, or between schools of different academic ratings such as used in England.

A second limiting factor is the size of the sample selected for this study, although as stated earlier, there are recorded numerous studies in research literature in which small numbers were used, for example, Barrett (1957), Bos and Filip (1984), Barsuck (1989), and Scruggs and Mastropieri (1992), stated earlier in Chapter 1. The number of students participating in this study was fewer than intended, because of a number of reasons such as, refusal to cooperate, lack of interest, and defection for other reasons, although the criteria for selection was unchanged. A total number of 37 underachieving students was small and in some cases prevented trends from being found within other 'types'. For example, Table 1A demonstrates that for two of the 16 possible 'types', no students were found in the sample and only one student numbered in each of five of the 'types'. Therefore, it is recommended, that for any further research, a larger number of students be used, from schools within similar socio-economic areas. This was not possible in this study because there were only three secondary schools within this particular region. In this study, the sample was limited only to underachieving science students from different schools from similar socio-economic areas, because it was the purpose of the study to identify causal factors of underachievement among underachievers. But a wider range of curriculum subjects could be used to find if the relationship between 'type' and underachievement was consistent for other subjects, as well as science. Although this could provide confounding results because of the different features associated with different subjects. Some subjects, such as mathematics and science tend to be quantitative and

impersonal, whereas others ones like art, music, and creative writing tend to be non-quantitative and personal.

The third limitation is related to the type of sample used. For this study the sample intentionally comprised of two categories of underachievers. This was intentional and was stated in the aims and research questions. The categories were used to find out if 'type' was related to underachievement among underachievers, and therefore only underachievers were selected for the sample. With an unlimited sample, the research question may have been more easily answered by comparing the achievers with underachievers through the use of an analysis of variance test (ANOVA) between the two levels of achievement.

The final limiting factor is related to the questionnaires. The questions were based upon hypothetical situations concerning success and failure and required a rational response, devoid of emotion, by the students about their attitudes and ideas towards success and failure. A person's response to failure or success may be quite different to what a person may rationally think about it, because of emotions that are associated with success and failure. Some students appear to be more affected than others and this may also be related to 'type' characteristics.

A recommendation for further study is to ask students, immediately following a failure, for the cause of their failure and similarly after a success. Responses would be more typical of those students are likely to make because of the emotional effect associated with the result.

Intervention Approaches

There are various approaches which can be made to reduce or prevent underachievement, and this section of the thesis does not claim to present an all-inclusive approach which will produce immediate results. Rather it suggests principles

which have been used by this author, and recommendations from other sources mentioned in Chapter 2. These can be used as a guide towards dealing with the problems of underachievement, particularly relating to 'type' and motivation.

Intervention is something that most teachers do, either consciously or unconsciously to produce benefits for the students under their care. Unfortunately not all interventions are beneficial, because most interventions have the potential for both negative and positive results. For example, the continual correction of a student's errors and mistakes may considerably affect the self-concept and attributional motivation of the student, as a consequence cause avoidance motivation problems (Adelman & Taylor, 1993). Also, if the teaching style used during intervention is a mismatch for the student's individuality and preferred learning style, then it may cause further behaviour and learning problems (Ballard, 1978; Cohen, 1981). According to Adelman and Taylor (1993),

> 'Intervention activity is often shaped by the way the term is defined and by the assumptions made about whom or what is its focus' (pp. 41-42).

For this thesis, a suitable definition for intervention given by Adelman and Taylor (1993) is as follows;

> 'Intentional interventions are the planned and unplanned actions that result from a desire to produce changes in existing problematic or non problematic conditions of a system (i.e. person, environment, or the transactions between both)' (p. 42).

It is important to see that interventions should not be always directed towards the individual, but by adopting a transactional view, a fuller set of options may be seen and may produce more effective results.

There are various forms of intervention that can be used to overcome underachievement and it is important that the form used should relate closely to the

major factor involved in underachievement, otherwise the learning problem may remain unchanged or become enhanced. However there are several principles which should be followed to gain success from any intervention and these are briefly explained.

First there needs to be some initial screening to identify the major causal factor of underachievement, followed by assessment and consultation with interested parties, namely the student, parents, and teachers concerned with the student's learning. This process may need to be made by some neutral person such as a guidance counsellor or senior teacher rather than the student's teacher (Adelman & Taylor, 1993). A principle of intervention advocated by Adelman and Taylor (1993), is one of 'least intervention needed' (p. 57). This principle implies that a minimal restriction of the environment is provided for the student, and any suggestions or attributions used by the student or teacher that cause negative achievement motivation should be avoided. The focus can be on providing a strategy, learning style, and attributional training that is based upon the student's individuality. In this way any intervention may be seen by the student as a means to remove obstacles that prevent the student from gaining the best results from his or her learning. Any remedial programme needs to be understandable and confidential for the student, and should require the permission of parents and student before being carried out (Adelman & Taylor, 1993).

It is very likely that the students involved in this research had been corrected, or advised regarding their performance at science, but intervention may have been fruitless or produced negative results. Some of the students in Category '1' (lower 10th percentile) with a low expectation for success, (questions 3 and 9, Table 6A), may have a history of underachievement, and therefore intervention to reverse the underachievement may require a long process in order to avoid a 'low ability' attribution by the students.

Category '2' students (previous good achievers but currently underachieving) for question 3,

> 'Varied in their expectations for success depending upon how they were feeling, and take the results as they come'.

For question 9, most of the students in this category, when faced with a difficult or challenging problem,

> 'Try to find the best strategy to solve the problem'.

Therefore, intervention for this group may need to be different to that required for Category '1' students.

The different variables mentioned so far relate to situations where intervention may occur. These variables may be either or an environmental nature, such as teaching style, classroom learning climate, physical factors outside of the student's control, or of a a student nature, in which the concentration is upon an aspect which directly involves the student (e.g. Barger & Hoover, 1984; Biggs, 1979, 1984, 1991; Brown & Palincsar, 1989; Adelman & Taylor, 1993; Ferguson & Fletcher, 1987; Glaser, 1992; Pressley et al., 1987, 1989; Rosenshine & Meister, 1992; Schmeck, 1988; Short & Weissberg-Benchell, 1989; Zeisset, 1991). It is likely that intervention may involve several of these variables, in which case careful judgment will be necessary in order to decide the extent and direction of such intervention.

Within the context of this study involving senior science students, a major causal factor of underachievement shown by the results is a lack of motivation, which is principally an internal controllable factor, but can be influenced by external factors (e.g. Ames, 1992; Biggs, 1984, 1991, Covington, 1987; De Charms, 1976; Dweck, 1986; Nicholls, 1984; Pintrich. & Schrauben, 1992; Weiner, 1979, 1984; Weiner & Kukla, 1970b). The results show that most students stated that they had not worked hard enough to gain better results from their science learning.

Eighty-six percent (Appendix E) of the students stated during the interview that their science results could be improved by giving more effort to their work, and 59% answered question 4, Questionnaire - Part 1,

'Could improve my results from science by working harder'.

It is unlikely that the general lack of effort by most of the students was caused by physical, or physiological factors because there was evidence to support the view that their motivation was affected by their low expectation of success and /or they did not have a high enough value or interest in what they were doing. However, the physical and physiological student factors should not be ignored because they are a part of the accumulated capacities that students take with them into the learning situation, and these may vary from one day to another and affect the attitudes and values of the students (Adelman & Taylor, 1993).

The lack of motivation expressed by some of the students, and their belief that greater motivation would improve their performance at science, supports the need for some motivational emphasis during science lessons. Seventy-eight percent agreed with question 15, Questionnaire - Part 2 ('My achievement at science is related to how motivated I am.') relating to the effect motivation could have upon their achievement. Therefore, motivation enhancement seems to be the major intervention requirement for these underachievers. Some strategies will be suggested later in this thesis. A problem that exists with motivation programmes is that some individual 'types' may be more easily motivated than others; also factors which motivate some people may lower the motivation of others. For example, in providing a choice of learning styles, it may suit some 'types', but cause confusion and tension to others; such as, a student given a global learning task, when an analytic form is preferred (Biggs, 1979, 1984, 1991; Dunn & Dunn, 1988; Dunn, 1990). The motivation strategy used must be suitable and agreeable to the individual 'type' and essentially be related to the key factors required for motivation. This again shows the relevance of the need for an understanding of 'type' in order to positively affect a student's motivation and reduce underachievement.

Attributional and Strategy Training

Attributional retraining is an intervention approach that aims to address some of the motivational problems students may have in learning and is based upon attributional theories of motivation (e.g. Ames, 1992; Borkowski et al., 1986, 1988, 1990; Carr & Borkowski, 1989; Cole & Chan, 1990; Covington, 1987; De Charms, 1976; Dweck, 1975, 1986; Nicholls, 1984; Weiner, 1984, 1985; Weiner & Kukla, 1970a,b; Zoeller, 1979). This type of training is designed to teach students to attribute their learning difficulties to factors that are under their control, such as insufficient effort or the ineffective use of learning strategies. Attributional retraining can be effective particularly for acute underachievers and can be used either as a separate programme for underachievers or be used as a basic teaching strategy during normal lessons. Research by Borkowski et al. (1988), Dweck (1975), and Chapin and Dyck (1978) show that effective results can be obtained by changing the causal attributes by making verbal statements particularly for failure, but can also be beneficial when used for successes. This researcher has used this form of training successfully within a reciprocal teaching method, similar in form to that used by Palincsar and Brown (1984).

Reciprocal teaching refers to the process whereby students take turns assuming the responsibility of the teacher by using the following skills; questioning, summarising, clarifying, and predicting learning outcomes (Englert & Mariage, 1991; Palincsar & Brown, 1984). The basic method centres on modelling and coaching students in the four strategic skills; formulating questions from the reading, summarising the text, making predictions, and clarifying difficulties with the text. Initially the teacher models this process, eventually giving it over to the students. In the early stages the teacher coaches the students and by offering help and suggestions provides 'scaffolding' for the students to become more proficient, and then reduces or 'fades' with the help when the students have reached a sufficient standard (Collins, Brown & Newman, 1989; Palincsar & Brown, 1984; Rosenshine & Meister, 1992). Although this form of

teaching tends to be used more for reading and comprehension programmes, it can also be successfully combined with attributional retraining for other subjects. In this form of teaching students are encouraged to give a reason for their success or failure and by using a reciprocal dialogue between the student, the teacher, and other class members, a more positive attribution can be used and thereby possibly raise the motivation level of the students. This can usually be combined effectively with strategy training, in which the discussion and demonstration of different strategies can be shown for solving problems. The training technique involves getting the students to say aloud to themselves statements relating to their learning performance. The suggestion is that only internal and controllable attributions are used for a start, for example,

> "With better knowledge and use of strategies, I will get better results", or
> "With more effort and better strategies, I will improve my results".

Ample research is available to show the positive effects of specific training, such as strategy training in combination with attributional training for students with acute learning problems or difficulties (Borkowski et al., 1988; Carr & Borkowski, 1989, 1990; Clifford, 1986). Borkowski et al. (1986, cited in Jones et al., 1987) argue:

> 'One of the principal goals of strategy training is to alter students' beliefs about themselves by teaching them that their failures can be attributed to lack of effective strategies rather than to the lack of ability or to laziness' (p. 56).

Therefore, strategy training including attribution training can be very effective for improving achievement motivation and learning.

Pressley et al. (1989) state, 'Strategies are the processes or sequence of processes used to facilitate performance' (p. 303). These can be used for specific learning tasks such as a heuristic for solving simultaneous equations, or for improving the learning environment, for example, providing adequate light, sound, a suitable context, or

arranging the class seating to gain the best results. The use of any particular strategy cannot be presumed to produce the desired result but should be carefully designed and evaluated for its effectiveness, particularly upon its effect on 'type'. Inappropriate strategies may produce the opposite effect of that intended and therefore strategies need to be regularly monitored.

Teachers generally want their students to learn but in reality find this is not always the case. Lack of achievement by students occurs for many reasons and some of these have been found during this research, indicating that an unsuitable strategy, or the lack of knowledge of suitable strategies by the students may be associated with underachievement (Bereiter & Scardamalia, 1989). Previous studies by this author in 1994 has found the effects of mismatch between the teaching style strategy used, and the learners' preferred learning style, resulting in underachievement. Therefore, it is an advantage for a teacher to recognise the different likely ways that the various 'types' may respond to various strategies, and help in the selection of an appropriate learning strategy (Lawrence, 1984; Fourqurean et al., undated; Roberts & Butler, 1982; Barrett, undated; DeNovellis & Lawrence, 1983).

It is suggested that strategy training should be used in conjunction with attributional training for underachievers and be related to the characteristics associated with individual 'type'. Seventy-six percent of the students in this study agreed with,

> 'I would gain better results if I had a wider knowledge of strategies to use to solve problems' (question 12, Questionnaire - Part 2).

The ST and NF Function Pairs had the highest percentage agreeing with question 12, and the SF group had no one disagreeing and 30% unsure. The NT and ST groups were the only Function Pairs containing students disagreeing with question 12, with 20% for ST and 40% for NT (Table 5B). This could be interpreted to mean that, the possession of a wide knowledge of cognitive and metacognitive strategies, and when to use them, would be very useful for students, particularly underachievers, and should

be included within the strategy and attributional training (Short & Weissberg-Benchell, 1989).

Strategy training generally may consist of the direct teaching of suitable step-by-step procedures to solve academic problems. For example, the strategy briefly mentioned earlier, developed and used by Palincsar and Brown (1984) within a reciprocal teaching approach for reading a text, would require students to;

(1) Summarise the main ideas of the text.

(2) Form self-questions pertaining to the text.

(3) Clarify the meaning of any unusual words or concepts in the text.

(4) Predict the outcome or content of the next part of the text (Brown & Palincsar, 1982, 1989; Cole & Chan, 1990).

This step-by-step method would need to be carefully constructed and flexible enough to meet with the students' learning needs.

Instructional and Motivational Strategies

There are many different instructional approaches and motivational strategies such as those suggested by Biggs (1984, 1991), Borkowski et al. (1990), Englert and Mariage, (1991), Golay (1982), Palincsar and Brown (1984), Short and Weissberg-Benchell, (1989), to mention some of the research literature covered in this thesis, which can be used in an attempt to reduce or overcome underachievement. The effectiveness of whichever approach used will depend on a number of factors, such as, the degree of underachievement, the previous history of the student, the personal learning style preference, and the resources and equipment available. The following elements contained within the instructional and motivation strategies (**Figure 4** and **Figure 5**) suggested by Ames (1992, p. 147) provide a guide, and can be selectively used to improve motivation and reduce underachievement. The elements have not been derived directly from this research, but do have features within them that could influence the students' cognitive and metacognitive processes of learning, together

with improving the students' motivation (Short & Weissberg-Benchell, 1989). Therefore, these suggestions have been included within this section. It is suggested by this author that when a strategy is selected for use with an underachiever it should first be chosen by considering the student's need, and then an effort should be made to ensure that the strategy is agreeable with characteristics of the student's 'type'. Otherwise a mismatch may occur and cause further underachievement. It may be advantageous to allow students to choose from a selection of strategies and thereby gain their cooperation and improve their motivation.

Figure 4 (page 145) displays a number of strategy items which can be used by the classroom teacher to assist students and improve the effectiveness of learning (Ames, 1992). These strategies would be especially useful for underachievers. The items would not all be used at the same time but could be selectively chosen and used within an Individual Educational Programme (IEP) according to the major requirement needed at the time of learning.

Instruction Strategies - elements

Focus on the meaningful aspects of learning activities.

Design tasks for novelty, variety, diversity, and student interest.

Design tasks that offer reasonable challenge to students.

Help students establish short-term, self-referenced goals.

Support the development and use of effective learning strategies.

Focus on helping students participate in the decision making.

Provide 'real' choices where decisions are based on effort, not ability evaluations.

Give opportunities to develop responsibility and independence.

Support development and the use of self-management and monitoring skills.

Focus on individual improvement, progress and mastery.

Make evaluation private and not public.

Recognise the students' effort.

Provide opportunities for improvement.

Encourage students to view mistakes as part of learning

Figure 4.
Instructional strategy elements.

Figure 5 on the following page shows some specific motivational approaches or strategies that can be used by teachers for underachievers (Ames, 1992). These strategies involve processes designed to specifically raise the student's motivation towards learning, although it is very likely that the instructional strategies would also have a motivational effect and therefore could be used in combination with the motivational ones. They would be used as a point of focus or emphasis within the normal classroom lesson by the teacher and preferably used as a natural part of the teaching style, either as IEP's or conventional class teaching. The selection used from the following strategies should be based upon the immediate need of the student as

perceived by the teacher and preferably be used in combination with instructional strategies.

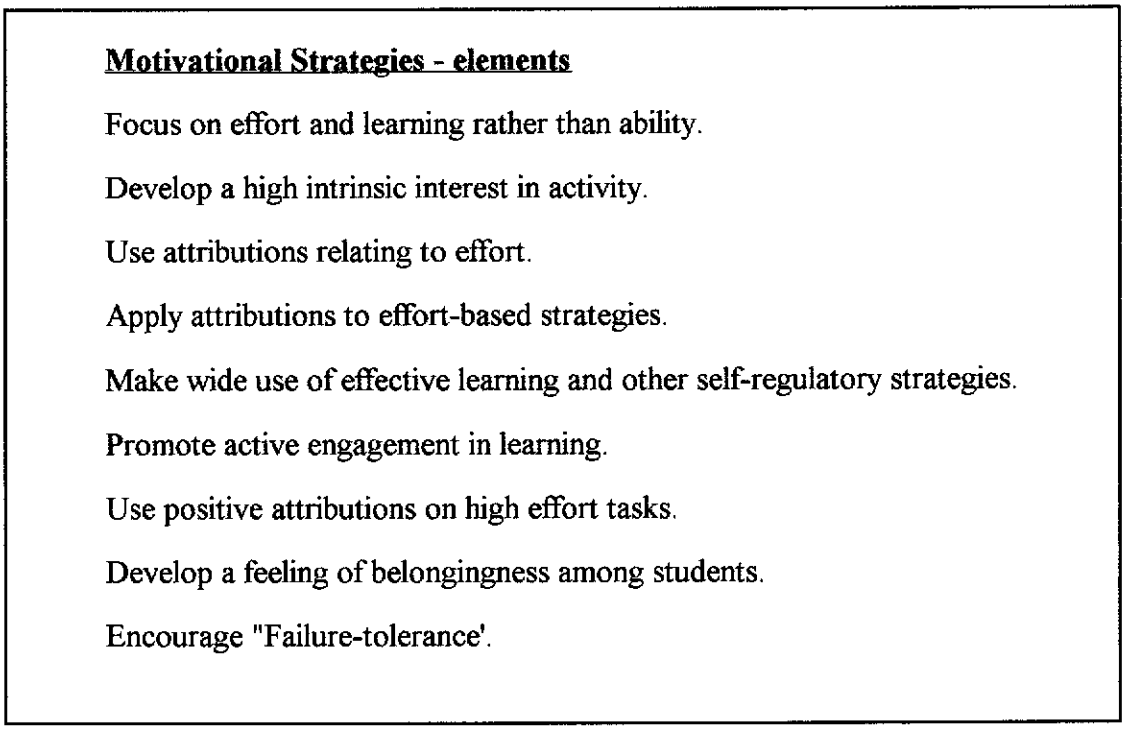

Figure 5.
Motivational Strategies

The principles relating to classroom structure and strategies for motivational enhancement have been outlined as being important, but equally important is the need to regularly assess how students perceive them. Specific motivational interventions suggested in this thesis may have different effects on different students, depending upon the students' prior experience and the effect of their individuality. It is suggested by Ames (1992) that the process of focussing on how students change with regard to their self-perceptions and progress may provide a meaningful approach to evaluation and be important for improving motivation.

Conclusions and Recommendations

The major aims of this research were to determine if underachievement, and the attributions given for success, and failure were related to individual 'type'. Individual

'type' was decided by using a modified form of Myers-Briggs Type Inventory (Briggs-Myers & Briggs, 1992; Lawrence, 1982). This research has found that certain individual 'types' are 'at risk', or likely to underachieve in science.

Taking into consideration the study's limitiations, it would appear that underachievement may be prevented or reduced by using learning styles that are agreeable with individual preferences, or by using appropriate intervention measures to reduce learning problems and increase motivation towards learning. Similarities were found in the attributions used by the sample for past 'failures', and differences were found in the attributions for 'future success'. These results suggest that an intervention approach using strategy and attributional retraining could be beneficial, particularly for underachievers and for those 'types' that may be 'at risk' towards underachievement (Borkowski et al., 1986, 1988; Cole & Chan, 1990; Covington, 1987; Weiner, 1979, 1984, Undated).

The attributions provided by senior students for their previous successes were inclined to be 'ability', and for failures, 'a lack of effort'. It is possible that the students tended to use 'lack of effort' to protect their self-image regarding ability. In so doing they could justify their lack of effort to external and uncontrollable causes, such as teaching style or insufficient strategies. According to Weiner (undated),

> 'It is well documented that individuals differ in their predispositions to attribute achievement outcomes to ability and/or effort' (pp. 211-212).

This is because there are a variety of factors such as the number of prior successes and failure experiences, the pattern of performance, social norms, time spent at the task, personal dispositions at the time of failure or success and other factors one uses to infer attributions of causality (Weiner, 1979; Weiner & Kukla, 1970a,b; undated). Therefore, although attributional retraining is suggested as a means to overcome the self-image defence behaviour by underachievers and simultaneously may improve the

students' self-concept, it will need to be prescribed carefully because of the factors which may cause attributional conflict.

The answers given by the students to the questionnaires did not unfortunately, necessarily follow some success or failure on their part and therefore may not fully reflect the students' reaction to success or failure, but be only a rational answer to a hypothetical question. Only the NT 'types' considered 'ability' was more important for success than 'effort'. For underachievers this attribution adversely affects achievement motivation and subsequent learning. However, for achievers, an ability attribution may improve motivation and could be used particularly when some success is gained. NT 'types' generally are achievers, and therefore could be encouraged to use ability attributions, but only in respect to successes.

According to Clifford (1986) a reliable distinction can be made between the use of effort and strategy attributions. Attributions are the reasons students give for their successes or failures. This aspect will be dealt with more fully later, but at this stage an 'effort' attribution can be identified when students blame themselves for not having worked hard enough, or attribute their successes to the amount of work they have done. That is very likely to be more used by a student for failure rather than for success; this was found to be the case in this study. A positive form of 'effort' attribution such as, "My results can be improved if I work harder" is a suggested form that can be used during attributional training. Strategy attributions refer to statements made by students regarding success or failure resulting from either using or not using a suitable strategy. This type of attribution can be used effectively with positive 'effort' attributions such as, "By using a suitable strategy and with more effort, I have improved my results". According to Carr and Borkowski (1989) strategy attributions tend to produce more positive and constructive judgments than do effort attributions. Results gained from these forms of training support the view that achievement can be improved with appropriate learning activities (Carr & Borkowski, 1989). Other means

may also be effective to improve learning, such as providing a learning style that is suitable for an underachiever, or by teaching specific strategies and improving the student's motivation to learn.

It may be necessary to be very careful with using the attribution 'more effort', particularly if the student has been working hard, or it will be a signal to the student that he or she is lacking in ability and will consequently demotivate the student. Ability attributions should generally be avoided for underachievers, until their achievements have improved to the extent that it will have an improved effect upon the student's motivation. Success as a reward from learning can be a good intrinsic motivator for a student (Deci & Ryan, 1985). Therefore, the use of suitable strategies, and the use of effort attributions should be used frequently to improve results from learning.

The students involved in this research gave honest reasons for their successes or failures, and generally wished to improve their performance. Teachers therefore, should where possible, use positive attributions that relate to the 'individual 'type' characteristics of their students. One suggestion of a positive attribution relating to 'type' constructed by this author, which is based upon attributional theories of motivation (eg. Weiner, 1979, 1984; Weiner & Kukla, 1970a;) and in agreement with principles of attributional retraining (e.g. Dweck, 1975; Cole & Chan, 1990) is;

> "You may learn better by seeing how everything fits into the whole picture rather than looking at bits of the picture."

This style of attribution is most suitable for those 'types' which prefer a global form of learning rather than an analytic form (Dunn, 1988, 1990). Should the underachiever be a 'type' that prefers analytic forms of learning, such as a ST 'type', then the attribution would need to be different, such as;

> "We have been looking at this problem from the complete picture, but now we can look at individual parts of the picture."

Other suggestions of attributions that can be used are;

"Given more time and with a different strategy, you will do very much better."

"By using a good strategy and with the amount of work you have done, your results have improved greatly."

"With your amount of effort and by working quietly on you own, it has enabled you to gain good results."

Motivational Enhancement: The motivational deficiencies of underachievers have been mentioned often throughout this study, principally because the students used for this research lacked achievement motivation, but generally recognised the importance of motivation for learning. Therefore, the use of an intervention approach that will develop a positive level of achievement motivation is necessary (Pintrich & Schrauben, 1992). It is suggested that the use of motivation enhancement strategies would be an important way for teachers to redress one of the causes of underachievement and improve the results from their teaching (Ames & Ames, 1984; Ames, 1992).

Motivation enhancement can be gained by either or both quantitative or qualitative means (Ames, 1992). The advantage of one form over another will depend upon the situation in which the enhancement approach is being used. A qualitative approach is concerned with how students think about themselves in relation to the learning activities and the process of learning. This type of approach may be suitable for all students, but particularly beneficial for those with a history of underachievement. With this kind of approach, specific goals in classroom structures can be used to orient students towards qualitatively different patterns, but this may require changing the teachers' goals for student's learning, and belief systems. Ames (1992) and Dweck (1975) suggest that goals used within the classroom should be described in relation to mastery and performance goals. Attributional training can be combined with mastery and performance goals in which the focus is upon effort and belief in the efficacy of

one's effort. Enhancing motivation therefore means enhancing the value of effort and a commitment to effort-based strategies through mastery-oriented structures. Ames (1992), states:

> 'In considering motivation enhancement, it is important to note that motivation is too often equated with quantitative changes in behaviour (e.g. higher achievement, more time on task) rather than qualitative changes in the way students view themselves in relation to the task' (p. 268).

Motivation may also be enhanced by providing a wider range of choices of learning styles, particularly those which include the various elements given by Dunn (1990). This view is supported by the responses given by most students in this study: they indicated that better results would have been likely if there had been the availability of choice from different learning styles. However, guidance on the selection of a learning style to suit an individual 'type' is necessary. All students may not automatically realise the strength or pattern of their individual characteristics, until they are explained to them or experienced by them. For example, 'global' learners may not realise their preference until they feel uneasy about 'analytic' learning. Similarly, students required to work within a group may feel uncomfortable because they find it difficult to work on their own ideas with other students, and prefer to work on their own (Dunn & Dunn, 1988; Dunn, 1990). It is important that a learning style should be suitable for the individual student, in order to gain good achievement motivation from learning situations.

A number of researchers have shown the improved motivational effect gained by encouraging students to become more active learners instead of passive ones (Ames 1992). De Charms (1976) argues from results obtained from the Carnegie Project (1967) on Motivation, that there is a relationship between classroom structure and pupil motivation. It was concluded that a rigid learning structure inhibited motivation whereas a 'right' structure enhanced motivation. A 'right' structure is considered as one

where there is reduced teacher dominance and where there is permitted a wide range of student choice. Therefore, students should be encouraged to become 'originators' and more active in their learning instead of being passive participators.

Underachievement is shown from the results to be possible for most 'types' of the Myers-Briggs coding, but the ESFJ and ISFJ 'types', and the SF Function Pair 'types', have shown in this research to be more 'at risk' for underachievement (Tables 3 and 3A). Caution is needed, however, regarding making strong categorisations or generalisations relating to failure or underachievement because of the small sample, and the tendency of producing a self-fulfilling prophecy. It appears that a characteristic of the dominant 'F' preference in combination with the 'S' preference tends to cause the SF 'type' to underachieve within science and similar quantitative type subjects. When the 'Feeling' ('F') preference acts as the dominant judgment preference in such 'types' as ESFJ, then decisions are made by weighing the relative importance or value of competing alternatives (Briggs-Myers & Briggs, 1992; Lawrence, 1982; McCaulley, 1990). They may be concerned about the value of their learning as far as it affects other people, rather than the learning for their development of ideas. The difficulties that SF 'types' may encounter in science may be overcome or moderated by using different approaches or emphases during their science learning. For example, if SF students can understand the relationship and ideas as they relate more to people, greater value may be ascribed to their work and consequently improve their motivation.

Achievement motivation, as indicated by the attributions used by students, is shown to be a major causal factor relating to underachievement within this study for all 'types'. An important implication gained from this study is that intervention approaches should be used to improve the attributional motivation for underachievers. Just how this is done and with whom may best be decided by using an intervention policy suggested earlier in this thesis. Motivation is a prerequisite for learning (Adelman & Taylor,

1993). Therefore, motivational enhancement strategies should be an important component of science teaching.

An important implication suggested from this research is that schools and teachers can be important agencies to redress some of the sociological causes of underachievement. This may be accomplished by using cognitive, metacognitive and motivational strategies that relate to individual 'type', or by modifying current instructional practices to better match individual differences (Chapman, 1994; Palincsar, 1986; Schmeck, 1983, 1988; Short & Weissberg-Benchell, 1989). By recognising the unique differences, and similarities that exist between students as they enter a learning situation, teachers should try to provide learning styles that are suitable for the individual and therefore avoid any mismatch with the teaching style.

Learning can be enjoyable for students who see the value in what they are learning, and who are using a learning style that is agreeable with their 'type'. Under such conditions, achievement motivation would increase the potential of each student to achieve more satisfying results from their learning tasks. In contrast to this scenario, is the situation where teaching and learning is difficult and unrewarding because of a mismatch between teaching style, and because of the students' low level of achievement motivation. The reversal from a condition of acute underachievement to one of achieving is possible if an appropriate intervention procedure is used. Teachers could be encouraged to become more aware of the effects individual 'type' have upon learning and should provide effective intervention measures to avoid or overcome underachievement by their students. The avoidance of a mismatch of learning style and negative attributions, have been suggested as primary measures to improve achievement, and thereby raise intrinsic motivation levels for all concerned in the learning tasks.

Few of the students in this study said they were familiar with, or practiced memory activities, yet 73% considered that a good memory was essential to gain good results from science. The planning of learning strategies, and the exercising of control over their learning were two other metacognitive skills generally lacking among those in the student sample. Sixty-seven percent of the students stated that they did not use their own planning strategies for learning; therefore, it is likely that they may not have generally produced sufficient good results to raise their achievement motivation levels. The lack of student motivation shown by the students' responses may have been be partially caused by their lack of metacognitive training (Short & Weissberg-Benchell, 1989). It is very likely the passive learning style and lack of choice from learning styles also would have affected students' motivation.

A need for a wider and more general use of metacognitive knowledge and skills for all learners, especially for underachievers, is supported by the results from this research. It has been suggested in the section on intervention that cognitive and metacognitive activities can be combined with attributional retraining for greater effectiveness to improve learning (Chapman, 1994; Short & Weissberg-Benchell., 1989).

There is the tendency to apportion blame either upon the student, or the school for underachievement. Neither of these reasons is given as a cause of the students' underachievement used in this research, and it was not the purpose of the study to apportion blame. But it is the view of this researcher that a much wider transactional view needs to be made of the learning situation to gain a much wider appreciation of the factors causing underachievement. Sometimes it may be the student's fault, or that of the teacher, but commonly it could be due to the interaction occurring between the various elements involved during the learning (Adelman & Taylor, 1993; Chapman, 1994).

Motivation in its various forms has been identified as a causal factor relating to underachievement in this study and therefore needs to be the focus of concentration, as suggested in the various intervention approaches. A point made throughout this thesis is that motivation is related to individual 'type' and therefore the recognition of the various characteristics associated with 'types' need to be carefully considered when using different learning styles, because of the different motivational effects, positive and negative, likely to result from a learning style. Also strategy training needs to be used more, particularly with underachievers and should be combined with attributional training (e.g. Biggs, 1984, 1991; Borkowski et al., 1986, 1988; Brown & Palincsar, 1982; Carr & Borkowski, 1989; Chi, 1985; Clifford, 1986; Cole & Chan, 1990; Cullen, 1985; Pressley et al., 1987, 1989; Schmeck, 1988; Short & Weissberg-Benchell, 1989; Weiner, 1984, 1985).

This study has concentrated on discovering relationships between 'type', underachievement, and motivation within one specific domain of knowledge, namely science, by using a biased sample of underachievers. It has demonstrated that certain 'type' may have achievement problems. Further research might involve increasing the size of the sample of science students, or to include achievers and underachievers in order to determine whether the 'types' common amongst underachievers are also common amongst achievers. This could also affirm whether the same individual 'type' tends to be among the underachievers within a larger 'purposive' sample, or whether there is any difference between a random sample of students. Also, research could be carried out to determine if the preferences of certain science topics or modules of work used within some school curriculums, is related to 'type'.

Finally, it is suggested that by carefully using the intervention approaches suggested in this thesis and by using a broader application of knowledge gained from individual 'type' analysis, teachers could greatly improve the effectiveness of learning, reduce underachievement, avoid deviant behaviour by students, and generally improve the

'learning climate' for all concerned (Ayllon & Roberts, 1974; Ballard, 1978; Barger & Hoover, 1984; Biggs, 1984, 1991; Schmeck, 1983, 1988; Zeisset, 1991). In particular, students who may be 'at risk' to underachieve can be helped to overcome failure, raise their level of achievement motivation, and gain success.

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Appendix A CONFIDENTIAL

INDIVIDUAL TYPE - QUESTIONNAIRE

The following questionnaire will enable you to study yourself in some of the ways you think and act both in and out of school. There are no right or wrong patterns. Think carefully and try to choose the answer that really describes you best. This exercise is not a test. it is simply a way for you to start looking at the patterns in yourself.

INSTRUCTIONS Place a tick on the line alongside the statement that best describes you, for each of the following pair of statements (ONLY ONE TICK ALLOWED FOR EACH PAIR OF STATEMENTS.)

(A)

I like learning activities with much action and variety. _____

I like quietness for learning and time to consider things. _____

I like to study by talking through problems with other students. _____

I like to study and learn privately on my own before talking and sharing with other students. _____

I act quickly to solve problems and school work often without much thought or reflection. _____

I am usually slow to start on school work and learning tasks because I need to give much thought to what is required. _____

I like to see how other people do a job, and to see their reults so that it may help me with similar tasks. _____

I like to understand the idea of a job and to work alone or with just a few people to solve learning problems. _____

I want to know from others what standards of work are required. _____

I like to set my own standards. _____

(B)

I prefer to learn from practical experience. _____

I like to understand the meaning of facts and how they fit together. _____

I like to use my senses (eyes, ears, touch, taste, and smell) to improve my understanding of things. _____

I like to use my imagination to come up with new ways to do things or find new possibilities. _____

I dislike solving new learning problems unless I fully understand ways to solve them. _____

I like solving new problems and discovering new ways to do things. _____

I enjoy using skills already learned more than learning new ones. _____

I like learning new skills more than practising old ones. _____

I am patient with details and like the challenge of complicated learning tasks. _____	I dislike complicated learning tasks and may become impatient if details are complicated. _____
(C)	
I like to make decisions logically and based upon facts. _____	I like to decide things based upon personal feelings and human values, even if they are not logical. _____
I like to be treated fairly and without favouritism. _____	I like to be praised and to please people, even in unimportant things. _____
I may neglect and hurt other people's feelings without knowing it. _____	I am aware of other people's feelings and try not to hurt them. _____
I give more attention to ideas or things than to human relationships. _____	I am more sensitive to how others feel than with ideas. _____
I do not easily get upset by arguments. _____	I get upset by arguments and conflicts. _____
(D)	
I like to have a plan; to have things settled and decide ahead. _____	I like to stay flexible and avoid fixed plans. _____
I try to make things come out the way they 'ought to be'. _____	I deal easily with unexpected happenings. _____
I like to finish one project before starting on another. _____	I like to start many projects but may have trouble finishing them all. _____
I usually have my mind made up. _____	I am often undecided and in need of more information. _____
I tend to decide things quickly _____	I tend to decide things slowly. _____
I want to be right. _____	I do not want to miss anything. _____
I live by standards and schedules that are not easily changed. _____	I live by standards and schedules that can be changed to deal with problems as they occur. _____

RESULTS (Add up your tick responses for each of the following sections)

(A) LEFT_____ RIGHT_____ _____
(B) LEFT_____ RIGHT_____ _____
(C) LEFT_____ RIGHT_____ _____
(D) LEFT_____ RIGHT_____ _____

Thank You for your cooperation.

Appendix B

CONFIDENTIAL
SCIENCE PERSONAL ACHIEVEMENT QUESTIONNAIRE - PART 1

These questions are related to your achievements at Science and the results obtained can be useful to assist future learning. Your answers are confidential and will be used for research to assist in helping to raise achievement levels from Science teaching.

Do not spend too much time on each question: your first answer or impression gained from the question is usually correct, as far as it relates to you. There is no right or wrong answer expected from the questions but only that which applies to you.
CHOOSE THE LETTER CORRESPONDING TO THE RESPONSE THAT YOU THINK BEST APPLIES TO YOU. Write the letter on the line.

1. Do you think that any success by you at Science is due to ?
   (a) Your ability. (b) Your effort.
   (c) Your mood or feelings. (d) Luck.
   (e) The teaching style.

   _____

2. What do you think is the main cause of any failure or underachievement results that you may have experienced?
   (a) Task was too difficult. (b) Lack of ability.
   (c) Did not work hard enough. (d) Bad luck.
   (e) Did not like the teaching style.

   _____

3. Do you generally...
   (a) Expect good results from your Science work?
   (b) Take the results you get as they come?
   (c) Not expect good results because of your past performance?
   (d) Vary in your expectation of results depending on how you feel?

   _____

4. Do you think you could improve your results from Science by...
   (a) Learning better ways to solve problems?
   (b) Being able to use your own style or learning?
   (c) Working harder?
   (d) Having a different teacher?
   (e) Having a different attitude towards Science?

   _____

5. If you receive a disappointing Science result, do you...?
   (a) Put it down to a chance event - or bad luck?
   (b) Treat it as a learning task and want another go at it?
   (c) Try to find out what would be the best strategy to use to improve future results from similar tasks?
   (d) Consider the task was beyond your ability?
   (e) Decide to give much more effort at your Science work?

   _____

6. Do you consider that Science as a subject for you is...
   (a) Just another subject within the school curriculum for you to do?
   (b) A very worthwhile subject which has much value for everyday living?
   (c) Essential, only as a means to gain future qualifications?
   (d) Not very interesting and boring?

7. Which do you think is the most important factor that would help you to gain good results at Science?
   (a) Having a good level of intelligence.
   (b) Working harder at the subject.
   (c) Knowing and using better strategies to solve problems.
   (d) Appreciating the value of Science as a school subject.

8. Do you consider that...
   (a) You work hard at Science but do not gain good results because of your ability?
   (b) You have a good level of ability, but do not always work hard enough?
   (c) You have reasonable ability but are not interested in Science?
   (d) You work hard but do not expect good results?

9. When faced with a challenging or difficult problem in Science, do you...?
   (a) Give up without trying too much.
   (b) Persist in spite of any failures until you achieve a satisfactory result for you.
   (c) Consider the problem beyond your level of ability, and not try again.
   (d) Try to find out about the best strategy to use to solve the problem.

10. Do you think that intelligence is...
   (a) A fixed mental ability that you are born with?
   (b) A flexible mental ability that can be improved with learning?
   (c) A quality that you cannot do much to improve?
   (d) A mental ability that improves with age?

THANK YOU FOR YOUR COOPERATION
NOW PLEASE COMPLETE QUESTIONNAIRE - PART 2.

Appendix C **CONFIDENTIAL**

SCIENCE ACHIEVEMENT QUESTIONNAIRE - PART 2

Using the scale given below, circle the number of your choice for each of the following statements. Only one choice is required for each statement.

1 = Strongly agree. 2 = Agree. 3 = Uncertain.
4 = Disagree. 5 = Strongly disagree.

* * * * * * * * * * * *

1. Any success I have at Science is due mainly to my ability.
   1 2 3 4 5

2. Better results are obtained when I work hard.
   1 2 3 4 5

3. Ability is more responsible for success at Science for me than is effort.
   1 2 3 4 5

4. Luck is a big factor in the results that I gain from tests.
   1 2 3 4 5

5. The harder I work the luckier I seem to be with gaining good test results. 1 2 3 4 5

6. My failures at Science are due to my lack of knowledge.
   1 2 3 4 5

7. My interest in Science is important in order to gain good results.
   1 2 3 4 5

8. My results from Science tests could be better. 1 2 3 4 5

9. A choice from different ways of learning , such as learning by doing practical work, would enable me to gain better results.
   1 2 3 4 5

10. The teaching method used has a large affect upon my results.
    1 2 3 4 5

(continued over page)

11. I seldom expect good results from my Science tests. 1 2 3 4 5

12. I would gain better results if I had a wider knowledge of suitable strategies to use to solve problems. 1 2 3 4 5

13. Intelligence is a fixed mental ability that determines the results I get from Science. 1 2 3 4 5

14. I would gain better results if I was able to have more time to study my Science work. 1 2 3 4 5

15. My achievement at Science is related to how motivated I am. 1 2 3 4 5

*****

THANK YOU

Appendix D

CONFIDENTIAL

SCIENCE ACHIEVEMENT : INTERVIEW QUESTIONS

The following questions will be asked each student involved with the written questionnaires at the completion of the questionnaires. A withdrawal choice will be permitted and answers to the questions will only be recorded on paper, with the student's approval.

1. How do you think your achievements or results at Science could be improved?

2. How important is a good Science result for you?

3. How important is a good memory for gaining a good result?

4. Do you spend much time planning your learning strategy?

5. Do you think you are capable of gaining better results from science?

Appendix E

STUDENTS' STATEMENTS GIVEN TO ORAL QUESTIONS

The following statements were given by students during an interview session with the researcher. The dominant dimension of each Function Pair, together with the number of responses by each respective dimension is shown.

Question 1. *How do you think your achievements or results at Science could be* improved?

		Total	Male	Female	Dominant Dimension
ST	'More effort required'.	2	1	1	S(2)
	'More study'.	2	1	1	S2)
	'Make the subject more interesting'.	1	1		T(1)
	'Better motivation'.	1	1		T(1)
SF	'Better understanding'.	1	1		S(1)
	'More effort required'.	11	6	5	S(8) F(3)
	'Higher motivation'.	3	2	1	S(2) F(1)
	'Different learning style'.	2	2		F(2)
	'More concentration'.	1	1		F(1)
	'More time'.	4	2	2	S(2) F(2)
	'More practical work'.	2		2	S(1) F(1)
	'Studying harder'.	5	1	4	S(2) F(3)
	'Different teaching method'.	4	2	2	S(2) F(2)
	'More encouragement'.	1		1	S(1)
	'More help'.	2		2	S(1) F(1)
	'Different teacher'.	2		2	S(1) F(1)
	'More interest'.	3	3		S(2) F(1)
NT	'More study'.	2	2		N(1) T(1)
	'More effort'.	2	2		N(1) T(1)
	'More practical work'.	1	1		N(1)
	'Different teaching style'.	1	1		N(1)
	'Different teacher'.	1	1		N(1)

NF	'More time'.	1	1		N(1)	
	'More effort'.	4	1	3	N(1)	F(3)
	'Concentrate more'.	1	1			F(1)
	'Different teaching approach'.	4	3	1	N(3)	F(1)
	'Study harder'.	2		2	N(1)	F(1)
	'More practical work'.	1		1	N(1)	
	'More notes from Teacher'.	2	1	1	N(2)	

Question 2. *How important is a good Science result for you?*

ST	'Not important'.	1	1		S(1)	
	'Quite important'.	1	1		S(1)	
	'Take it as it comes'.	1	1			T(1)
	'Very important for pride and satisfaction'.	2	1	1	S(1)	T(1)
	'Very important for qualification'.	1	1			T(1)
SF	'Very important for personal pride'.	2	1	1	S(1)	F(1)
	'Not very important'.	6	4	2	S(3)	F(3)
	'Important for qualifications'.	2		2	S(1)	F(1)
	'Fairly important'.	3	2	1	S(2)	F(1)
	'Very important for qualifications'.	5		5	S(2)	F(3)
	'Important for motivation'.	1		1	S(1)	
NT	'Very important for qualifications'.	3	3		N(2)	T(1)
	'Fairly important for qualifications'.	2	2		N(1)	T(1)
NF	'Not important'.	3	2	1	N(2)	F(1)

NF (cont)						
	'Quite important for qualifications'.	1	1			F(1)
	'Very important'	1		1	N(1)	
	'Very important for qualifications'.	1		1		F(1)
	'Important for self confidence'.	1	1		N(1)	

Question 3. *How important is a good memory for gaining a good result - do you practice any memory skills?*

ST	'Not very important - very little'.	3	3		S(2)	T(1)
	'Very important - no practice'.	1	1			T(1)
	'Important - no practice, do not know how'.	1		1	S(1)	
SF	'Not important - No'.	5	2	3	S(1)	F(4)
	'Very important - No'.	1		1	S(1)	
	'Very important'.	10	4	6	S(6)	F(3)
	'Very helpful'.	3	1	2	S(1)	F(1)
	'Very important - do some practice'.	1		1	S(1)	
NT	'Important - No'.	2	1	1	N(1)	T(1)
	'Very important - No'.	2	1	1	N(2)	
	' Helpful'.	1		1		T(1)
NF	'Very important - No'.	5	4	1	N(4)	F(1)
	'Very important.'	2		2	N(1)	F(1)

Question 4. *Do you spend much time planning your learning strategies?*

ST	'Very little'.	1	1		S(1)	
	'No'.	2	2		S(1)	T(1)
	'No I just do the work'.	1	1			T(1)
	'No I don't have a learning strategy - don't have time'.	1		1	S(1)	
SF	'Not much'.	5	3	2	S(2)	F(3)
	'None'.	11	3	8	S(5)	F(6)
	'Spend much time'.	1		1	S(1)	
	'Yes'.	2	1	1	S(2)	
	'No I just do the work'.	1		1	S(1)	
NT	'No I just do the work'.	1	1		N(1)	
	'No I can't be bothered'.	1	1		N(1)	
	'No'.	3	3		N(1)	T(2)
NF	'No - I can't be bothered'.	2	2		N(1)	F(1)
	'No - I just do the work'.	1	1		N(1)	
	'I try to but don't have much time'.	1	1			F(1)

Question 5. *Do you think that you are capable of gaining better results from science?*

ST	'Yes"	3		3	S(3)	
	'Yes but only if it was more interesting'.	1	1			T(1)
	'It is possible'.	1	1			T(1)
SF	'No I have a motivation problem'.	1		1	S(1)	
	'Yes'.	17	6	11	S(8)	F(9)
	'Unsure - but would like to'.	1		1	S(1)	
NT	'Yes'.	3	3		N(1)	T(2)

NF	'Yes'.	5	3	2	N(3) F(2)
	'No'.	1		1	N(1)
	'Yes if I put more effort in'.	1	1		N(1)

Summary of Factors and Total Number of Attributions given in Oral Answers by Function Pairs - (male and female)

Question 1. *'How science results could be improved.'*

Effort Attribution. ST(4 : 2m,2f), SF(17: 8m,9f), NT(4: 4m,0f), NF(7: 2m,5f)

Motivation Factor. ST(2: 2m), SF(6: 2m,4f), NT(0), NF(0)

Teaching Style. ST(0), SF(16: 5m,11f), NT(3: 3m), NF(8: 5m,3f)

Learning Style. ST(0), SF(2: 2m), NT(0), NF(0)

Question 2. *'The importance of science.'*

Motivation Factor:

Important - ST(4: 3m1f), SF(13: 3m,10f), NT(5: 5M), NF(4: 2m,2f)

Not important - ST(2: 2m), SF(6: 4m,2f), NT(0), NF(3: 2m,1f)

Question 3. *'The importance of memory for science achievement.'*

Learning Strategy:

Important - ST(2: 1m,1f), SF(15: 5m,10f), NT(3: 1m,2f), NF(7: 4m,3f)

Not important - ST(3: 3m), SF(5: 2m,3f), NT(2: 1m,1f), NF(0)

Question 4. *'The use of planning strategies.'*

Metacognitive Factor:

Used - ST(0), SF(8: 4m,4f), NT(0), NF(1: 1m)

Not Used - ST(5: 4m,1f), SF(12: 3m,9f), NT(5: 5m), NF(3: 3m)

Question 5. *'Capability for better results from science.'*

Metacognitive Factor:

Capable - ST(5: 2m,3f), SF(17: 6m,11f), NT(3: 3m), NF(6: 4m,2f)

Not capable - ST(0), SF(2: 2f), NT(0), NF(1: 1f)

Number of Responses given for Factors and Attributions by Function Pairs

	ST(5)	SF(20)	NT(5)	NF(7)
Question 1.				
Effort Attribution	4	17	4	7
Motivation Factor	2	6	0	0
Teaching Style	0	15	3	8
Learning Style	0	2	0	0
Question 2.				
Motivation Factor: (Value of the subject)				
Important	4	13	4	4
Not important	2	6	0	3
Question 3.				
Learning Style: (Use of a learning strategy)				
Important	2	15	3	7
Not important	3	5	2	0
Question 4.				
Metacognitive Factor: (Planning of learning)				
Used	0	8	0	1
Not used	5	12	5	3
Question 5.				
Metacognitive Factor: (Self-evaluation)				
Capable	5	17	3	6
Not capable	0	2	0	1

Appendix F

DESCRIPTION OF MOTIVATIONAL FEATURES CONTAINED WITHIN QUESTIONS - QUESTIONNAIRE PART 1

Question	Feature	Comments
1.	Attributional factor for success.	Relates to achievement motivation - the students' perceived cause for success.
2.	Attributional factor for failure.	Relates to achievement motivation - the students' perceived cause for failure.
3.	Motivational factor - expectation.	Motivation characteristic - one of two factors important for success motivation.
4.	Learning style for improvement.	Relates to preferred learning style. Important factor for achievement motivation.
5.	Attitude and value.	Reactions to results - important factor for achievement motivation..
6.	Motivational factor - value.	Relates to the choice of subject taken. One of two important factors for success motivation.
7.	Attribute and value for success.	Motivational characteristic and attributional cause for success.
8.	Attribute for ability or effort.	Relates to students' perceived cause for success. Attributional Motivation factors.
9.	Motivational factor - persistence or avoidance.	Relates to motivational pattern.
10.	Motivational pattern.	Relates to adaptive or maladaptive motivation.

Appendix G

DESCRIPTION OF MOTIVATIONAL FEATURES CONTAINED WITHIN QUESTIONS - QUESTIONNAIRE PART 2

Question	Feature	Comments
1.	Attribute for ability.	Relates to the students' perceived cause for success or failure.
2.	Attribute for effort.	Causal ascription for success or failure.
3.	Attribute for ability.	Causal ascription for success or failure.
4.	Attribute for luck.	Causal ascription for success or failure.
5.	Attributes for luck and effort.	Causal ascription for success or failure.
6.	Attribute for ability.	Causal ascription for success or failure.
7.	Value and attitude factors.	Achievement motivational factors.
8.	Motivation factor - expectation.	Achievement motivational factor.
9.	Learning style - choice.	Achievement motivational factor.
10.	Teaching style - methods.	Achievement motivational factor.
11.	Motivation factor - expectation.	Achievement motivational factor.
12.	Cognition - achievement	Achievement motivational factor.
13.	Motivational pattern.	Adaptive or maladaptive pattern.
14.	Learning style - time.	Achievement motivation factor.
15.	Motivational intensity.	Achievement motivational factor.

Appendix H

STRONG PREFERENCES BY FUNCTION PAIRS

QUESTIONNAIRE - PART 1

The following shows the percentage of each of the function pairs shown in Table 5A that agree with the following question statements. Only scores of 60% and greater are given. The response item is shown underlined in brackets.

Question	Response Statement	Function Pair
1.	'Success mainly due to ability.' (a)	NT(60)
2.	'Did not work hard enough.' (c)	SF(75), NT(80) NF(86), ST(60)
3.	'Did not expect good results.' (c)	NT(60)
4.	'Improvement gained by working harder.' (c)	ST(80), NF(71) NT(80)
5.	'Science is essential to gain future qualifications.' (c)	NT(80)
6.	'The most important factor for success is to work harder.' (b)	ST(80), SF(65) NT(60)
7.	'Have good ability but do not work hard enough.' (b)	ST(60), NT(60) NF(71)
8.	'Give up easily without trying.' (a)	ST(60)
9.	'Persist in spite of failures.' (b)	NT(80), NF(71)
10.	'Intelligence is a flexible quality which can be improved.' (b)	ST(60), NT(80) SF(80)

Appendix H (cont)

STRONG PREFERENCES BY FUNCTION PAIRS

QUESTIONNAIRE PART - 2

The following preferences were selected by 60% or more of the function pairs.

Question	Response Statement	Function Pair
1.	'Success is due to my ability.' (2)	ST(80), NT(80)
2.	'Better results are obtained when I work hard.' (1)	ST(60), NT(80), NF(70)
3.	'Ability is more important for success than effort.' (1)	NT(80)
"	'Effort is more important than ability.' (4)	ST(60)
4.	'Luck is a big factor influencing results.' (4) (5)	ST(60), NT(80)
5.	'The harder I work the luckier I am.' (3) (2)	NT(60),NF(70)
6.	'Failures due to lack of knowledge.' (2)	ST(60)
7.	'Interest in Science is essential for good results.' (1,2,3)	NF(70),ST(60)
8.	'My results from science could be better.' (1,2)	ST(80), SF(100) NT(60).NF(100)
9.	'Choice of learning styles would improve results.' (2)	ST(60), NF(86)
10.	'Teaching method has a large effect upon results.' (2)	ST(60), NF(86)
11.	'Seldom expect good result.' (2)	ST(60)
12.	'Better knowledge of strategies is needed ' (2)	ST(60), NF(100)
13.	'Intelligence is a fixed mental ability.' (4)	ST(60)
14.	'Better results from more study time.' (2)	ST(60)
15.	'Achievement is related to motivation.' (1)	ST(60), NT(60) SF(75)

Appendix I

CHARACTERISTICS OF SENSING-FEELING TYPE (SF)

The following characteristics relating to the ***Sensing-Feeling Function Pair*** type have been derived from the highest responses given for Questionnaires Part 1 and Part 2 (Appendix B) and shown in Tables 5A and 5B.

The responses which differ from the ST type are indicated with an asterisk. *

++ Oral answers generally in agreement with the questionnaire responses.

- - Oral answers from some SF students at variance with modal responses to questionnaires.

They generally .....

Consider that success at Science is due to their own effort.

See any failure at Science is due to not having worked hard enough.

Have low expectations for success and tend to take the results as they come.

Tend to think that improvements in Science achievement could result from working harder. ++

* Attribute a lack of ability as a cause of a disappointing result.

* Consider that Science is only essential for gaining future qualifications.

Consider the most important factor to gain better results is to work harder.

Consider they have a good level of ability but do not always work hard enough.

Consider that intelligence is a flexible mental ability that can be improved with learning.

Agree that previous success at Science is mainly due to their ability.

Strongly agree that better results are obtained when they work hard.

Do not agree that ability is more responsible for success than is effort.

Disagree that luck is a big factor in the results gained at Science.

Are uncertain as to whether hard work is associated with luck in gaining good results.

Attribute failures at Science due to a lack of knowledge.

* Consider that interest in the subject is important for good results

Strongly of the opinion that their results could be better. - -

Agree that a choice from different learning styles would improve their results.

Agree that the teaching method has a large effect upon their results. ++

Seldom expect good results from their Science tests.

Agree they would gain better results if they had a wider knowledge of suitable strategies.

Tend to show low persistence to challenging or difficult problems.

* Are uncertain that intelligence is a fixed mental ability that determines their results from Science.

Agree they would gain better results if more time was available to study.

Strongly agree that motivation is important for them to achieve at Science. ++

Appendix J

CHARACTERISTICS OF SENSING-THINKING TYPE (ST)

The following characteristics relating to the ***Sensing-Thinking Function Pair*** type have been derived from the highest responses given for Questionnaires Part 1 and Part 2 (Appendix B) and shown in Tables 5A and 5B.

The responses which differ from the ST type are indicated with an asterisk. *

++ Oral answers generally in agreement with the questionnaire responses.

- - Oral answers from some ST students at variance with modal responses to questionnaires.

They generally .....

Consider that their success at Science is due to the teaching style

See any failure at Science is due to not having worked hard enough.

Have low expectations for success and tend to take the results as they come.

Tend to think that improvements in Science achievement could result from working harder. ++

Attribute a disappointing Science result to bad luck.

Consider Science a worthwhile subject, which has much value for everyday living.

Agree that the most important factor to gain better results is to work harder. ++

Consider they have a good level of ability but do not always work hard enough.

Tend to show low persistence to challenging or difficult problems

Consider that intelligence is a flexible mental ability that can be improved with learning.

Agree that previous success at Science is mainly due to their ability.

Strongly agree that better results are obtained when they work hard.

Do not agree that ability is more responsible for success than is effort.

Disagree that luck is a big factor in the results gained at Science.

*Are uncertain that interest in Science is important to gain good results.

Strongly of the opinion that their results could be better. ++

Agree that a choice from different learning styles would improve their results.

Agree that the teaching method has a large effect upon their results. ++

Seldom expect good results from their Science tests.

Agree that they would gain better results if they had a wider knowledge of suitable strategies.

* Disagree that intelligence is a fixed mental ability that determines their results from Science.

Agree that they would gain better results if more time was available to study.

Strongly agree that motivation is important for them to achieve at Science. ++

Appendix K

CHARACTERISTICS OF INTUITION-FEELING TYPE (NF)

The following characteristics relating to the ***Intuition-Feeling Function Pair*** *type* have been derived from the highest responses given for Questionnaires Part 1 and Part 2 (Appendix B) and shown in Tables 5A and 5B.

The responses which differ from the NT type are indicated with an asterisk. *

++ Oral answers generally in agreement with the questionnaire responses.

- - Oral answers from some NF students at variance with modal responses to questionnaires.

They generally .....

* Consider success at Science is due to their efforts.

Strongly agree that the main cause of failure is that they did not work hard enough.

Take results as they come. - -

Strongly believe that they could improve their results by working harder. ++

When faced with a disappointing result, tend to decide to work harder to improve.

Consider Science only essential to gain future qualifications.

The most important factor to gain better results is to work harder. ++

Consider that they have reasonable ability but do not work hard enough.

When faced with a difficult or challenging problem they try to find out the best strategy to use to solve the problem.

Consider that intelligence is a flexible mental ability that can be improved with learning.

Agree that success at Science is due to their ability.

Strongly agree that better results are obtained when they work hard. ++

* Are uncertain as to whether ability is more responsible for success than is effort.

* Strongly disagree that luck is a big factor in their results gained from Science tests.

* Agree that the harder they work the luckier they are in gaining good test results.

* Are undecided as to whether failure at Science is due to lack of knowledge.

* Agree that interest is important in Science is important to gain good results.

Agree that their Science results could be better. ++

Agree that a choice of learning styles would improve their results. ++

Agree that the teaching method has a large affect upon their results. ++

Seldom expect good results from Science tests.

Agree that they would gain better results if they had a wider knowledge of suitable strategies.

* Are uncertain that intelligence is a fixed mental ability that determines their results.

* Agree that they would gain better results if more time was available to study.

Strongly agree that motivation is important for them to achieve at Science.

Appendix L

CHARACTERISTICS OF INTUITION-THINKING TYPE (NT)

The following characteristics relating to the ***Intuition-Thinking Function Pair*** *type* have been derived from the highest responses given for Questionnaires Part 1 and Part 2 (Appendix B) and shown in Tables 5A and 5B.

The responses which differ from the NF type are indicated with an asterisk. *

++ Oral answers generally in agreement with the questionnaire responses.

- - Oral answers from some NT students at variance with modal responses to questionnaires.

They generally .....

* Agree that their success at Science is due to their ability.

Strongly agree that the main cause of failure is that they did not work hard enough.

Take results as they come. - -

Strongly believe that they could improve their results by working harder. ++

When faced with a disappointing result, they tend to decide to work harder to improve.

Consider Science only essential to gain future qualifications.

The most important factor to gain better results is to work harder. ++

Consider that they have reasonable ability but do not work hard enough.

* Tend to have high persistence in dealing with challenging or difficult problems.

Consider that intelligence is a flexible mental ability that can be improved with learning.

Strongly agree that success at Science is due to their ability.

Strongly agree that better results are obtained when they work hard. ++

Consider ability is more responsible for success than is effort.

Strongly disagree that luck is a big factor in their results gained from Science tests.

* Are uncertain as to whether luck and hard work are associated with their results.

* Strongly disagree that any failure at Science is due to lack of knowledge.

* Strongly agree that their interest in Science is important in order to gain good results.

* Are undecided as to whether their Science results could be better. - -

Agree that a choice of learning styles would improve their results. ++

Agree that the teaching method has a large affect upon their results. ++

Expect good results from Science tests.

Agree that they would gain better results if they had a wider knowledge of suitable strategies. ++

* Agree that intelligence is a fixed mental ability that determines their results.

* Strongly agree that they would gain better results if more time was available to study. ++

Strongly agree that motivation is important for them to achieve at Science.

Appendix M

Table 2
Details of Sample Population.

Student No..	Type	School	Subject	Sex	Category
1	ISTJ	A	CH	M	2
2	ENTJ	A	CH	M	1
3	ESFJ	A	BIO	M	2
4	ESFP	A	PHY	M	2
5	ENFJ	A	PHY	M	2
6	ENFJ	B	PHY	F	2
7	ISFJ	B	CH	F	2
8	ESFP	B	CH	F	2
9	ISFP	B	CH	F	1
10	ESFJ	B	PHY	F	2
11	ISFP	B	CH	F	2
12	ESFJ	B	CH	F	2
13	ISFJ	B	BIO	F	1
14	ISFJ	B	CH	F	2
15	ENFP	B	BIO	F	2
16	ISFJ	B	CH	F	1
17	ESFJ	B	BIO	F	1
18	ENFP	B	S.B	F	1
19	ESFJ	B	PHY	F	2
20	ESFP	A	CH	M	2
21	ESFJ	A	CH	M	1
22	ESFJ	A	BIO	M	1
23	ESFP	A	BIO	M	2
24	ENTP	A	PHY	M	2
25	INTP	A	PHY	M	2
26	ESTP	A	PHY	M	1
27	ISFJ	A	PHY	M	1
28	ENFP	A	HOR	M	2
29	ISFJ	A	HOR	M	1
30	INFJ	C	BIO	M	2
31	ESFP	C	BIO	F	1
32	ISTJ	C	PHY	F	2
33	ENTP	C	PHY	M	2
34	INFP	C	G.S	M	1
35	ESTJ	C	CH	M	2
36	ESTJ	C	CH	M	1
37	ENTP	C	PHY	M	2

Legend and Abbreviations:
A - College 'A' B - College 'B' C - College 'C' G.S - General Science.
F - Female. M - Male. 1 or 2 - Category of Underachiever.
CH - Chemistry. PH - Physics. BIO - Biology. S.B. - Social Biology.