The Relationship between Teachers’ Perceptions of Pupils’ Intelligence and Pupils’ Cognitive Styles

Julia Morwenna Anne Clark

Submitted in part fulfilment of the requirements for the Continuing Professional Development Doctorate in Educational Psychology (DEdPsy)

University of London

2005
Submission Statement

I confirm that:

1. This submitted thesis is my own work; and
2. I have read and acted upon the guidelines for avoiding plagiarism contained in the DEdPsy Handbook
3. The content of this Thesis has not been published in similar form elsewhere, or offered in respect of any other degree, diploma or other academic award.

Course Members Signature: ___________________________ Date: 27/4/05
ABSTRACT

Central to this study was the research question of whether teachers' perceptions of pupils' intelligence are significantly influenced by pupils' cognitive styles. Furthermore, it was considered whether teachers view pupils who learn in a verbal manner to be more intelligent than pupils who learn in a visual manner, and whether such beliefs subsequently have implications for pupils' learning outcomes.

The constructs of cognitive style and intelligence were identified as core elements in the examination of these research questions. These areas were explored through the literature within the context of research into teacher perceptions. A model to propose how interaction effects between these factors might affect pupil outcomes was developed and this provided a rationale for the study.

A pilot study provided an opportunity to explore the protocols for the main study using a small cohort of pupils. The methodology for the main study was then modified according to the recommendations made within the pilot.

The hypotheses were tested using a fixed design approach involving Year 6 pupils from five midshire primary schools (n=114). Subjects were individually assessed for cognitive style and this information was compared to teachers' rankings of pupils' intelligence, teachers' ratings of pupils' cognitive styles and independent measures of predictive intelligence and attainments.
The results of the study indicated that teachers were not able to identify pupils' cognitive styles within the classroom through daily contact; however, a significant relationship was discovered between teachers' perceptions of cognitive style and their perceptions of pupil intelligence. An iterative model was subsequently developed to explain this association.

The strengths and weaknesses of the study were examined and recommendations for future research subsequently discussed. The findings elicited by the study indicate this to be an area of research that has both good face validity and one that warrants further investigation through psychological research.
ACKNOWLEDGEMENTS

With eternal gratitude to the following people.....

Isaac for helping me to keep things in perspective

Jason for your problem solving skills, proof reading and practical support

Mum for all your encouragement and babysitting

Susan, my comrade in arms

Adele who now knows the CSA as well as I do

Joanna Preston for all the information and LEA data

The staff, parents and pupils who gave their permission and time to help with this research.

And last, but by no means least...

Dr Sean Cameron and all the team at UCL.
TABLE OF CONTENTS

TABLE OF FIGURES...........................................................................................................5
LIST OF TABLES ................................................................................................................7
CHAPTER 1: LITERATURE REVIEW.................................................................................8
CHAPTER 2: PILOT STUDY ............................................................................................51
CHAPTER 3: METHODOLOGY FOR THE MAIN STUDY .............................................83
CHAPTER 4: RESULTS ..................................................................................................107
CHAPTER 5: DISCUSSION ............................................................................................167
CHAPTER 6: REFERENCES ............................................................................................202
CHAPTER 7: APPENDICES ............................................................................................214
## TABLE OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The dimensions of cognitive style (from Riding and Cheema 1991)</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>A model to propose how the relationship between teacher perceptions, pupil intelligence and pupil cognitive style might affect pupils' learning outcomes</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>The percentage of subjects categorised by their degree of SEN</td>
<td>111</td>
</tr>
<tr>
<td>4</td>
<td>The percentage of subjects from each of the participating schools who were reported to have special educational needs (SEN)</td>
<td>112</td>
</tr>
<tr>
<td>5</td>
<td>VR data for all subjects</td>
<td>113</td>
</tr>
<tr>
<td>6</td>
<td>The relationship between gender, VR score and school attended</td>
<td>115</td>
</tr>
<tr>
<td>7</td>
<td>Distribution of pupils within the CSA categories</td>
<td>119</td>
</tr>
<tr>
<td>8</td>
<td>The relationship between the VI Speed Index and SEN category</td>
<td>127</td>
</tr>
<tr>
<td>9</td>
<td>The relationship between the WA speed index and SEN category</td>
<td>127</td>
</tr>
<tr>
<td>10</td>
<td>The relationship between SEN category and the mean percentage of correct VI items</td>
<td>132</td>
</tr>
<tr>
<td>11</td>
<td>The relationship between SEN category and the mean percentage of correct WA items</td>
<td>133</td>
</tr>
<tr>
<td>12</td>
<td>The relationship between gender and KS2 English levels achieved</td>
<td>140</td>
</tr>
<tr>
<td>13</td>
<td>The relationship between gender and KS2 Maths levels achieved</td>
<td>141</td>
</tr>
<tr>
<td>14</td>
<td>The relationship between gender and KS2 Science levels achieved</td>
<td>141</td>
</tr>
<tr>
<td>15</td>
<td>The relationship between KS2 English level achieved and school attended</td>
<td>143</td>
</tr>
<tr>
<td>16</td>
<td>The relationship between KS2 Maths level achieved and school attended</td>
<td>143</td>
</tr>
<tr>
<td>17</td>
<td>The relationship between KS2 Science level achieved and school attended</td>
<td>144</td>
</tr>
<tr>
<td>18</td>
<td>The relationship between teachers' WA ratings and the mean KS2 English level achieved</td>
<td>148</td>
</tr>
<tr>
<td>19</td>
<td>The relationship between teachers' WA ratings and the mean KS2 Maths level achieved</td>
<td>149</td>
</tr>
<tr>
<td>20</td>
<td>The relationship between teachers' WA ratings and the mean KS2 Science level achieved</td>
<td>149</td>
</tr>
</tbody>
</table>
Figure 21: The relationship between VI rating and KS2 levels in English -- 151
Figure 22: The relationship between VI rating and KS2 levels in Science -- 151
Figure 23: The relationship between WA rating and mean KS2 English mark -- 157
Figure 24: The relationship between WA rating and mean KS2 Maths mark -- 158
Figure 25: The relationship between WA rating and mean KS2 Science mark -- 158
Figure 26: The relationship between VI rating and mean KS2 English mark -- 160
Figure 27: The relationship between VI rating and mean KS2 Maths mark -- 161
Figure 28: The relationship between VI rating and mean KS2 Science mark -- 161
Figure 29: A model of the relationship between cognitive style in relation to teachers' perceptions of pupils' ability, tested intelligence and teachers' perceptions of cognitive style -- 184
LIST OF TABLES

TABLE 1: THE PERCENTAGE OF SUBJECTS FROM EACH OF THE PARTICIPATING SCHOOLS WHO SPOKE
ENGLISH AS AN ADDITIONAL LANGUAGE ............................................................................................................. 110

TABLE 2: THE RELATIONSHIP BETWEEN VR DATA AND TEACHERS’ RANKINGS OF PUPILS’
INTELLIGENCE ........................................................................................................................................................ 116

TABLE 3: TESTS FOR NORMALITY WITHIN RATIO SCORES ......................................................................................... 120

TABLE 4: MEAN RATIO SCORES ACHIEVED BY SUBJECTS IN EACH SCHOOL ON THE WHOLIST-ANALYTIC
(W-A) AND THE VERBAL-IMAGERY (V-I) DIMENSIONS .......................................................................................... 121

TABLE 5: TESTING FOR NORMALITY WITHIN SPEED INDICES .................................................................................. 125

TABLE 6: THE RELATIONSHIP BETWEEN THE WA AND VI SPEED INDICES AND TEACHERS’ RANKINGS OF
PUPILS IN LITERACY, NUMERACY AND SCIENCE (SPEARMAN’S RHO) ................................................................. 129

TABLE 7: TESTING FOR NORMALITY WITHIN ITEMS CORRECT ON CSA ........................................................................ 130

TABLE 8: MEAN PERCENTAGE OF CORRECT ITEMS ACHIEVED BY SUBJECTS IN EACH SCHOOL ON THE
WHOLIST-ANALYTIC (W-A) AND THE VERBAL-IMAGERY (V-I) SCALES ................................................................ 131

TABLE 9: MEAN WA AND VI RATINGS BY TEACHERS ................................................................................................ 137

TABLE 10: THE RELATIONSHIPS BETWEEN THE LEVELS ACHIEVED IN KS2 TESTS AND THE SPEED
INDICES OF THE CSA (SPEARMAN’S RHO) .............................................................................................................. 146

TABLE 11: THE RELATIONSHIPS BETWEEN TEACHERS’ RANKINGS OF PUPIL INTELLIGENCE AND LEVELS
ACHIEVED IN KS2 TESTS (SPEARMAN’S RHO) ........................................................................................................ 147

TABLE 12: RESULTS OF THE TESTS FOR NORMALITY WITHIN KS2 SATS MARKS ......................................................... 152

TABLE 13: THE CORRELATION BETWEEN KS2 TEST MARKS AND TEACHER’S RATINGS ON THE WA
CONTINUUM ............................................................................................................................................................. 156

TABLE 14: THE CORRELATION BETWEEN KS2 TEST MARKS AND TEACHERS’ RATINGS ON THE VI
CONTINUUM ............................................................................................................................................................. 159

TABLE 15: THE OBSERVED PATTERN BETWEEN SEN AND % OF CORRECTLY ANSWERED ITEMS ON THE
CSA .............................................................................................................................................................................. 178
Chapter 1: Literature Review

1.0 BACKGROUND
1.1 HYPOTHESES
1.2 CONTEXT
1.3 CORE DIMENSION A: TEACHERS’ PERCEPTIONS
1.4 CORE DIMENSION B: INTELLIGENCE
1.5 CORE DIMENSION C: COGNITIVE STYLE
1.6 INTERACTION EFFECTS BETWEEN THE CORE DIMENSIONS
1.7 A MODEL OF INTERACTION
1.8 HYPOTHESES
1.9 RESEARCH OPPORTUNITIES
1.10 SUMMARY
1.0 Background

The purpose of this study was to explore the relationship between pupils' cognitive styles and teachers' perceptions of intelligence within the classroom. The overarching research question introduced the possibility that teachers' perceptions of pupils' levels of intelligence are influenced by the ways in which pupils assimilate and process information according to their cognitive style. It was subsequently suggested that teachers view pupils who learn in a verbal manner to be more intelligent than pupils who learn in a visual manner and that if this was found to be the case, teachers' perceptions of pupils' cognitive styles could have important implications for pupils' learning outcomes.

In considering these research questions, evidence was drawn from the literature to consider three key concepts relating to this area: teacher perceptions, the nature of intelligence and the construct of cognitive style. These concepts were identified as being the three core dimensions for the study and have consequently been considered in some detail throughout the following chapter. Potential interaction effects between the dimensions were identified from the literature and three specific hypotheses were then developed. A model was subsequently proposed to suggest how these relationships might affect pupils' learning outcomes and this provided a rationale for the study.

The specific research questions and hypotheses were explored through the research process and the extent to which they have been addressed is evaluated at the end of the study. This research project appears to be unique
within the field of educational psychology and many opportunities for further research are subsequently proposed.

1.1 Research questions

The specific research questions were defined as follows:

- Are teachers' perceptions of pupils' intelligence influenced by pupils' cognitive styles?
- Do teachers perceive pupils who learn in a verbal manner to be more intelligent than those individuals who learn in a visual manner?
- Is there a relationship between teachers' perceptions of pupils' intelligence and pupils' learning outcomes?

1.2 Context

Within the Local Education Authority (LEA) in which the study was conducted, cognitive style is recorded within the Special Educational Needs handbook for schools as being a significant contributing factor to establishing an effective learning environment. This guidance suggests that a learning environment offering a teaching style that is not matched to the cognitive style of the pupil is a barrier to learning that should be removed to help promote educational inclusion. This premise is also supported within the literature, for example Riding (2002) summarised a number of studies in which students were offered choices in the way that learning materials were presented. This review of the research indicated that individuals tend to display a preference for those activities that sit most comfortably with their particular cognitive style and that
those activities also result in the most favourable learning outcomes (Riding and Watts, 1997). This has been found to be particularly significant for pupils who have learning difficulties who appear to find it more difficult to develop coping strategies when confronted with materials that do not match their preferred cognitive styles (Riding, 2002).

In considering this perspective, there is an assumption that teachers play an important role in identifying pupils' cognitive styles and in differentiating the curriculum accordingly to meet individual differences within the classroom. Little evidence has been found within the literature to indicate that teachers are able to accurately identify pupils' cognitive styles purely through observation and teaching and consequently it could be suggested that the barriers to learning remain. There is a clear need for teachers to be able to assess and identify individual cognitive styles within their classrooms and the particular objective of this study was to explore whether this activity is currently occurring. In order to explore this issue, teachers' descriptions of pupils' cognitive styles were compared with an independent measure of cognitive style, namely the Cognitive Styles Analysis (Riding, 1991a) to establish whether there was a correlation between the two factors. Riding (2002) reported that pupils can find it helpful to be aware of their own cognitive style within a context of understanding the implications of this information. It is furthermore suggested that teachers should be trained in techniques to identify the cognitive styles of pupils.

The significance of understanding the effects of interpersonal perceptions within the classroom provoked numerous studies between the 1960s, 1970s and early
1980s, but this area has enjoyed less attention within the past two decades. It is likely that this is partly the result of conceptual and methodological difficulties in applying the principles of social psychology to an educational context although it is also true that the zeitgeist has altered to reflect more interest in how cognitive models influence educational theory. In contrast, the study of individual ability and intelligence appears to have been of longstanding interest to humankind and continues to be an aspect of psychological and educational research that engenders much speculation and investigation.

This study attempts a synthesis between aspects of cognitive psychology and social psychology within an educational context. The purpose of this amalgamation of approaches is to explore the overarching research questions that consider whether a relationship exists between teachers' perceptions of pupils' intelligence, pupils' cognitive styles and pupils' learning outcomes.

This area of research is one that appears to have previously been neglected within the literature and consequently there are many opportunities for further research in this field that are suggested by this study.

1.3 Core dimension A: Teachers' perceptions

In 1968, the classic Rosenthal and Jacobson study, ‘Pygmalion in the Classroom’ asserted that teachers' perceptions of pupils' ability could affect pupils' attainments achieved within the classroom. This research significantly contributed to psychological knowledge in creating interest into teacher expectancy effects, and as a result of the study the description of “The
Rosenthal Effect" became used synonymously with self-fulfilling prophecy models in psychology.

In spite of the interest that 'Pygmalion' caused, the study also received considerable criticism on both methodological and statistical grounds. Nash (1976) challenged the assumptions upon which the work was based, in particular he questioned whether teachers' expectations of pupils' academic performance could be implicitly communicated to the children within their classes and that the pupils would subsequently respond to these tacit processes. An extensive critique of the methodology for the study is described by Snow (1969). He suggested that the use of IQ tests, that had been administered by teachers within the research, created opportunities for bias during the data collection process. Snow (op cit) also reported that the Test of General Ability (TOGA) that was used within 'Pygmalion' was an inappropriate measure of pupil ability for the study because its standardisation was comparatively limited. It should be stated however that the TOGA was only one of two independent measures of pupil ability used within the original study, the second being the Harvard Test of Inflected Acquisition that was standardised more widely. This aspect of the research was not reported by Snow, who also omitted to state that during the research process the TOGA and Harvard test were scored twice by research assistants who were naïve to the groupings of the children, thus reducing bias at this stage of the procedure. Criticisms of the methodology that appear to be more valid are reported by Pidgeon (1970), who suggested there to be fundamental difficulties in researching teacher expectancy effects in schools due to the constraints of
class sizes, which largely determine the number of subjects within each experimental group.

Following 'Pygmalion', research from the 1960s and 1970s suggested that teachers form their judgements about individual pupils as a result of a wide range of factors and that the teacher's own constructed reality affects the manner in which they behave and the attitudes that they hold in relation to their pupils. The 'Pygmalion' study initiated considerable interest in this area and despite the criticisms of this work many researchers remained in support of the findings. Insel and Jacobson (1975) reported over 80 studies in which they described consistent evidence to support the notion that teacher expectancy effects influence outcomes within the classroom. This work should be treated with some caution however because Lenore Jacobson was responsible for evaluating studies that could potentially pose a challenge to her original work. This perspective might have influenced the level of objectivity that she was able to provide in her considerations of the original research. Other authors such as Rogers (1982) have nonetheless also reported that a clear relationship exists between teacher perceptions and classroom interactions and thus supported the theory that teacher expectations can influence learning outcomes.

Closely linked to the work on teacher expectancy effects is that of Attribution Theory which also encompasses aspects of research into motivation, the psychology of individual differences and personality. Weiner (1986, 1992) is considered to be the father of Attribution Theory and at the heart of his work is
the philosophy that psychological research should seek to understand why humans act in a particular way rather than merely observing how individuals behave. Much of the literature relating to this area dates from the 1960s and 1970s, with early work into Attribution Theory primarily considering the basis upon which individuals make inferences about others. Within Attribution Theory, person perception is viewed as an active process in which information is interpreted in order to make sense of the world (Schneider et al., 1979). Information available to the perceiver is used to make inferences in relation to the behaviour and personality of other people and this in turn affects the manner in which the perceiver responds and reacts to the stimuli. It is suggested within Attribution Theory that individuals make judgements as self-protection mechanisms for maintaining a positive self-esteem. This assertion can be translated into an educational context by considering the effect upon a teacher of working with a child who has been labelled as having special educational needs. Teachers might attribute any difficulties in meeting the child’s needs as a result of a medical or educational label rather than due to their own skill level or experience (Rogers, 1982). This possibility is particularly pertinent when considering how labels relating to medically or educationally diagnosed disorders might influence teachers’ attributions and perceptions of their ability to control particular variables within the classroom.

A recent overview of Attribution research is reported by Larsen and Buss (2002) who consider the contributions made by researchers from different fields within psychology and evaluate how each has added to understanding in the area of individual differences. Contemporary research findings in this area
are limited and therefore Attribution Theory is an aspect of psychological research that would benefit from further exploration using current knowledge and research methodologies.

Related to the area of Attribution Theory is that of Implicit Personality Theory. This theory attempts to explain why an individual might make rapid judgements about another person's behaviours and intentions through unrelated factors such as gender or physical attractiveness. Asch (1946) initially considered why individuals might perceive there to be relationships between certain traits to form the basis of the theory. Wishner (1960) then reviewed this work and concluded that individuals do perceive certain traits to be closely linked together because this fulfils a need in individuals to be able to predict the behaviours of others. Contemporaneous to the time when Implicit Personality Theory was gaining momentum, theories of cognitive style were also being developed, although research did not focus upon how individual cognitive style labels might link to other traits. Evidence in this area has remained incomplete and therefore this continues to be an area of psychological research that would benefit from further attention.

Within this reported study, the deficit of knowledge within psychological theory is explored in terms of considering whether teachers make cognitive connections between the construct of intelligence to particular aspects of cognitive style and whether such links might affect learning outcomes. This area of research is suggestive of Implicit Personality Theory but the reported study considers the relationship between the three core dimensions within a broader context.
1.3.1 Pupils' perceptions

There is some evidence to suggest that pupils' perceptions of their own levels of intelligence are not based purely upon academic achievements, but that teachers' perceptions of the individual are also highly influential in how the individual perceives him or herself as a learner (Nash, 1976). These findings have been replicated in cross-cultural studies, and furthermore it had been indicated that children's self perceptions have correlated positively with their performance in literacy tasks, although not in numeracy tasks (Roazzi and Nunes, 2000). The small sample sizes involved within these studies however mean that this is an area that should be considered for additional research before further conclusions can be drawn.

There has been some renewed interest in the effects of pupil perceptions and the effects on classroom performance in recent years. Burnett (1999) considered the relationship between children's self-talk and academic self-concept based on a model by Blote (1995). Blote appealed for further research to be conducted into this area, particularly in terms of considering mediating variables between teacher expectancy effects and pupils' self concept. The challenges associated with bringing social psychological principles into an educational context cannot be underestimated, particularly in terms of the methodologies employed within the classroom (Rogers, 1982).

Riding and Staley (1998) considered the area of pupil perceptions of ability in different curricula subjects, and concluded that students tend to underestimate their performance in subjects that do not match their personal cognitive style.
This proposal may be important when considering the implications for learning and examination outcomes. Riding and Staley (op. cit.) also emphasise that this is only part of the picture of how successful learning outcomes are achieved, and that other factors such as motivation and interest in a particular topic will also be significant in how well the pupil performs in a subject area.

1.4 Core dimension B: Intelligence

Intelligence is a historically and culturally defined concept and attempts to encapsulate the nature and essence of intelligence have interested philosophers and scientists throughout history. The first attempt was recorded in the 3rd century BC when Plato defined intelligence as the, "...soul's entrapment of ideas" (Ceci, 1996. p6) whilst within more contemporary Western society, attempts to identify and measure the nature of intelligence have remained in the forefront of educational research for the past century. The development of an understanding of the construct of intelligence is complex and subject to much controversy. Debates relating to the differing perspectives and models of intelligence are reviewed widely within the literature, for example both Mackintosh (1998) and Slavin (2003) provide comprehensive historical overviews of the research, including current perspectives in this area. This task is consequently not repeated within this chapter; rather the aspects of the subject of intelligence that are relevant to this study are explored.

Current understanding of intelligence is based upon a synthesis of the available theories: psychometrics, developmental perspectives and multiple forms of intelligence (Teele, 2000). Debate continues in relation to the hereditary nature
of intelligence compared to environmental factors, and how individual differences such as ethnicity and gender contribute to our knowledge in this area whilst a psychobiological view is provided by Ceci (1996) through an anthropological and ethnographic perspective. Attempts to provide a definitive description of intelligence however have elicited, "...more definitions than experts" (Sternberg and Detterman, 1986, p10). For the purposes of this study, intelligence is defined as being the behaviours and outcomes relating to pupil attainment within the classroom that result from both innate abilities and acquired skills.

One area of specific interest in relation to this study is the factors by which teachers make their judgements and attributions about pupil intelligence. It has been suggested that schools generally recognise a limited number of performances as being related to the intelligence of pupils (Slavin, 2003), and that teachers form opinions about pupils through social, physical, environmental and personality factors. The relationship between cognitive style and teachers’ perceptions of pupil intelligence is an area that has been neglected within the literature to date and is the main consideration of this study. This research project therefore attempts to play a significant contribution to the development of psychological theory by increasing understanding in this area.

1.5 Core dimension C: Cognitive style

Cognitive style is generally identified as being an innate and individual characteristic that affects learning behaviour (Riding, 2002). More specifically it can be described as, "...an individual's preferred and habitual approach to
organising and representing information" (Riding and Rayner, 1998). Richard Riding has dominated much of the recent work in this area and therefore it is important to consider the possibility of experimenter bias within his abundant research. Although he has been prolific in the number of studies that he has completed both as an individual and in conjunction with others, much of his research has been completed on a comparatively small scale. Out of 21 studies reported by Riding in a single research article, the mean number of subjects participating in the research was 122, with a range from 15 to 340. This would suggest that some of his findings should be treated with caution, particularly where small samples have been involved in the research process. Riding's work does form the basis of much of the understanding in this area however and subsequently this study draws heavily upon his theoretical perspective.

Riding and Rayner (1998) argue that cognitive style is an independent psychological construct with a physiological basis, and in this sense can be compared to intelligence. Cognitive style is generally viewed within the research as being a stable aspect of an individual's make up (Riding, 1997) that is likely to be present from birth (Riding and Rayner, 1998) and it is therefore differentiated from acquired characteristics such as learning strategies and learned knowledge. Riding and Rayner (op. cit.) propose that an individual's cognitive style affects many aspects of their functioning including their behaviours. No research evidence has been found to suggest that an individual's attributions might be affected by their cognitive style and therefore this might be considered an area for further study.
1.5.1 Historical context

Research into cognitive style emerged from four main fields of psychology: perception, cognitive processes, mental imagery and personality; although recent work in this area has focused upon individual differences within the field of cognitive psychology. Research has produced a myriad of information that has been difficult to refine on two basic levels; the definition of cognitive style, and the measurement of cognitive style Riding (1997). Sternberg and Zhang (2001) provide a detailed history and overview of the development of research relating to cognitive style from the 1940s. A description of many of the style labels that were elicited during this period are included within the information as well as a critique of the assessment tools and empirical evidence base relating to the nature of cognitive style. It is acknowledged that individual researchers over this time period developed their own descriptions and interpretations of the cognitive style constructs and that this led to some confusion in how to encapsulate the essence of cognitive style in a representative, yet accessible way. Amongst this climate of confusion, researchers sought ways in which the numerous style labels could be conceptualised to provide a more unified approach to defining cognitive style (Curry, 1983). A model of cognitive style was subsequently proposed by Riding and Cheema (1991) who reviewed over thirty style labels and considered the commonalities between them. They suggested that many of the elicited constructs shared core features and could consequently be simplified by being defined within a common dimension. Through analysis of the style labels Riding and Cheema (op cit) developed a model based upon a bipolar categorisation of cognitive style involving two
independent dimensions, namely the 'Wholist-Analytic' dimension and the
'Verbal-Imagery' dimension (see Figure 1).

Figure 1: The dimensions of cognitive style (from Riding and Cheema 1991)

Riding and Cheema (op. cit.) described the 'Wholist-Analytic' dimension as a
method of representing cognitive organisation. Individuals who are assessed to
be Wholists tend to process information as a whole rather than break it into
component parts, whilst Analytics consider information as a collection of smaller
items without always considering the wider context. Individuals placed in the
middle of the Wholist-Analytic scale are described within this model as
Intermediates and do not display a strong preference for learning in a Wholist or
an Analytic manner. Within the Riding and Cheema model the 'Verbal-Imagery'
dimension reflects mental representation, with Verbalisers preferring to learn
through words and Imagers through visual associations. For those individuals who are placed within the middle of the Verbal-Imagery scale and therefore do not learn in a strongly verbal or visual manner, the term 'Bimodal' is used. These descriptions are discussed in more detail in Riding et al. (2003).

Evidence suggests that the two dimensions within the Riding and Cheema (1991) model are continua that are independent of each other and investigations to consider correlations between the two factors have been reported as not being significant (Riding and Douglas, 1993; Riding and Wigley, 1997). The establishment of independence between the two dimensions is significant in ensuring that the continua are measuring different elements of cognitive style.

Although Riding and Cheema (op. cit.) addressed a clear need for streamlining and condensing the many style labels that had been elicited by different researchers, it is possible that in doing so their results might be considered as being rather too simplistic. Some of the factors that were used to combine different style labels, as described within their paper, appear to make rather tenuous links between different aspects of cognitive style proposed within the research and in doing so attempt to fit 'square pegs into round holes'. One example of this is where the 'convergent-divergent thinking' label, elicited by Guilford (1967), is explored by Riding and Cheema and is reported as belonging within the bounds of the wholist-analytic dimension. This is despite there being, "no hard evidence to connect the convergent-divergent thinking style to otherstyles" (Riding and Cheema, 1991. pp 201) and therefore this would
potentially appear to be an inappropriate categorisation of that particular style label.

In attempting to combine style labels into a unified whole, Riding and Cheema also neglected aspects of previous research paradigms that did not fit easily within their model. This included activity centred aspects of learning and kinaesthetic approaches to tasks. This omission was justified within their paper as being due to conceptual differences between the factors with activity centred approaches being considered as being related more to an individual’s learning style than their cognitive style; the distinction between these two factors will be considered later in this chapter. In ignoring the areas of research that did not appear to support their own model of cognitive style the work of Riding and Cheema (op. cit.) could have been subject to bias and error. These issues of validity require careful consideration and this did not appear to have been addressed within Riding’s subsequent work.

Another aspect of the Riding and Cheema (1991) model that requires further scrutiny is the fact that it is a passive approach in which interaction within the environment appears to have little impact upon how an individual approaches a task. It is anticipated that a person will approach a task consistently due to their cognitive style however this is in contrast to the findings reported by a number of research studies in which the individual’s response to extraneous factors plays a vital role in the learning context (Dunn et al. 1985). Factors that are seen to influence learning include emotional, physical and social aspects of the environment and the perception of the learning environment is considered a
complex, active process rather than the rather simplistic proposition of Riding and Cheema’s model.

Within the context of the study reported within this thesis, the relationship between the environment and cognitive style is a central consideration of the research. In this study it is the socio-psychological aspects of learning that are under scrutiny and in particular the perceptions of pupils by their teachers. This work therefore addresses a caveat in the research by considering a richer picture of cognitive style than has been previously explored. Within this study, the Riding and Cheema model of cognitive style is used as a basis for the research although this is conceptualised through considering how perceptions within the learning environment affect learning outcomes.

Another important aspect for consideration within this study was the premise that cognitive style is an independent construct in its own right. In examining this hypothesis, research has sought to define the nature and measurement of cognitive style and the relationship between this concept and factors such as intelligence and gender. To date, links to other areas of psychology have largely been ignored but by considering how work on cognitive style might link to other fields of psychology, a broader understanding of the construct might be developed. Furthermore, by considering more specific questions, such as how teachers’ perceptions and attributions relate to pupils’ cognitive styles, a vacuum within the research can be addressed. This study attempts to consider this question within the context of research in this area and consequently the construct of cognitive style will be explored in some detail.
1.5.2 Cognitive style as an independent construct

1.5.2.1 Cognitive style and gender

Although research has suggested that there are no differences in cognitive style that relate to gender (Riding et al., 1995; Riding, 1997), subsequent work has proposed that gender may interact with the verbal-imagery dimension, although not the wholist-analytic dimension (Riding and Rayner, 1998). Titus et al. (1990) considered evidence relating to gender differences and cognitive style and felt that no clear conclusions could be drawn as to whether these factors were related. Riding and Staley (1998) describe the complexity of biological and cultural factors that can make research into this area rather difficult.

Riding and Al-Sanabani (1998) considered the relationship between the wholist-analytic dimension of Riding and Cheema's 1991 model in relation to gender. In this work, results indicated that placing subheadings within a piece of text was helpful to wholists and male analytics. Female analytics gained less benefit from the imposed structure, suggesting that when the dimensions are looked at individually, some gender differences may be present. Gender differences have been noted in information processing tasks through EEG patterns (Riding et al., 1987), and through speed and depth of processing (Riding and Vincent, 1980; Riding and Smith, 1981; Riding and Egelstaff, 1983).

1.5.2.2 Cognitive style and pupil age

In their 1998 book, Riding and Rayner stated that they believed cognitive style to be present at birth or infancy although it was acknowledged that the question of whether cognitive style is actually part of an individual's physical makeup is
rather difficult to determine. They proposed that there is no significant
correlation between cognitive style and age and supported this with
observational evidence of infants, who they suggested display consistent
behavioural patterns from 12 months of age in relation to preferred modes of
approaching tasks.

A view that seems to challenge this proposal comes from Pressman and Dublin
(1995) who suggest that different styles need to be emphasised at different
developmental stages due to the maturation of the brain and neural system.
This indicates a fundamental difference in the way that approaches to educating
pupils are viewed; for example whether common developmental characteristics
of a group dictate the teaching and learning strategies that are seen within the
classroom, or whether individual differences influence the curriculum and layout
of the learning environment. One reason for this difference in perspective may
be the definition of ‘learning style’ and ‘cognitive style’, which has been used by
different researchers in different ways, an issue that will be explored further
within this chapter.

A question that is central to this study is whether cognitive style is a separate
construct to intelligence. As these factors are both considered core dimensions
within this study, research in this area is considered within section 1.6 in which
interaction effects between the core areas is explored. In summary however, the
literature suggests cognitive style to be an independent construct although it is
clear that more research needs to be conducted within this area.
1.5.3 Learning style

Within the melee of style labels that were elicited during early research into the construct of cognitive style, the terms *learning style* and *cognitive style* were often used synonymously (Entwhistle, 1981). This distinction between the labels continues to be blurred (Cameron and Reynolds, 1999), but Riding and Rayner (1998) differentiate between the concepts of cognitive style and learning style and provide a detailed critique of learning style models. They suggest that whilst cognitive style is considered to be a fixed, stable and innate variable, learning style is viewed as being changeable over time, process-based and dependent upon the nature of the learning context.

Curry (1983) considered a broader relationship between cognitive style and factors within the learning environment in the Onion Model. This can be conceptualised as a three-dimensional sphere with layers surrounding the core. At the core of the model is the individual’s cognitive personality style. The middle layer is the individual’s information processing style and finally, the outside layer involves the individual’s instructional preference. This model is useful in considering the interaction between cognitive style and other cognitive factors, although environmental and personality factors related to learning are not included within this model which might be viewed as an inherent challenge to its validity.

1.5.4 Learning strategy

Riding (2002) describes learning strategies as being coping strategies that are employed by an individual to meet the demands of a task that is not presented
in their preferred cognitive style. There is some support for this proposal, for example Dowker (1992a) described how children with uneven patterns of skills learn to seek and adapt alternative strategies when standard procedures do not work for them. Differentiation between cognitive style, learning style and learning strategy provides a huge challenge in terms of conceptualisation, definition and measurement. Relevant to this study is the question of whether teachers are able to identify pupils' cognitive styles through their daily interactions or whether these assessments are skewed by behaviours relating to learning style or learning strategy. Moreover, it is the purpose of this study to question how pupils' cognitive styles affect teachers' perceptions of pupils' intelligence.

1.5.5 Implications for teaching and assessment

Appreciating that pupils have different cognitive styles can provide alternative interpretations of classroom performance and can help teachers with appropriate differentiation of the curriculum. Research indicates that by responding to cognitive style, teachers are able to promote successful classroom experiences for young people. Dunn et al. (1995) conducted a metaanalysis of thirty six studies and concluded that when individuals who had been identified as being a “failing student” were taught using methods that embraced their learning style, the students attained significantly higher grades that when taught conventionally. As previously stated, teachers display a preference for teaching in a manner that reflects their own cognitive style and pupils placed within classes where their cognitive style differs from that of their teacher may consistently be viewed as performing poorly in particular lessons.
Banner and Rayner (1997) stated that emotional and behavioural difficulties are likely to be observed in pupils who are frustrated due to being exposed to teaching methods and the presentation of materials that are contrary to their cognitive style. This might also be related to the indication that pupils' achievements are higher where the learning environment is matched to the pupils' cognitive style thereby reducing the possibilities of poor motivation and low self-esteem. It should also be stated that many variables affect pupils' emotional responses to learning and the learning outcomes of individual subjects, including their peer group, environmental factors and chosen methods of assessment. For this reason the findings reported within the study should be interpreted with some caution.

Riding et al. (2003) made suggestions for curriculum adaptations and learning strategies to improve individual's abilities within the classroom in relation to memory, gender, and cognitive style. These strategies have not been measured to establish whether they make a significant impact on pupil performance within the classroom and it is suggested that the obtaining of this information would be vital before the reported techniques are highlighted as examples of good practice. Riding and Rayner (1998) considered data from four previous studies of pupils in the 11 to 14 year old age ranges in which some of the data was reworked to ensure that the same criteria were used throughout. Pupils were placed in four groups according to their cognitive style analysis, using the wholist-analytic/verbal-imager dimensions from the Riding and Cheema (1991) model. In mathematics, the wholist-verbalisers consistently achieved the lowest scores across the four studies. This pattern of achievement has also been
observed in a study of Kuwaiti students by Ahmad Al-Loughani (1997), cited in Riding and Rayner (1998). Within an older age group the pattern is not consistent. At the age of 16, the wholist-verbalisers outperformed all the other groups in their mathematics GCSE, whilst the wholist-imagers achieved the lowest results. It is clear that more research needs to be conducted in this area but the results are intriguing. If supported by further evidence, this information would suggest that the GCSE materials used within secondary schools are not favourable to certain groups of students, depending on their cognitive style. If this is the case there are important implications for current curriculum teaching and assessment methods within Key Stages 3 and 4. It could subsequently be suggested that students of differing cognitive styles should be offered alternative assessment choices in order to display their skills most effectively, for example through multiple choice questions, assignments, continual assessment, examinations. It could even be recommended that a choice of teaching methods is employed for particular groups of students depending on their cognitive style assessment. Riding and Sadler-Smith (1992) looked at teaching strategies and proposed that a combination of a highly verbal delivery and abstract diagrams was the least effective method in terms of pupil outcomes for each cognitive style. This is interesting as it appears to reflect the common mode of instruction within UK secondary school classrooms. Typically, students also work from the same scheme or materials that are not differentiated in terms of delivery towards multisensory or multimedia approaches.
There is a body of research that counteracts this opinion that is reported by Gagne and Briggs (1974) and Rowntree (1982). They state that individuals learn equally well from the same basic materials, although this is strongly resisted by Riding and Ashmore (1980), Riding et al. (1989) and Riding and Buckle (1990) who report that imagers learn best from pictorial representation and verbalisers from text. Riding and Sadler-Smith (1992) stated that the structure of the presented materials also significantly influences learning and concluded that where there is a mismatch between the cognitive style of the individual and the learning experience, performance will be diminished.

1.5.6 Teachers’ assessments of pupils’ cognitive styles

Riding and Rayner (1998) suggested that when an individual is placed within a learning situation, their preferred mode of interpreting and assimilating the knowledge available is dependent upon cognitive style. Individuals are required to make adaptations however where the presented information is not provided in a manner that most suits an individual’s cognitive style. As stated previously, these adaptations are described by Riding and Rayner as ‘learning strategies’, and their theory is extended by the proposal that the combination of cognitive style and learning strategies might be conceptualised as an individual’s ‘Personal Learning Style’. This hypothesis is speculative and difficult to quantify; it should consequently be viewed with some caution. Riding and Rayner (op. cit.) provide no indication about how an individual’s Personal Learning Style could be identified or measured and also how this information could be used within educational settings.
When considering how teachers might differentiate the classroom and learning environment to accommodate a range of cognitive styles, it should be questioned whether they are able to identify pupils' cognitive styles. As stated previously, research suggests that it is likely that teachers provide learning situations that are linked to their personal cognitive style and this would therefore suggest that pupils who do not share this style would experience a certain degree of cognitive dissonance. Pupils in this situation, using Riding and Rayner's theory of Personal Learning Style, would be required to develop a range of learning strategies in order to access classroom materials. It might be suggested therefore, that the observable behaviours within the classroom relate to a pupil's Personal Learning Style, rather than to their cognitive style. Furthermore, it is questioned whether teachers are able to identify pupils' cognitive styles through their daily interactions where the complex relationship between cognitive styles and learning strategies make it difficult to establish the extent to which the teacher is observing a coping strategy or a true facet of cognitive style. One of the questions that this study aims to address is whether teachers are able to identify the cognitive styles of pupils within their classes, or whether they are identifying other underlying factors that might influence their assessments of pupils' cognitive styles, such as intelligence or speed of processing.

1.5.7 Measuring cognitive style

Riding (1997) and Riding and Rayner (1998) reviewed and critiqued a range of assessments that purported to identify aspects of cognitive style and proposed their own assessment tool, the Cognitive Styles Analysis (Riding, 1991a). Prior
to the Cognitive Styles Analysis (hereafter described as the CSA) being
developed, aspects of cognitive style were measured through self-reporting,
questionnaires and tests of style, however these were criticised for only
assessing aspects of cognitive style rather than gaining a comprehensive
picture of the construct (Riding 1997). The use of self-reporting and
questionnaire techniques to assess cognitive style could also be criticised on
methodological grounds as these tools can be intrusive and difficult to validate
(Cohen et al, 2000). Another important aspect of questionnaire and self-report
design is the establishment of the reliability and validity of the methods, which
can be achieved through rigorous piloting although this also takes a
considerable time (Robson, 2002).

Riding and Cheema (1991) describe in detail the background to the
development of the CSA, which is a computer presented assessment package
that aims to provide a quantitative measure of an individual's cognitive style.
This software comprises three subtests that were developed to examine a
respondent's performance in terms of their skills on both the verbal/imagery
items and wholist/analytic items, as defined within the Riding and Cheema
(1991) model of cognitive style. The material presented within the CSA involves
a number of written statements requiring a 'true or false' response as well as
geometric figures upon which particular judgements and comparisons have to
be formed. Within the paper however, a number of assumptions are made that
might provoke a challenge to the rationale behind and the validity of the CSA.
Firstly, it is reported that the program assumes that individuals who learn in a visual manner, defined as imagers, respond more rapidly to statements involving the appearance of an object or concept whilst verbalisers respond more quickly to statements involving oral categorisation. This has not been explored widely within the literature and Riding and Cheema (op cit) state within their paper that this aspect of the CSA is based upon assumption rather than empirical evidence. A second assumption upon which the CSA was developed involves the latter two subtests that consider a respondent's skills in considering geometric figures. Riding and Cheema state that where individuals are asked to make judgements about whether two geometric shapes are the same or different, certain assumptions can be made about the performance of individuals according to their cognitive styles. It is suggested that those people who are categorised as wholists will be more successful at this particular task than those who are described as analytic learners because the task requires a judgement to be made about a whole picture rather than component parts. Conversely, where an individual is asked to judge whether an individual shape is contained within a larger geometric design, Riding and Cheema suggest that individuals classed as analytics would probably be more successful than wholists because their cognitive style means that they habitually break down information in order to facilitate their learning. Studies using the CSA software should account for this aspect of the tool's validity when interpreting the results of the study, a factor that does not appear to have been explored within the many studies conducted by Riding either individually or in conjunction with others. As the CSA is used within the majority of these reported studies it would appear to be fundamental to examine whether individuals' cognitive styles do
actually reflect their performance in these specific tasks in the manner described. Some discrepancies have also been identified within Riding's 1997 paper in which he detailed the content of the CSA. One example is that although the CSA is described as being, "...probably culture free" (pp 32), Riding (op. cit.) called for cross-cultural studies to be conducted using the CSA following the acknowledgement that most studies using the CSA had been conducted within the UK. It is important to note that more rigorous exploration of the CSA as an assessment tool is required, both in terms of the rationale upon which it is based and upon the contexts for which it is validated. The CSA does enjoy many benefits as an assessment tool however and these are evaluated within Chapters 2 and 3 of this research project.

1.6 Interaction effects between the core dimensions

1.6.1 Pupils' cognitive styles and teachers' perceptions of intelligence

There is little evidence available within the published literature to address the question of whether teachers' perceptions of pupils' academic intelligence are influenced by pupils' cognitive styles. Professor Nunes of Oxford Brookes University and Ursula Pretzlik from the Institute of Education convened a symposium proposal that considered this possibility in September 2000 and this was presented to the British Psychological Society's Developmental Section. The five studies submitted to the conference within this subject area suggested that teachers' perceive children with good verbal ability to be more intelligent than their peers. This was reported within the press under the provocative title, "Noisiest children are given the best marks at school" and continued, "...psychologists claim pupils who quietly sit and do sums are now considered
less bright than their mouthy counterparts” (Victoria Fletcher, *Sunday Express*. September 17th 2000. pp 30).

The Nunes and Pretzlik research provided some tentative hypotheses in relation to teachers’ perceptions of pupils’ learning behaviours and in particular concluded that teachers appear to base their views of pupil intelligence upon verbal ability, defined in terms of both oral and literacy skills. This finding would suggest that pupils who prefer to learn in a verbal manner might be perceived as being more academically able within the classroom than those individuals who learn in a visual way when using the verbal-imagery dimension of cognitive style from the Riding and Cheema (1991) model. Furthermore, research evidence to suggest that teachers’ views of intelligence are based primarily upon verbal ability has been replicated in cross-cultural studies in Greece, England, India and Brazil (Tsolaïdou and Pretzlik, 2000). This is an important finding and one that requires further investigation and research.

Nunes et al. (2000) reported from her research that a child’s reading score was a more significant predictor of the teacher’s judgement of intelligence than their IQ, following a study in which a traditional intelligence test was administered to a pupil and the results were shared with their class teacher. Concerns were expressed within this paper that teachers might be at risk of underestimating the intelligence of children with delayed reading development, but it could also be suggested that there are implications for pupils who display a discrepancy between the development of their verbal and non-verbal skills. These include children who have a developmental language delay or disorder, those who have
social communication difficulties and children who have a hearing impairment. Other pupils who might be affected by the findings of this research include selective mutes and young people who speak English as an additional language. This information has implications in terms of equal opportunities and in the promotion of successful inclusion within educational settings.

It could be argued that it is classroom performance in all curriculum subjects that affects teachers' perceptions of pupils' intelligence rather than merely performance in verbal skills. Nunes and Pretzlik (2000) considered this possibility within the research conducted for their symposium proposal and discovered some conflicting evidence on the subject. Their original research suggested that teachers' representations of pupil intelligence were more closely related to pupils' oral and reading ability than to their mathematical ability, and additional research conducted by Pitkanen and Nunes (2000) drew similar conclusions. In replicating the latter study, Nunes et al. (2000) reported that the subsequent research indicated that although teachers perceived intelligence to be strongly related to verbal ability, performance in mathematics also played a significant part in teachers' judgement of overall pupil intelligence. This research was conducted on a small scale however and therefore the need for more work within this area was emphasised. Within these studies the effect of mediating variables such as gender and age was not acknowledged, and this would consequently be an important aspect of research to consider within future work in this area.
The information reported by the Nunes and Pretzlik symposium contains significant implications for both educators and pupils. If verbal ability does play a significant part in teachers’ perceptions of pupil intelligence, pupils with a visual cognitive style that does not reflect the traditional views of intelligence within the classroom are likely to be disadvantaged. This hypothesis is particularly important when considered in conjunction with psychological models of teacher expectancy effects, and how these factors impact upon learning within the classroom. For teachers, the knowledge that their perceptions of pupils’ intelligence may be based upon a restricted body of information might encourage greater reflection and differentiation based upon cognitive style paradigms. This could subsequently impact upon their practice in terms of ensuring that lesson preparation, assessment and classroom management styles encompass a range of cognitive styles. Within educational psychology, the information raised by the Nunes and Pretzlik symposium is highly significant in terms of research, assessment and consultation with schools. There is some evidence to suggest that teachers’ perceptions of pupils’ cognitive styles are dependent on teachers’ own cognitive styles. Riding (1997) stated that it is ‘highly likely’ that lecturers and teachers reflect their own style in how they represent information and Riding and Rayner (1995) reported that verbalisers tend to use a high verbal content when delivering lessons whilst imagers prefer the use of pictures and diagrams. This has overt implications for recommending that teachers should operate as reflective practitioners and monitor their differentiation of classroom materials and resources to meet the needs of all pupils.
When considering how new skills are learned it has been suggested that the cognitive style of the individual plays a significant part in how successfully the information is processed. Banner and Rayner (1997) provided the example that individuals identified as being ‘imagers’ are likely to learn new topics more effectively where diagrams are used as part of the learning experience and this information would suggest that in situations where teachers have not used multisensory or multimedia approaches within the differentiation of their lesson a proportion of pupils may have been disadvantaged by the task presentation. The teacher may subsequently have perceived some pupils within the group as being less skilled at a particular task because their cognitive style did not lend itself to the manner in which the lesson was presented. Saracho (1988) considered it likely that a relationship exists between cognitive style and academic performance. This is important to consider in light of the assertion that intelligence does not correlate with cognitive style and supports the hypothesis that there may be interaction between these and other mediating variables, such as teacher expectancy effects.

1.6.2 Cognitive style and intelligence

The question of whether cognitive style and intelligence are independent constructs is of particular significance to this study, which examines whether teachers perceive a relationship between the two factors. The hypothesis that cognitive style and intelligence are separate constructs is attractive to educators on several different levels. The belief that individuals can be successful learners if taught in a manner that suits their cognitive style is seductive; it promotes positive feelings in relation to both teachers and pupils, and it is therefore
expected that this is a concept that individuals would want to believe in. Conversely, it defers responsibility from teachers who may rationalise that the classroom materials and schemes that are not differentiated by cognitive style are responsible for limited academic gains within the classroom, and for students who may wish to explain a perceived underachievement. The attractive nature of the independence of these concepts is a potential source of bias and therefore this should be taken into consideration when exploring this relationship through research.

If it is assumed that cognitive style and intelligence are separate constructs it is important to define how they differ conceptually from each other. Sternberg and Zhang (2001) describe cognitive style as being learning and processing preference and state that an individual can be successful or unsuccessful at accomplishing a task depending on the way that the learning experience is presented to them. A cognitive style paradigm therefore assumes that an individual will have a predisposition to responding to materials and instructions of a particular type and that it is the matching of these preferences to materials that will determine the effectiveness of the learning outcomes.

A number of studies have explicitly suggested that intelligence is independent of cognitive style, although as previously acknowledged, intelligence is a difficult construct to define and measure. Riding and Pearson (1994) reported that no correlation was found between the British Abilities Scales (BAS) Short Form and cognitive style, whilst Riding and Agrell (1997) found similar results in Canada. The definition of intelligence used in examining the relationship between this
construct and cognitive style is significant in considering the results of this research. By considering the links between cognitive style and the results of psychometric tests, only one aspect of intelligence is considered, that which is measured by the particular tests used within the studies. From within the literature, research has focused upon intelligence being viewed as a separate construct to cognitive style, where crystallised intelligence has been used within the definition. Crystallised intelligence is defined as, “the accumulation of knowledge and skills” (Sternberg, 2004) and the term was derived from an early hierarchical model of intelligence (Horn and Cattell, 1966). It is therefore suggested within this study, further research should consider the broader picture of the relationship between cognitive style and intelligence. Alternative definitions of intelligence, for example Gardner's eight multiple intelligences (Gardner and Hatch, 1989) appear to lend themselves more closely to the concept of cognitive style. Within his research, Gardner places his theory of multiple intelligences within an educational context with the suggestion that individuals would benefit from being taught in a manner that relies upon their own personal strengths and intelligences. Early work by Gardner considered the concept of cognitive style, an overview of which is contained in Goldstein and Blackman (1978). Two aspects of Gardner's theory appear to link particularly closely with work on cognitive styles; those of Linguistic Intelligence and Spatial Intelligence. These terms both relate to an individual having particular sensitivities to aspects of learning, with Linguistic Intelligence being defined by Gardner and Hatch (1989) as relating to aspects of words and language, and Spatial Intelligence being concerned with visual and spatial skills.
These two aspects of Gardner's definitions of intelligence appear to reflect one of the dimensions of Riding and Cheema's 1991 model of cognitive style, that of the verbal-imagery continuum. Riding and Rayner (2002) also provide a similar recommendation to Gardner, that individuals should be taught in a manner that best reflects their cognitive style to maximise their learning outcomes.

Riding (2002) suggests that aspects of cognitive style share close links with components of working memory and draws upon Baddeley's triadic theory of working memory to support this view (Baddeley, 1999, 2000). Recent evidence (Riding et al., 2003) suggests that the performances of individuals who are assessed as being either an 'Analytic' or a 'Verbaliser' are significantly affected by the capacity of their working memory, whilst this relationship is less apparent in 'Wholists' and 'Imagers'. Riding concluded that the wholist and imagery dimensions are less demanding of memory function, but stated that these two styles groups are often considered to be less successful academically than individuals who are classed as analytics or verbalisers. These interpretations should be treated with caution however, as there is very little evidence within the literature to suggest a causal relationship between specific cognitive styles and academic performance and Riding (1997) found evidence to support the independence of cognitive style from intelligence in earlier research.

From work in British secondary schools, Riding and Caine (1993) suggested there to be significant interactions between cognitive style and pupil performance in different school subjects. The Author of the current study argues that although these factors may have impacted upon pupil performance within
the classroom, the curriculum and assessments used within this study were part of the General Certificate in Secondary Education (GCSE) and therefore standardised. Furthermore, Teachers participating in the research would have had little control over the assessment methods that were used and this draws into question the validity of the study. Factors that are not introduced within Riding and Caine's study as being influential in affecting the relationships between cognitive style and pupil performance are the environmental and social aspects of learning. Of particular interest to the study reported within these chapters would be information relating to teachers' perceptions of the pupils' intelligence and pupils' cognitive styles. This study attempts to consider whether this relationship might be significant.

1.6.3 Teachers' perceptions and intelligence

As stated in section 1.3, interest in the relationship between teachers' perceptions and intelligence commenced with Rosenthal and Jacobson's 1968 study, *Pygmalion in the Classroom*. The results of their research appeared to indicate that pupils would fulfil the expectations placed upon them by their teachers and this type of outcome subsequently became known as 'The Rosenthal Effect'. The research has been considered hugely controversial and although studies into person perception enjoyed huge interest up until the 1980s through work into Attribution Theory, it is not an area of research that is under popular consideration today. The question of whether there are interaction effects involved between pupil intelligence and teacher perceptions is one that warrants further research and this is, to some extent, considered within this study.
From considering the potential relationships between the three core dimensions, a model of interaction is proposed hereafter, and hypotheses relating to the research questions are elicited.

1.7 A model of interaction

From consideration of the current literature, a model was developed to propose interaction affects between teacher perceptions, pupil intelligence and pupil cognitive style, and the effects of these relationships upon learning outcomes (Figure 2).

Within this model the three core dimensions of relevance to this study: Teacher perceptions (A), Pupil intelligence (B) and Cognitive style (C); were considered to be significant in predicting pupils' learning outcomes (X) within the classroom, and these dimensions were perceived as being embedded within the learning context. The proposed model relates directly to the research questions for the study that were defined as follows:

- *Are teachers' perceptions of pupils' intelligence influenced by pupils' cognitive styles?*
- *Do teachers perceive pupils who learn in a verbal manner to be more intelligent than those individuals who learn in a visual manner?*
- *Is there a relationship between teachers' perceptions of pupils' intelligence and pupils' learning outcomes?*
Figure 2: A model to propose how the relationship between teacher perceptions, pupil intelligence and pupil cognitive style might affect pupils' learning outcomes

AB = Interaction effects between teacher perceptions of pupil intelligence within the learning context
AC = Interaction effects between teacher perceptions of pupil cognitive style within the learning context
BC = Interaction effects between cognitive style and intelligence within the learning context
X = Pupil outcomes resulting from the interaction between teacher perceptions, pupil cognitive style and pupil intelligence within the learning context
Dimension A relates to the perceptions of pupil intelligence elicited from the teacher. As stated previously, these perceptions may be based upon a range of factors and this perspective relates closely to research into Attribution Theory (Weiner, 1992). Dimension B is concerned with pupil intelligence, which for the purposes of this study is defined as the behaviours and outcomes relating to pupil attainment within the classroom that result from both innate abilities and acquired skills and Dimension C focuses upon the cognitive style of the pupil. It is proposed within this model that it is the interaction effects between all three factors that influence pupils' learning outcomes \((A + B + C = X)\). This area of study is significant because the literature suggests that this triadic relationship has not previously been identified within psychological research. In educational settings, pupils' academic results are often thought to derive from a unilateral relationship between pupil intelligence and pupil attainment (Slavin 2003), whilst educational psychologists enrich this picture through broadening the context to include factors such as pupil motivation and emotional responses to learning.

Inherent to this research project is the notion that teachers' perceptions of pupils' intelligence also have a major impact in determining pupils' academic outcomes and that these perceptions are significantly influenced by the pupils' cognitive style. The rationale for this study is to explore how this unique combination of factors relates to pupils' academic outcomes. It is argued that this study provides a distinctive contribution to psychological theory that has practical implications for teachers in terms of both teaching and assessment.
1.8 Hypotheses

The hypotheses were derived from the research questions and proposed model and were recorded as follows:

- Teachers are able to make objective judgements and classifications relating to pupils' intelligence and to use this information to predict academic outcomes
- Teachers can accurately classify pupils' cognitive styles through information collected in daily classroom interactions such as observation and teaching
- Pupils' academic outcomes are independent of teachers' perceptions of pupils' intelligence

1.9 Research opportunities

By considering the research questions, model and hypotheses, the areas in which more research is required to build understanding in this field of psychological knowledge were identified. These include:

i. The interaction effects between teachers' perceptions and intelligence within the learning context (AB). This area has enjoyed little attention since work on Attribution Theory was reported by Weiner (1986, 1992) and would thus benefit from a more contemporary approach.

ii. Research into the interaction effects between teachers' perceptions and pupils' cognitive styles (AC). This has been explored to a limited
extent by Nunes and Pretzlik 2000 but requires further consideration due to the small sample sizes involved in the studies.

iii. The interaction effects between cognitive style and intelligence (BC) have been considered by, amongst others, Riding and Rayner (1998). Some similarities have been observed between the concepts, particularly where a paradigm of multiple intelligences is used within the definition of intelligence (Gardner and Hatch 1989).

Areas for future research are also considered within Chapter 5, in which the research questions, hypotheses, research process and results of this study are scrutinised.

1.10 Summary

Central to this research was the research question of whether teachers' perceptions of pupils' levels of intelligence are influenced by the ways in which pupils assimilate and process information according to their cognitive style. In more specific terms, it was suggested that teachers might view pupils who learn in a verbal manner to be of higher intelligence than pupils who learn in a visual manner and that teachers' perceptions of pupils' cognitive styles could have important implications for pupils' learning outcomes.

In order to explore these questions further, evidence was drawn from the literature within three areas, teacher perceptions, intelligence and cognitive style. A model was developed to describe the interaction effects between these areas and a rationale for the study was developed relating to the triadic
relationship between the three dimensions. Three specific hypotheses were detailed to provide a context for the research. The research questions and hypotheses were explored through the research process.

A particular vacuum within the research was discovered when considering how teachers perceive the skills and abilities of pupils within their classes who have different cognitive styles. This study aimed to provide a synthesis between concepts from the fields of social and cognitive psychology and research evidence relating to teacher attributions and cognitive styles to address this deficit in psychological theory and knowledge, within the context of pupil intelligence. In doing so a unique perspective was developed which has important implications for both future research and the application of psychology within a real world context.
2.0 Introduction

The research questions considered whether teachers' perceptions of pupils' intelligence are influenced by pupils' cognitive styles and specifically whether teachers perceive pupils who learn in a verbal manner to be more intelligent than their visual-learning counterparts. It was proposed that if this was found to be the case, these factors might impact on pupil outcomes within the classroom. From considering the available literature in relation to the core dimensions of teacher perceptions, intelligence and cognitive style, a research vacuum was identified in terms of studies that link these concepts together. It was consequently not possible to explore the research questions purely though the interrogation of current research in the area and this finding initiated an opportunity for a research study.

A model of interaction between the core dimensions was developed. Three hypotheses were subsequently elicited in light of the research questions and were recorded as follows:

- Teachers are able to make objective judgements and classifications relating to pupils' intelligence and to use this information to predict academic outcomes
- Teachers can accurately classify pupils' cognitive styles through information collected in daily classroom interactions such as observation and teaching
- Pupils' academic outcomes are independent of teachers' perceptions of pupils' cognitive styles
A study was then developed to address the hypotheses with a pilot study included within the methodology. The rationale for the pilot study was to provide a small-scale dry run of the main study in order to consider whether the methodology was sound, and to explore the suitability of the research tools in addressing the specific questions contained within the study.

Six pupils were selected at random from a Year 5 class to participate in the pilot study. Observations were made within the classroom using an identified protocol to consider how pupils’ classroom behaviours might reflect their cognitive styles; the pupils were then individually assessed for cognitive style using specific computer software. The third stage of the pilot study, which involved the pupils’ class teacher completing a ranking exercise, could not be completed because the teacher was absent from school. Implications for the timing of the main study and contingencies were therefore considered in light of these experiences as were the suitability of the research tools and aspects of the methodology.

2.1 Objectives of the pilot study
The pilot study provided an opportunity to consider the suitability of research tools and methods that would be used within the main study in order to examine the hypotheses. The objectives of the Pilot Study were summarised as follows:

2.1.1 Practical aims
i. To trial selected measurement tools to establish the practicalities of their use for the main study
ii. To consider the type of data that could be elicited from the selected measurement tools

iii. To ascertain whether observed behaviours within the classroom related to pupils’ cognitive style, and whether such behaviours could be measured effectively using an observation schedule

iv. To identify any practical issues or limitations from gaining a teacher’s ranking of pupil intelligence

v. To highlight any strengths, constraints, limitations and implications for the main study

2.1.2 Conceptual aims:

In considering the possible link between teachers’ perceptions of pupil intelligence and pupils’ cognitive styles the following assumptions were made:

i. Pupils’ behaviour within the classroom reflects their personal cognitive style

ii. Cognitive style is an independent construct that can be measured

iii. Teacher’s perceptions of pupil intelligence can be measured

An important function of the pilot study was therefore to test these assumptions prior to the implementation of the main study, and to make any required modifications within the research design as a result of the piloting process.
2.2 Methodology

2.2.1 Ethical considerations

The methodology for the pilot study was developed with regard to the ethical principles relevant to applied psychological research (BPS 2000). Issues of confidentiality, informed consent and feedback were considered to be highly significant within the study and the school that participated in the research was assured of anonymity for the pupils and staff involved in the project. It was stated explicitly during meetings with staff that the school would not be named or identified in the reporting of the study and in addition, parents who gave permission for their child to take part in the research were also reassured of confidentiality.

Informed consent for the study was obtained through meetings with school staff and a letter to parents (see Appendix 1). Feedback was provided to staff and parents through a short report (see Appendix 2) in which parents were also encouraged to discuss the findings with their child.

2.2.2 Sample

The school in which the pilot study was conducted was a small, village school with an intake of pupils that contained little social or ethnic diversity. The percentage of children within the school who are placed on the special needs register is below average and behaviour within the school is generally well managed.
Six pupils who were naïve to the purposes of the research were chosen at random from within a Year 5 class to participate in the pilot study. A small sample size was chosen because the purpose of the pilot was to explore the means and methods most suited to gain the data required rather than to elicit comparative data. The class teacher and other school staff involved in the study were blind to the specific nature of the study.

The observation schedule selected for the procedure allowed a simultaneous observation of six pupils in one session and therefore this was the number of pupils chosen for the pilot. An equal balance of males and females were selected and the pupils' identities were made anonymous and coded (P1 to P6) for analysis. One subject (P6) was placed on the school's special needs register under the category of learning difficulties. It was not possible to choose an ethnically diverse sample because all the pupils within the classroom were white and spoke English as their home language.

Pupils within the upper primary age band were selected for the pilot study for particular reasons. Secondary School pupils were discounted from the study as the Local Authority in which the research took place operates a selective intake system using the 11+ Verbal Reasoning examination. After Year 6, pupils attending mainstream LEA schools transfer either to a Grammar School if they achieve appropriate grades in the 11+ exam, or to an Upper School if their grades are below the required standard. It was therefore felt that the study would be subjected to considerable bias if pupils at secondary level were chosen as subjects for the research because the young people involved
would have already been categorised and divided within the education system according to an ability test. If secondary pupils within Grammar Schools were chosen for the study, the experimental population would comprise pupils who were tested to be successful at verbal reasoning tests. If Upper School pupils had been selected, the sample would have been biased in having proportionally greater numbers of pupils who performed less successfully on the tasks within the 11+ exam. Upper Schools also have higher populations of pupils with special educational needs, which would have introduced a further source of bias. Using samples from both types of schools would have been difficult, as the study would not have been comparing similar groups of pupil populations. The situation would be further complicated by the fact that eight out of the thirteen Grammar Schools within the LEA provide single sex education and therefore this would restrict the schools that could be involved, as the study aimed to consider male and female pupils within the same classroom setting. For these reasons it was decided that using a primary population would reduce bias within the study by providing a representative sample of pupils.

The measure selected to assess pupils' cognitive styles was reported within the literature as being suitable for use with pupils from the age of nine years (Year 5) and therefore it was this school year that was selected for the pilot study. Year 6 pupils were discounted at this stage as it was felt that the class teachers within this year group already had a number of stressful and time-consuming events to contend with during the school year. These included the 11+ examinations within the Autumn Term, the results and appeals of the 11+
in the Spring Term and SATs tests and transition to secondary school in the Summer Term. It was also felt that teachers in Year 6 would be aware of the 11+ predictions and results of the pupils within their classes and that this could introduce bias into the study in terms of how this information might affect teacher perceptions of the intelligence levels of individual children. The Researcher hypothesised that if a pupil who was not predicted to pass the 11+ later achieved the required grade, they might be perceived as being more able by their class teacher as a result of this assessment than prior to the 11+ result. Conversely, a pupil expected to pass the examination might be seen as less able if they were then placed at an Upper School as a result attaining a particular score on the 11+ examination.

2.2.3 Research design

For the purposes of the pilot study, the research took on the following format:

i. Classroom observation to consider whether pupils' behaviour within the classroom reflected their cognitive style

ii. Individual assessment of pupils' cognitive styles

iii. Teacher rating of pupil intelligence, using a basic ranking system

The results were then analysed and recommendations for the main study were recorded in light of completing this process.
2.2.4 Measures

2.2.4.1 Observation

A structured classroom observation was conducted to consider pupils' behaviours within the classroom based on the assumption that their actions would reflect their cognitive style. From researching the literature, it appeared that no specific observation schedules had been developed as a measure of pupils' cognitive style within the classroom or in linking pupil behaviour to a specific cognitive style. A range of different individual observation schedules were considered in order to establish which would be suitable for identifying pupil behaviours within the classroom that could then tentatively be linked to pupils' cognitive styles.

The observation schedule chosen was the Classroom Observation Schedule (COS) (Waxman et al., 1988), which is a method of observing children's behaviours within a classroom setting to consider and monitor classroom climate and organisation. It was anticipated that within the main study the profile elicited by the COS could be compared to the child's recorded cognitive style to consider the correlation between the child's classroom behaviours and personal cognitive style. A full account of the uses and administration of the COS is provided in Appendix Four.

2.2.4.2 Cognitive style

One research tool that had been cited in the literature as a measure of pupil's cognitive style was the 'Cognitive Styles Analysis' (Riding, 1991a). A copy of this measure was obtained and considered carefully. It appeared to be
suitable as an assessment tool for the pilot study on a number of levels. These included: the pupil age upon which the CSA was standardised, the straightforward nature of its administration and scoring, the described levels of validity and reliability and the rigorous standardisation procedure that it had been subjected to.

The Cognitive Styles Analysis (CSA) is an individual assessment tool that is designed to identify a subject’s cognitive style on the basis of two dimensions, the Wholist-Analytic Dimension and the Verbal–Imager Dimension. This is based upon the Riding and Cheema (1991) model of cognitive style. It is designed for use by professionals who have experience and knowledge of assessment, and is particularly useful as a research tool for those working in education. The dimensions are independent continua, and an individual’s results can be plotted independently of each other in order to gain a picture of their cognitive style.

The CSA is a piece of computer software comprising three subtests in which a range of questions and images are presented to the subject on an individual basis. An administrator provides basic instructions to the subject but the tasks are completed independently, reducing opportunities for experimenter bias to be introduced. During the first subtest, a written statement is presented for a few seconds before being replaced by another. In total, 48 statements are presented in this way and the respondent is required to decide whether they believe the statement to be true or false. The ‘N’ and ‘B’ keys of the computer keyboard are colour coded as blue and red for ‘true’ and ‘false’ responses respectively, prior to the program being started. The respondent then uses
these keys to deliver their answer. The colours are also graphically represented on the computer screen to remind the respondent of which coloured key should be pressed for their choice of answer. Half of the written statements relate to the appearance of an object whilst the other half consider conceptual categorisation, 50% of the presented items within this subtest are true.

Within the second and third subtests, geometric figures are presented to the respondent. In the first task, the subject is asked to decide whether two figures are the same or different and then to use the same colour coded keys on the keyboard to communicate their answer as in the first subtest. In the second task, the subject views a shape alongside a geometric design and is asked to decide whether the former is contained within the latter. The coloured keys are then used again by the subject to record their answer. The subject is not made aware that the assessment tool is recording their response times and that this directly relates to how their cognitive style will be assessed.

Prior to the program being run, the administrator records demographic details about the subject on the system and after the tasks are completed, the computer automatically scores and records the individual's results in the following categories:

- Wholist-Analytic (WA) data
This includes three factors; the individual subject's position on the WA continuum (WA Ratio), their Speed Index, and the number of answers that the
individual subject answers correctly on WA items. The speed index considers their overall speed on WA tasks within the CSA.

- **Verbal-Imagery (VI) data**

This provides the same data for the VI continuum as described for the WA data, that is a VI Ratio, VI Speed Index and the number of correctly answered VI items.

The CSA is described in the Research Administration as being a robust piece of software that was standardised on a sample of 999 subjects (496 males and 503 females). This document reports the correlation between the ratios on the two dimensions as being “low and non-significant (r= -0.01: p=0.867)” (CSA Research Administration, 2001).

Each individual subject's position on a cognitive styles dimension is recorded as a ratio. The CSA then uses this data to place the individual into a category according to their ratio on the WA and VI continua. The categories are derived by dividing each continuum into three equal groups and the individual is then described as being positioned in one of nine positions in terms of their cognitive style (see Appendix 3).

### 2.2.4.3 Rating of pupil intelligence

The class teacher was asked to rate the pupils in her perceived order of their general intelligence using a basic ranking system. The names of the six children who participated in the study were written on individual cards and the teacher was required to place the named cards in her chosen order on a blank sheet of paper. The teacher was given the specific instruction to consider each child in
terms of their overall ability within the classroom and to place the child whom she considered to be most able at the top of the sheet of paper. The card that recorded the name of the child who she perceived to be the next able was then placed below the previous card and so forth until she had used the cards to list all the children's names according to her perceptions of their ability. The word *ability* was used rather than *intelligence* at this stage because it was felt to be less controversial and it suited the definition of intelligence used within the study (see 1.4).

2.2.5 Procedure

Prior to the study being conducted in school, discussions occurred with the Head Teacher and the Year 5 class teacher to ensure that they were in agreement with the school's participation in the research. A permission letter was sent to parents with the opportunity for them to agree to their child participating within the study (see Appendix 1). One parent responded to indicate that they were not willing for their child to be potentially included within the research and therefore this pupil worked in a different classroom during the day upon which the research was conducted.

On the day of the study, an observation of the six subjects took place within the classroom according to the instructions and recommendations of the COS. On the same day, the CSA was completed with individual pupils within a 'quiet room' at the school. The recommendations for administering the CSA were followed, as outlined in the Research Administration document. This suggests that the administrator should provide a relaxed atmosphere for the individual
being assessed, with minimum verbal instruction and little scrutiny during the administration of the task. The administrator is encouraged not to imply that the CSA is a test or that timing of the tasks is involved in the responses. One of the recommendations for using the CSA is that it should be completed prior to the person being assessed receiving information about the nature of cognitive styles, and the study complied with this recommendation.

The class teacher was asked to complete her intelligence ranking exercise of the six children involved in the pilot study on the same day as the COS and CSA were completed in school.

Summary reports describing the subjects' cognitive styles were completed and posted home to the parents of the children who completed the CSA for information. Appendix 2 provides an anonymous example of such a report.

2.3 Results

2.3.1 Classroom Observation Schedule (Waxman et al., 1988)

The data elicited by the COS provided information about the behaviours of the pupils within the classroom in six categories: Interaction (see Appendix 5), Selection of activity (See Appendix 6), Activity types (See Appendix 7), Setting (See Appendix 8), and Manner (See Appendix 9). The language used throughout the session was English.

2.3.2 Cognitive Styles Analysis (Riding, 1991a)

Four out of the six pupils within the pilot study had different cognitive styles, as assessed by the nine categories of the CSA (See Appendix 9). Two pupils
therefore were placed within the same category. Within this small sample, no patterns could be identified in terms of linking pupils’ cognitive styles with other factors, although this had not been the purpose of the pilot study and therefore was not expected. It was noted that the two pupils who were placed within the same category were female, and one of these two subjects was the individual who was placed on the SEN register. It was decided that within the main study the gender effects of pupils’ cognitive styles could be considered further and that other mediating variables, such as whether the pupil had special educational needs, should be included in the research design.

Out of the six pupils who were assessed using the CSA the following trends were observed. On the Wholist-Analytic Dimension, four pupils fell within the ‘Wholist’ category, one within the ‘Analytic’ category and one was placed near the middle of the continuum as an ‘Intermediate’. On the Verbal-Imager dimension, the pupils were equally divided, with two pupils placed within the ‘Verbaliser’ category, two within the ‘Imager’ category and two within the ‘Bimodal’ category.

It was not possible to compare the Year 5 pupils within the sample to the CSA standardisation sample which only records the results of pupils from the age of 11 years. It is important to appreciate that the labels given to pupils according to their positioning on the WA and VI ratios are arbitrary, a point that is made in the Research Administration of the CSA. It will therefore be more important to compare the pupils’ position on the WA/VI Ratio within the main study than to consider the pupils by category.
2.3.3 Teacher rankings

On the day of the study, the class teacher was called away from school suddenly due to a family bereavement. She did not return to school before the end of the school term and so it was not possible to elicit this data. This situation highlighted the necessity for careful planning in terms of timings for the main study, particularly where the research is scheduled for the summer term. It also emphasised the need for contingency time to be built into the planning process that could be put into operation in the event of individuals being unavailable to participate in the work as planned.

2.4 Discussion

From completing the pilot study a number of conceptual and methodological issues were raised which had implications for the main study. The pilot was considered to be invaluable in terms of informing procedures within the main study, and a number of changes were made to the research design as a result of this process. During the planning for the study it had been hypothesised that children's behaviour within the classroom would reflect their cognitive style. The COS was selected for the reasons previously stated as the classroom observation schedule that could be used as a mechanism for exploring this issue further. Throughout the implementation of this procedure however, the usefulness of this particular tool for the specified purpose was much less apparent.
2.4.1 Specific issues relating to the COS

As the COS allowed only one behaviour to be recorded per 30 second observation within a category, some of the rich picture of the working environment was lost, which it was felt would be important in considering how behaviour is linked to pupils' cognitive styles. The measure was not specific, defined or precise enough to be a useful tool within this context, although it was acknowledged that within different settings and contexts, the COS would be much more helpful. Examples of this might include observations to ascertain whether pupil relationships within the classroom were impacting on their application to task or in considering interactions within the classroom in defined groups such as gender or ethnicity. The COS was rather unwieldy to administer which was felt could lead to bias and error between observers. The issue of inter-rater reliability was particularly significant to this study as it was anticipated that Assistant Educational Psychologists (AEPs) would be responsible for collecting some of the data using the COS.

Within the COS, some categories in which to record behaviours appeared in more than one area, for example 'Instructional Interaction' is recorded as a category in both the 'Interaction' and the 'Activity types' categories. This meant that some judgements had to be made about the most appropriate category in which to record a particular behaviour. This was felt to be a further source of potential bias that could have been reduced through having tight definitions of when to record particular behaviours prior to the observation taking place. The types of behaviours recorded within the session were highly dependent on the
nature of the activity that was occurring within the classroom, and the observed lesson did not provide many opportunities for interaction. In order to control these variables it would be necessary to plan the observed lesson with the class teacher to ensure that there were opportunities for observing a range of interaction and communication styles. This level of control did not suit the planned research model because as at the start of the study it had been anticipated that pupils would be observed within a naturalistic environment.

The scoring methods used in the COS looked at total percentages for the group being observed rather than individual interactions and therefore cannot be translated to consider individual children's styles of learning. The scoring method used within the pilot was adapted from the standardised version, which may have introduced error and bias into the methodology. Further apprehension about using the COS as a mechanism for exploring pupils' behaviours within the classroom for this study arose from the fact that the COS provides a snapshot approach to assessment. Following the pilot study, this tool for understanding the climate within the classroom appeared to be rather simplistic and therefore it was felt that the COS might not be the most appropriate method of identifying observable cognitive style. Cognitive Style is reported to be a preferred and habitual manner in which an individual responds to their environment (Riding and Rayner, 1998) and although within a single observation some information relating to a pupil's preferred style might be identified, it is not possible to comment on whether the behaviours observed are habitual. The issues of how to distinguish between observations of cognitive style, learning style and learning strategy were also considered.
and it was proposed that a longitudinal approach to observing classroom behaviours would be more effective to consider this research question. This type of study was not possible within the time constraints of this research project and as a result of these concerns it was decided that a classroom observation might not be the most successful method of understanding how pupils' cognitive styles were being presented.

The benefit of the COS was that it provided a great deal of rich data, but this was not of the type that was helpful or informative to the main study. Using the COS for the pilot study was an extremely helpful exercise in exploring the issues around the use of a specific tool for measuring behaviours within the classroom and considering how this information could be generalised. Although it might be argued that an alternative observation measure would have discriminated more effectively between different styles in the classroom it could be suggested that this too would have limitations. Single observations do not regulate or allow for the type of activities that are observed within a particular lesson and therefore cannot be considered as a representative picture of the child's behaviours in different contexts. Controlling variables within the presented lesson would limit the extent to which the observation could be considered naturalistic and this factor was important within this study.

2.4.2 Specific issues relating to the CSA
The CSA was a straightforward assessment to administer and appeared to be enjoyable to the participants within the Pilot group. The results were calculated by the software and each of the computed ratio scores, timings and correct
responses were recorded automatically, reducing opportunities for human error in this process. The CSA was not however, without some difficulties and issues that had implications for the main study. A prerequisite for using the CSA is that the individual subject can read fluently. The Research Administration for the CSA (CSA, 2001) described it to be suitable for use with pupils aged from 9 years and over although the reported standardisation sample range was 11 years plus. Out of the Pilot group of pupils, one of the six children was slower to read and process the information on the screen than their peers. This pupil was placed on the SEN register for learning difficulties and was reported by the class teacher to have particular difficulties with literacy tasks. This factor might have had implications for the results of the CSA and in particular the cognitive style that was attributed to the pupil at the end of the computer assessment. Within the CSA, one element for eliciting a pupil's cognitive style ratio is the time taken by the subject to complete a variety of tasks.

Another limitation of the CSA is that it provides a snapshot assessment of pupils' skills within a short, single period, and as for all assessments of this type, it does not account for pupils' emotional responses to the assessment environment. Attempts were made to minimise discomfort for the participating subjects by their class teacher talking to the whole class in general terms about what to expect if they were going to participate in the study. The researcher attempted to build a rapport with the participating pilot pupils by entering with them in general conversation, prior to the start of the CSA assessments.
One potential source of anxiety for those completing the CSA was the fact that it is a computer-administered assessment, which could create tension for individuals who do not feel confident in the use of IT. The program is designed to account for this fact and only two keys are used during the assessment. In addition to this the keys are colour coded in order to make a Yes/No answer accessible. It was acknowledged during the pilot study that storing personal data on a computer may need registration under the Data Protection Act and therefore the information and data elicited by the CSA was coded for anonymity.

The CSA is visually a rather dated piece of software with low screen resolution due to working in DOS. Individuals using the CSA at the current time are likely to be familiar with using packages that reflect more advanced technologies such as Microsoft Windows. The visual limitations of the software might impact upon the face validity of the CSA as an assessment tool but there are also practical implications in using this package. Due to the limitations of the CSA, more complex exporting tools are required in order to manipulate the elicited data. The results from the CSA are placed automatically in a text file by the software and this can be more difficult to transfer into other contexts, such as EXCEL and SPSS when required for analysis. The alternative procedure, which would involve the manual transfer of each recorded score into a spreadsheet, was not appropriate in terms of being both time consuming and procedurally clumsy and likely to introduce significant errors into the recorded data. Ideally, the CSA would require considerable updating to utilise the benefits of current technology and although this was not possible within the
study, highlighting these issues was significant in order to contextualise the elicited results. It is clear from the pilot study that although the CSA is a useful tool for small scale research, a more sophisticated mechanism would need to be developed for more extensive studies in order to overcome some of the difficulties described.

2.4.3 Specific issues relating to the teacher ranking procedure

For the reasons stated previously, the class teacher was not available to complete the teacher ranking procedure and therefore this could not be accomplished. Prior to her departure however, she had commented that she would find it difficult to rate pupil ability in terms of an overall level and would prefer to be given key subject areas to comment upon, or a specific category such as 'verbal reasoning' with which to compare individual pupils. These suggestions were considered carefully when the methodology for the main study was being developed, and this aspect of the study was then adapted to reflect teachers' perceptions of pupils' ability in the core subject areas of Literacy, Numeracy and Science. It was also felt that this modification could help to operationalize the rather unwieldy concept of intelligence by bringing more concrete factors into the arena to help focus teachers' thinking about comparative intelligence between individual pupils. Within the study, the definition of intelligence described the behaviours and outcomes relating to pupil attainment within the classroom (see 1.3) and therefore this measure was subsequently used to identify teacher's perceptions of pupils' comparative intelligence within different subject areas.
The effects of the class teacher's own learning and teaching style in her assessments of the class had not been accounted for prior to starting the Pilot Study and this factor was acknowledged as a limitation of the study.

It was decided that an independent measure of intelligence should be used as part of the main study, and that the classroom observation should be eliminated from the research process as it had not elicited the type of information that had been anticipated at the start of the study.

2.5 Conclusions

The pilot study fulfilled the objectives identified at the beginning of the research process. In terms of the practical aims of the study, the pilot provided an opportunity by which the assessment tools selected were examined to establish the practicalities of their use for the main study. Their strengths and limitations were then considered in terms of the methodologies employed and the type and quality of the data that could be elicited from them.

An important conclusion made as a result of the pilot study was that within the time constraints available it would not be possible to consider whether pupils' observable behaviours within the classroom related to their cognitive style. There were serious methodological concerns in relation to whether the selected observation schedule was appropriate for the pilot study and therefore it was decided that an alternative procedure to this should be sought for the main study. The assumption that pupils' behaviour within the classroom reflects their cognitive style could therefore not be tested within the context of
this research, although this continues to be an important area for consideration and would benefit from further scrutiny.

Both practical issues and methodological limitations were identified from the process of a teacher's ranking of pupil intelligence. One practical consideration was the timing of the study within the school term and the opportunity for building into the research design a contingency time to allow for teacher absence. Through discussion with the class teacher involved in the pilot study, the ranking exercise within the main study was altered to reflect three core areas of the curriculum, Literacy, Numeracy and Science.

2.5.1 Strengths of the pilot study

The response from both EP colleagues and school staff suggested that the question of whether particular cognitive styles relate to different levels of intelligence, or perceived intelligence within the classroom, had good face validity. Colleagues were keen to express their views on this subject and also to discuss the implications of this question within the local context.

The pilot study provided a useful opportunity to ascertain whether the protocols identified for the main study were sound by using a small number of subjects in a dry run of the research procedure. Consideration of specific aspects of research design, such as ethics, consent and data protection were also highlighted by the process.
2.5.2 Constraints and limitations

There were a number of identified practical constraints within the pilot study that had implications for the main research. Only one laptop computer that was able to run the CSA was available within the Educational Psychology Service, which had implications for the timing of the study. Negotiations had to be made with the EP that used the laptop for her specialist role, and subsequently the pilot study had to be run at the end of the school term when the laptop was not in use for that purpose. Two of the desktop computers within the school would have been able to run the software, but these were unsuitable to use within the study due to their location within individual classrooms. This would have been a distracting environment for the subjects involved to complete the tasks on the CSA and against the recommendations of the administration guidelines which state that the individual being assessed should be, “free from distraction or interruption” (CSA Research Administration, 2001). It was felt that a busy classroom could not offer this type of peaceful environment and that this would also affect confidentiality within the procedure. Due to issues of obtaining the equipment required in order to run the CSA, the study was conducted at the very end of the summer term, which may have been unsettling for the pupils. The excitement of the impending summer vacation may have made it more difficult for the children to concentrate appropriately.

When the CSA was completed with individual pupils, it became clear that the screen of the laptop was rather small and this affected the pupils' ability to read the instructions clearly. A larger screen or monitor would have been more
suitable for the study but as described previously, there were considerable
difficulties in accessing the IT facilities for this study. Another limitation of the
CSA that was identified during the pilot study was the fact that it is unsuitable
for children who are not proficient in reading English, and therefore excludes
some pupils who speak English as an additional language. Versions of the
CSA are available in other languages, including Arabic and French and this
might address some of these concerns. It was felt to be unlikely that the CSA
would be suitable for pupils from special populations, for example children with
generalised and specific learning difficulties who have difficulties in literacy. It
would also be inappropriate for pupils with visual impairment. It is suggested
that the software could be modified or adapted in order to take account of
these issues, perhaps by being standardised more widely.

Another constraint of the pilot study related to the very small sample size,
which did not provide an ethnically or culturally diverse sample of subjects. It
had always been anticipated that the pilot served the purpose of being a dry
run of the main study rather than for eliciting comparative data, but it was felt
that greater diversity should be sought within the main study to provide a more
representative sample. The unexpected absence of the class teacher from
school meant that it was not possible to complete the ranking exercise during
the pilot phase of the research, although this had been discussed with both the
teacher and the head teacher during the planning phase of the study. Another
aspect of the study that had not been considered prior to the pilot was the
need to include some independent measures of pupil intelligence as part of
the research design and this was explored within the methodology for the main study.

2.6 Implications for the main study

As a result of completing the pilot study, implications were identified for the main study in terms of the cohort of subjects, measures used and the research design.

2.6.1 Sample

During the planning phase of the pilot study it had been decided to select pupils in Year 5 to participate in the pilot and that this research should occur within the summer term. This was the term before the pupils took their 11+ examinations, which it was felt would reduce bias effects in terms of the class teachers' knowledge of how each child had performed within the 11+. This period of time also represented a less demanding school year in terms of the expectations placed on pupils and teachers, as they were not exposed to the pressures of Year 6, such as SATs, the 11+ exams and secondary transfer procedures. Since undertaking the pilot study, it was decided that it would actually be more appropriate to work with pupils in Year 6 for the main study. The reasons for this were threefold. Firstly, the standardisation sample of the CSA was based on children from 11 years of age and most children within Year 6 are aged between 10 and 11. Secondly, as a result of the pilot study it was decided that an independent measure of intelligence should be included within the research design for the main study. By using pupils in Year 6, data from both the 11+ and SATs could potentially be available for the research.
Finally, by using pupils in Year 6 for the main study it would be expected that a higher proportion of the children would have reached the level of fluency in reading required to access the CSA. There is no indication within the CSA research administration as to the reading level required to work independently on the CSA and therefore it is not easy to identify whether a child would be able to access the software prior to using it. This need for fluency in reading might well bias the results as many of the items are timed. This is therefore an important area to be considered within the main study.

As part of the research design for the main study it was planned that schools with diverse ethnic and social catchments should be asked to participate in the research in order to gain a representative sample from the County population. In addition to this, it was decided that pupils from schools in each of the three LEA areas of the County should be used for the sample population. Within the Authority, these areas are viewed as being distinct in terms of their pupil populations and it was hoped that by including schools from all three areas that a representative sample would be achieved for the study.

One important aspect of the main study was to ensure that the teacher involved within the ratings procedure had a good knowledge of the children within his or her class. This would therefore be an individual who had had the time to get to know the pupils for a considerable period rather than a new member of staff or somebody with significantly reduced contact with the pupils due to other responsibilities or through a job share. It was felt that it would be harder for a teacher within the secondary school system to complete a rating
of pupil intelligence as they spend less time with individual pupils than a primary school teacher who teaches the same groups of pupils for the majority of the lessons. This factor also impacted upon the timing of the study as it was felt that in the Autumn and early Spring Terms, class teachers would not have such an established view of the class as in the Summer Term. Avoiding stressful times of year, such as coinciding with OFSTED, SATs and 11+ exams was also felt to be important for school staff.

2.6.2 Measures
The observation schedule used was very intense and time consuming. The information that it provided was not of the type that could easily be compared to the other data collected and did not provide the type of information that had been hoped for. The results had to be inferred rather than measured, and it could only be used concurrently with six pupils. By comparing groups of six pupils in different lessons and on different days it was felt that bias could be introduced, particularly as the nature of the information elicited was closely related to the activity presented within the classroom. After reflecting upon these issues it was decided that an alternative indication of pupils’ presented cognitive styles within the classroom should be identified. A proforma was then developed to help elicit this information from class teachers and this procedure is detailed within the ‘Methodology’ section of the main study.

An area of identified weakness within the pilot study was that no standardised measures of pupil intelligence were incorporated within the research design to provide an independent means with which to compare teachers’ rankings and
cognitive style data. Liaison with the Policy, Performance and Information department of the County Council suggested that data could be available from a variety of sources including the 11+ examination results and information from the SATS assessments. It was subsequently decided that this should be investigated further for use in the main study.

2.6.3 Review of the hypotheses

Upon completion of the pilot study, the extent to which the hypotheses had been explored was limited due to the small numbers of subjects involved. Each hypothesis was considered individually following the pilot process to ensure that they continued to be appropriate for the main study. In addition to this reflection upon the hypotheses, it was decided that within the main study some consideration would be given to the possible mediating variables that might impact upon the research. These included gender, special educational needs categories (SEN) and pupils' home language and were recorded within the methodology of the main study as sub-hypotheses.

2.6.3.1 Hypothesis 1

'Teachers are able to make objective judgements and classifications relating to pupils’ intelligence and to use this information to predict academic outcomes'

This hypothesis remained appropriate for the main study but the ranking system that had been developed to gain this information was not used within the pilot study due to the teacher’s absence from school. From the teacher's initial comments about the task during the planning phase of the pilot, some
adaptations were made to the system before it was used within the main study. In addition to the ranking system the possibility of using data from the County's records was explored in order to employ an external measure of pupil intelligence alongside the participating teacher's judgements of pupils' intelligence.

2.6.3.2 Hypothesis 2

'Teachers can accurately classify pupils' cognitive styles through information collected in daily classroom interactions such as observation and teaching'

This hypothesis also remained appropriate. It was felt that the CSA could be successfully used to explore this hypothesis within the main study, but for the reasons described within this chapter it was decided that the observation tool selected for the pilot was not useful and that the methods of collecting this data would be modified for the next part of the research process. This procedure is detailed further in Chapter 3.

2.6.3.3 Hypothesis 3

'Pupils' academic outcomes are independent of teachers' perceptions of pupils' cognitive styles'

This hypothesis continued to be appropriate for the main study. It was decided that the revised ranking system should be used in conjunction with the modified procedure for the teachers' classifications of pupils' cognitive styles to explore this hypothesis.
2.7 Summary

The pilot study provided an invaluable opportunity to undertake a dry run of the main study, the methodology of which was adapted as a direct result of completing the pilot process. Following this part of the research it was felt that the research question and hypotheses were valid and that the study could contribute to an under-researched area within this field of educational psychology.
Chapter 3: Methodology for the Main Study

3.0 INTRODUCTION
3.1 RESEARCH QUESTIONS AND HYPOTHESES
3.2 MEASURES
3.3 SAMPLE
3.4 TIMESCALE
3.5 ETHICAL CONSIDERATIONS
3.6 METHODS OF DATA COLLECTION
3.7 CRITIQUE OF THE METHODOLOGY
3.8 SUMMARY
3.0 Introduction

Following completion of the pilot study, adaptations were made to the methodology of the main study to reflect the recommendations made as a result of completing a dry run of the research process. The research questions and hypotheses remained appropriate, and provided a framework for the main study, although two sub-hypotheses were additionally developed to record the possible affects of specific mediating variables within the research design.

3.1 Research questions and hypotheses

3.1.1 Research questions

- Are teachers' perceptions of pupils' intelligence influenced by pupils' cognitive styles?
- Do teachers perceive pupils who learn in a verbal manner to be more intelligent than those individuals who learn in a visual manner?
- Is there a relationship between teachers' perceptions of pupils' intelligence and pupils' learning outcomes?

3.1.2 Hypotheses

- Teachers are able to make objective judgements and classifications relating to pupils' intelligence and to use this information to predict academic outcomes
- Teachers can accurately classify pupils' cognitive styles through information collected in daily classroom interactions such as observation and teaching
- Pupils’ academic outcomes are independent of teachers’ perceptions of pupils’ cognitive styles

3.1.3 Sub-hypotheses

- Mediating variables such as gender, special educational needs categories, school attended and pupils’ home languages do not influence independent measures of pupil intelligence
- Mediating variables such as gender, special educational needs categories, school attended and pupils’ home languages do not influence independent measures of cognitive style

3.2 Measures

The hypotheses were tested using a fixed design approach. A range of research measures had been explored within the pilot study and the methodology for the main study was revised as a result of this process. The measures used within the main study were as follows:

1. The Cognitive Styles Analysis Assessment (Riding 1991a) was used as an objective measure to identify pupils’ cognitive styles
2. Pupils were ranked in order of perceived intelligence by their class teachers
3. Pupils were rated on a scale of cognitive style by their class teachers
4. Results from the County 11+ examinations were obtained as a measure of pupils’ potential ability
5. Key Stage 2 SATS data in English, Mathematics and Science were obtained as a measure of pupils' outcomes.

6. Demographic data including gender, the position of the pupil on the Special Needs Register and whether the child spoke English as a home language (EHL) or as an additional language (EAL).

3.3 Sample

The cohort consisted of five schools within a midshire Local Education Authority representing three geographical areas of the LEA. Three of the five schools were situated within large towns and were diverse in terms of pupil ethnicity, the socio-economic status of the catchment families and the languages spoken within the pupils' homes. The two additional schools were in villages where the pupils were predominantly white and spoke English as their home language.

114 pupils from five Year 6 classes were used in the study. The reasons for choosing Year 6 pupils were threefold: Firstly, the pupils sat their 11+ examination in the Autumn Term of Year 6 and this data was available on County records by the Summer Term. Secondly, pupils in LEA mainstream secondary schools had been categorised in terms of ability by the 11+ exam and therefore bias would be introduced by using older pupils in KS3 or KS4 who had been segregated in this way. Finally, the Cognitive Styles Analysis computer program that was being used to consider individual pupil's cognitive styles was reported to be suitable for pupils from the age of 9 years and over. During the pilot study, when pupils of this age in Year 5 had been selected, it was found that their literacy skills were not always fluent enough to be able to
respond appropriately to the questions provided by the CSA. By using pupils who were predominantly 11 years old, it was anticipated that their reading skills would be more fluent and that this would increase the accuracy with which the CSA could be used within the sample of pupils.

3.4 Timescale

The study took place in the Spring and Summer terms of 2003, with planning and preparation taking place in the Spring and the active research phase being put into operation in the Summer Term, after the SATs had been completed. This timescale was built into the research design in order for the staff involved in rating and ranking the pupils to get to know the pupils over the two previous terms and subsequently to be well placed to comment upon the skills of the individuals. By working with schools after SATs had been completed it was anticipated that the multiple demands being placed upon teachers at this time of year would be reduced. In addition to this, the 11+ (VR) data was made available from June 2003 and the Key Stage 2 (SATS) data was available from the Planning, Performance and Information department after September 2003 and this furthermore dictated the timescale in which the study could be completed. The fact that some of the individual class teachers had been given access to their pupils' VR data prior to completing the ranking exercise could potentially be considered a source of bias and this is acknowledged as a constraint within the methodology of the study.

3.5 Ethical considerations

Information was sought from the BPS and appropriate literature in relation to the ethical principles and considerations relevant to research in schools (BPS
2000). The following issues were considered to be highly significant to the study; confidentiality, informed consent and feedback.

3.5.1 Confidentiality

A significant methodological consideration in relation to research design relates to confidentiality within research procedures. Bell (1991) suggests that all participants in educational research should be given the opportunity to remain anonymous and that information should be treated in strictest confidence. From the initial stages of developing the study, the five schools involved were reassured that no information would be reported within the study to identify them, their staff or pupils by name and that all personal details would remain confidential. This information was also provided for parents to reassure them about this aspect of the research. In making the sources anonymous, the schools were each given a number, 1 to 5, and the pupils were also identified via a case number, 1 to 114.

3.5.2 Informed consent

In addition to issues of confidentiality, information gained from the literature raised a number of issues in relation to how informed consent should be obtained from the participants. It was suggested that individuals should be made aware of who was conducting the study and why, the nature and purpose of the study and the costs and benefits involved in participating in the study. It was also recommended that individuals should have the opportunity to ask questions of the researcher before, during and after the research process and to be free to withdraw consent without prejudice (Cohen et al. 2000). These principles were taken into account when planning and
implementing the study and informed consent was obtained by using the following procedures:

3.5.2.1 School

A letter and information sheet (see Appendices 10 and 11) was initially sent to the three 'town' schools to request their participation in the study in the Spring Term of 2003. The three schools all agreed to take part in the study and further questions raised by the schools in relation to the process were answered in the manner selected by the staff involved. This included the researcher visiting one school in person and responding by email to questions posed by the other two. A sample consent letter was emailed to all of the participating schools that could be sent home to parents. Blank spaces were left within this template for the school's personal details to be included and for a letter heading to be added to the page (see Appendix 10). It was anticipated that approximately 100 pupils would be required for the main study.

During the course of the research it became clear that the number of parental consent responses that had been received was not sufficient for the study and as a result it was decided to involve more schools in the project. Early in the Summer Term, two further schools were approached by email to ask whether they would be prepared to participate in the study and both of the schools agreed. These schools received the same information fact sheet and sample consent letter that had previously been emailed to the three schools that had already agreed to participate in the research.
3.5.2.2 Parents

Four out of the five schools that agreed to take part in the study sent their parental consent letter home via the pupils but one school requested that it should be posted to parents directly from the Researcher, as they believed that this would encourage a higher return rate. The sample letter developed for the schools by the Researcher contained an incentive for parents to return the reply slip as all the returned slips were placed in a 'prize draw', with one name from each school being selected at random to win a box of chocolates. The decision to include this incentive within the letter was considered carefully as it was felt that this could create a self-selecting group of respondents and that individuals who were diabetic or on special diets might not respond. Ethically, it was felt that in order for individuals not to feel pressurised into returning positive responses, all returned slips would be included within the prize draw, whether the parent wished for the child to participate in the study or not. One school chose to remove this incentive from the letter.

The response rate from the school that requested that the consent letters be posted directly to parents was initially the lowest. A higher return was gained after the letters were sent out for a second time, but this time via the pupils, which had been the preferred method of delivery for the other four schools. One reason suggested by the school for the low response rate was that the parents were from an ethnically diverse population and that some of the parents were not literate in English. This would not explain why the response rate increased when the letters were sent home via the pupils however and
therefore an alternative reason might be considered. The differences in response rates through the two approaches could be an indication of the importance that the parents of children from that particular school placed upon information that was sent from the school rather than through the post, that could be construed as 'junk mail'.

One school had experienced problems in sending the letters out to parents far in advance of the study because the school secretary was not well. Follow-up telephone calls were therefore made by the Researcher to establish verbally whether parents were happy for their child to take part in the study.

3.5.2.3 Pupils

The pupils who participated in the study were asked verbally whether they were willing to do so prior to completing the computer program that was used to assess cognitive style. All 114 pupils who had parental consent agreed to take part in the research.

3.5.3 Feedback

3.5.3.1 School

A summary of the key findings of the research study was developed and sent to each of the schools involved. In addition to this, one school requested in-service training for their staff about the nature of cognitive styles as a direct result of being involved in this research project.
After each child was assessed for their cognitive style category, the information was recorded on a short report (see Appendix 13) that was given to the child's class teacher and parents.

3.5.3.2 Parents

In addition to receiving the report describing their child's cognitive style, parents were invited via the report to contact the Researcher with questions or requests for further information. One parent telephoned as a result of this invitation and additional information was given both verbally and by post as a result of this interest.

3.5.3.3 Pupils

Individual pupils were told of their cognitive style label after the assessment and given very brief feedback about the meaning of the label. They were informed that their parents and teacher would be receiving a report describing this in more detail and were encouraged to talk to their families or school staff about the given information.

3.6 Methods of data collection

3.6.1 The Cognitive Styles Analysis (CSA)

As detailed within the previous chapter, the Cognitive Styles Analysis computer program elicits data in relation to a pupil’s cognitive style on two dimensions (verbaliser-imager and wholist-analytic) using the Riding and Cheema (1991) model of cognitive style. The results of this assessment provide a description of an individual on each of these continua following the
completion of three subtests. The individual’s cognitive style is reported both in terms of two ratio scores and a cognitive style description. The description is derived directly from the ratio scores and consists of a respondent being placed into one of nine categories, which is achieved by dividing the population on each dimension into three similarly sized groups. A person’s cognitive style is therefore described in one of nine positions (see Appendix 3). Information in relation to the use and applications of the CSA is reported within the previous chapter.

An Assistant Educational Psychologist (AEP) supported the Researcher in collecting some of the CSA data for the study. In order to promote consistency between the two individuals, the AEP was trained in the use of the CSA and the Researcher modelled an assessment session for them. An additional laptop computer that was capable of running the CSA software was made available to the Researcher during the main study, which facilitated the data collection process.

When collecting data using the CSA, some practical difficulties were encountered. These included pupils being absent from school on the day of the data collection and also being out of school for sports classes and rehearsals for school concerts. Following the Pilot Study, it had been recommended that some additional time should be allowed for contingencies within the research design. As a result of these recommendations the budget of time allowed within the methodology for data collection was extended thus allowing enough flexibility to make return visits to the schools as necessary.
3.6.2 Teacher ranking

Each participating class teacher was asked to individually consider the pupils who had permission to take part in the study in terms of their ability in three subject areas, Literacy, Numeracy and Science. The teacher was required to complete a ranking exercise in which they placed the pupils within a hierarchy, depending on the teacher’s perception of each pupil’s comparative ability in each subject area. To assist with this exercise they were provided with a proforma (see Appendix 14). This procedure had been altered from the pilot study in which the class teacher had stated that it would be difficult to make comparisons in relation to pupils’ levels of general ability without specific subject areas in mind. This modification streamlined the ranking process and procedurally this aspect of the study was successfully executed.

3.6.3 Teacher rating

A rating scale was developed for completion by each of the class teachers involved in order to measure their perceptions of pupils’ cognitive styles. The scale required the respondent to rate each pupil on a scale of 1 to 6, depending on firstly the extent to which they believe the pupil to be a verbal or visual learner and secondly whether they believe the pupil to learn in a wholist or analytic manner. Instructions for this exercise were provided both verbally by the Researcher and in written form at the top of the scale sheets. During the study, the Researcher was responsible for working with the class teachers to complete both the rating and ranking exercises to promote a consistent approach to the tasks.
3.6.4 VR data

Collection of the VR data to include within the study was also a new component of the research, and resulted from pupils' completing the LEA's 11+ examination. The 11+ is a parametric, norm-referenced test of achievement potential produced by the National Foundation for Educational Research (NFER). Pupils sit three examinations in the Autumn Term of Year 6 and mean of the two highest scoring papers is calculated. It is this figure that represents the VR score used by the Authority to determine the type of school in which a pupil will be placed in Year 7. The Policy, Planning and Information department within the Council provided this VR data for use within this research study. In order for this to happen, an initial meeting was set up with a senior manager from the department to discuss the type of data required and the time scales involved. This information was confirmed by email and then passed to the Council's Data Protection Officer to ascertain whether it would be possible for the information to be utilised in this way. The Data Protection Officer confirmed that the information could be used if parents were made aware of the nature of the study and if sources were made anonymous in the reporting of the research. This aspect of the study had already been considered according to British Psychological Society guidelines (BPS 2000) and copies of the draft parental permission letter and school's factsheet were sent to the Officer accordingly.
3.6.5 Key Stage 2 (SATS) data

The end of Key Stage 2 (KS2) tests in English, Mathematics and Science generated the data used in the study as an independent measure of pupil performance. Two aspects of the data were used, the marks achieved by the pupils in the three subject areas and the standardised attainment levels that are reported to schools and parents as a measure of pupil performance compared to age related expectations. The Policy, Planning and Information department provided this statutory Key Stage 2 data for the Researcher. Testing occurred during the Summer Term of 2003, shortly before pupils' cognitive styles were assessed.

3.6.6 Demographic data

The Policy, Planning and Information department within the Council and teachers within the participating schools provided demographic information about individual pupils. This information included whether a child's home language was English, their date of birth, and whether they were placed on the Special Needs register. This information was confirmed, where appropriate, with the school's SENCO. Due to the comparatively small sample used within the study, it was not possible to categorise the demographic variables too closely, as the frequencies contained within individual cells would have been too small to warrant useful analysis. The ‘SEN’ category was therefore divided into four groups, firstly children not placed on the SEN register, secondly children placed at School Action, thirdly children placed at School Action + and finally the pupils with Statements of Special Educational Needs. The information in relation to the range of languages spoken by the pupils was
collected and then subjects were placed in one of two categories depending on whether they spoke English as a home language (EHL) or English as an additional language (EAL). This information were simply categorised as 'Yes' if they spoke EAL or 'No' if English was their home language (EHL). This information was helpful in terms of considering the analysis of variables within the collected data although was not considered to be an exclusively representative method of categorisation.

3.6.7 Data analysis
The data was examined using a range of statistical tests that considered descriptive statistics, exploration of the relationship between variables through correlations and statistical techniques to make comparisons between groups. The results are described in detail within Chapter Four of this thesis.

3.7 Critique of the methodology

3.7.1 CSA
As a research tool, the CSA provides many benefits. It is easily administered by a subject using a computer and takes only 10 to 15 minutes per subject from start to finish. The instructions and training in completing the tasks are minimal, reducing researcher bias, and the results are scored and analysed by the software, reducing the possibility of human error as might be expected in a task involving analysis by a researcher. There is evidence of the CSA being a robust and reliable research tool, however when using the CSA during the study, the following issues were raised.
Within the Research Administration (Riding, 2001) it is reported that the CSA can be successfully used with pupils as young as 9 years old, the main prerequisite for its use being the ability to read fluently. During the course of the research it became clear that it was not only the ability to read well that was important for pupils answering questions within the CSA, but that their understanding of vocabulary and other aspects of language development were also important. Many of the pupils involved in the study questioned the meaning of words used within the first subtest of the CSA in which they were required to read and respond to a series of written statements. The most common requests for clarification in relation to the meaning of individual words were for: lawn, heather, herring, canary and omelette. The issue of whether pupils understood the meanings of words, even when they appeared to be able to read them fluently, appeared to be unrelated to whether the pupil's home language was English, as children from a range of ethnic backgrounds asked similar questions.

In addition to the need for a child to have a broad understanding of language and a wide vocabulary to complete the CSA, it could be argued that some of the statements within the CSA are ambiguous and require revision. The following examples illustrate this point: Pupils were presented with a statement and required to give a yes/no response; "Fork and spade are the same type." Two pupils questioned whether this sentence related to a garden fork or to an item of cutlery and the accuracy of the answer clearly depended heavily on the child's interpretation of the word 'fork'. Similarly, when it was stated: "Cook and teacher are the same type", one pupil asked whether the word 'cook' was
being used as a noun or a verb in order to facilitate their ability to make an accurate response.

In addition to concerns about the CSA itself, there were also some questions raised about how it was presented to the individual children. During the study the CSA was presented to the individual pupils on a laptop computer, which was easily transported between schools. It was decided not to ask schools for the use of their computers, not only to minimise disruption to their timetables, but also so that the location could be selected to ensure that pupils were free from distraction whilst undertaking the CSA. In terms of confidentiality, it was felt to be more appropriate that the computer could be placed away from other pupils within the school who might be curious about the tasks being undertaken.

One of the difficulties of using a laptop computer was the size of the materials that were presented to the pupils. The size of the writing and images were manageable for somebody who might be considered as having average eyesight, but for some individuals it was acknowledged that the information presented to them might appear rather small. This had been identified within the Pilot Study as a potential constraint, but as there were a limited number of laptops available that were suitable for running the software no alternative method of presentation was possible.

Keyboard skills are not a prerequisite for completing the CSA as it involves the subject using only two colour-coded keys although, as acknowledged within the Pilot Study, some individuals feel anxious when faced with using a
computer and this anxiety could affect their responses. One individual who completed the tasks said that the colour coding system used in the responses was confusing. In the CSA, the key marked with a red sticker meant giving a response of ‘false’ or ‘wrong’, depending on the type of question given. Conversely, the key marked with a blue sticker enabled the respondent to record an answer of ‘true’ or ‘correct’. It was suggested during the course of the study that the appropriate key to press would be more easily identified if the system was based upon red and green stickers, which would perhaps be more easily processed as ‘stop’ and ‘go’. The question of whether this would adversely affect pupils who are red/green colour-blind was raised and any change in procedures would need to be piloted as part of the CSA development in order to establish whether changing the colours for responses would affect subjects’ results significantly.

During the administration of the CSA, individuals are given immediate written feedback on the computer screen about whether their previous response was correct or incorrect. Both the Researcher and AEP perceived that this affected the way in which the respondents approached subsequent items, although there is no evidence to support this belief within the CSA. Some individuals made exclamations after reading that they had made an incorrect response to an item and were observed to check the following statement more carefully before pressing the response keys. Conversely, some of the individuals who achieved several consecutive, incorrect feedback statements appeared to consider the questions less carefully and to push buttons at random until the task was completed.
3.7.2 Teacher ranking

In two out of the five schools used within the study, the children were segregated by ability within their year groups for literacy, numeracy and science. This created some difficulties in terms of completing the teacher ranking exercise, as individual class teachers felt unable to comment upon the range of ability for all of the pupils within their class. This subsequently required meetings with other teachers within the school who taught the participating pupils for their 'streamed' subjects. Time for these additional meetings had not been anticipated and placed additional demands upon members of staff who had not agreed to be part of the research within the planning phase. This is one area that would need more careful consideration in completing further research of this type.

3.7.3 Teacher rating

The rating scale was used within this study for teachers to record their perceptions of pupils’ cognitive styles. Class teachers were asked to consider the individual pupil’s cognitive styles on two dimensions, Verbal-Imagery and Wholist-Analytic which related to the Cognitive Styles Analysis program. This was an aspect of the research that had not been used within the Pilot Study and therefore the development of this scale was considered carefully, particularly in relation to its objectives, content, format, reliability and validity. A six point summated rating scale was developed and piloted on an Assistant EP and an EP colleague to check for clarity within the instructions (see Appendix 15). This type of scale, often referred to as 'Likert scales', are tools used to measure attitudes and regarded to have high reliability (Oppenheim,
They can provide an ease of response that is not found in alternative methods, such as in questionnaires and are considered to be attractive to respondents (Robson, 2002). A summated rating scale with an even number of response items, such as the six-point scale used in this study, removes the opportunity of a mid-scale answer and therefore encourages answers that reflect a particular attitude or opinion.

Despite the obvious benefits of using summated rating scales within research, it should be acknowledged that these methods are not straightforward to develop and require considerable planning to reduce opportunities for contamination and bias. Any single methodological tool that purports to measure individuals' attitudes can be criticised for attempting to summarise complex information in an overly simplistic manner (Robson, 2002). This may pose a threat to the validity of the data and the interpretation of the results.

The internal consistency of the scale was considered using Cronbach’s alpha coefficient and the Alpha value was calculated to be 0.703. This figure was above the accepted threshold of 0.7 (Pallant, 2001), and the scale can subsequently be considered as being internally consistent.

The types of validity of particular relevance to the development of this scale were; Face validity, Construct validity, External validity and Internal validity. Other forms of validity, such as Predictive Criterion validity were not included for consideration, as they did not relate to the methodology and style of this study. The scale appeared to have good face validity, as it appeared to be a
A straightforward and reasonable method of collecting the required information. A potential threat to the construct validity of the scale was considered because the construct labels used within the scale (e.g., Wholist/Analytic) were provided for the respondent which could mean that their interpretation of the terms was different to that of the Researcher. This possibility was accounted for by piloting the scale on an Assistant EP and EP colleague to establish whether the terms and instructions were clear for the respondent. When implementing the study however, one of the five teachers who completed the teachers’ rating scale found it difficult to respond easily to the presented task. This teacher had been provided with the same instructions as the other members of staff, but was unclear about where to place pupils on the scale if they were perceived to learn in both a verbal and a visual way. Further piloting of these procedures would be recommended if this study were to be repeated in order to promote consistency between respondents.

The scale was considered by the researcher to have rather a narrow external validity because the results of the study were generated from Year 6 pupils and consequently could not be generalised onto other populations. Caution was also given to the level of internal validity in terms of describing the scale as one of cognitive style, because it aimed to consider teachers’ perceptions of pupils’ learning preferences, rather than cognitive style per se. For this reason, the instructions given to the class teachers did not use the term cognitive style, rather they were asked to provide information in relation to their views of pupils’ learning preferences.
3.7.4 VR data

The midshire county in which the research was conducted is one of the few counties in which pupils still routinely sit 11+ examinations in Year 6, the outcomes of which establishes whether they will attend a Grammar or Upper School within the Authority upon secondary transfer. In each year, the pass mark for going to a Grammar School is different, as the marks are standardised to ensure that a correct number of pupils are offered Grammar School places. For pupils who do not achieve the required standard on the 11+ exam to go to a Grammar School, there is an appeals procedure for considering extenuating circumstances that might have adversely affected a pupil’s performance. A case in these circumstances has to be presented to a panel within the Council by parents with the support of the head teacher of their primary school. Within the Authority, teachers, parents and pupils have all reported during casework that the 11+ exams place a great deal of pressure upon the children, their families and school staff. In using the VR data as part of the study, there was some concern that this could again raise anxiety level for pupils and their parents, particularly if they perceived themselves to have ‘failed’ by having been selected for an Upper School as opposed to Grammar School.

Prior to the VR data being used within the study, careful consideration was given to whether it would be a suitable tool for including as part of the data set. In favour of using this information, the 11+ (VR) scores provide standardised data that is available from within the County. VR scores are considered to be objective measure of future potential that have been scrutinised for reliability and validity. The data provides comprehensive information about the majority
of pupils within the County as it is expected that all children will sit for the three exams unless their parents decide to let them opt out on ethical, personal or social grounds. The VR data was therefore considered to be a resource that would be useful and cost effective to be included within the study although this process also provoked some criticisms. One class teacher felt strongly that many of the children within their class had received significant levels of private tuition to coach them for the exams and that for this reason the VR data could not be described as a true measure of intelligence.

The validity of the 11+ exams themselves have been questioned within research and within this study the use of a verbal reasoning test was examined as a potential source of bias, particularly in relation to pupils who speak English as an additional language. There is some evidence to suggest that that differences in VR scores are consistently observed between pupils from different ethnic groups and in particular that pupils from Pakistani backgrounds achieve lower scores than peers who are of White UK ethnic origin (Fredrickson and Petrides, submitted for publication).

The Researcher questioned whether a Verbal Reasoning test would be biased towards pupils who learned in a verbal manner, as opposed to a visual manner and therefore it was decided that this hypothesis could be explored further within the study.

3.8 Summary
As a result of examining specific methodological approaches within the pilot study, a framework was developed for exploring the research questions and
testing the core and sub-hypotheses. Data was collected using the identified protocols and interpreted within the context of the constraints of the study.
Chapter 4: Results

4.0 Overview

4.1 Demographic information

4.2 Data relating to VR scores

4.3 Data relating to the Cognitive Styles Analysis

4.4 Teacher rankings

4.5 Teacher ratings

4.6 Data relating to Key Stage 2 results

4.7 Summary and conclusions
4.0 Overview

The data elicited by the study was interrogated through quantitative analysis, initially through descriptive statistics and subsequently though a range of statistical techniques. SPSS (version 11.5) was used to support this process.

The variables were assigned numerical codes prior to the data file being prepared, and the data was subsequently imported from the original sources. The information was then screened for errors by considering the range of the data and examining outliers from the elicited figures. Minimum and maximum scores within the data range were scrutinised, as were the means and standard deviations within the data set. Results that appeared to be atypical were examined for accuracy and subsequently corrected as necessary. Missing data, for example where a pupil had been absent for a particular test, was assigned a code to aid the process of analysis. Data in which a normal distribution was expected, such as in the VR scores, was subjected to tests of normality and this information was subsequently used to plan the choices of statistical analysis that would be most appropriate. The elicited results are reported hereafter, under the following headings:

i. Demographic information

ii. Data relating to VR scores

iii. Data relating to the Cognitive Styles Analysis

iv. Teacher rankings

v. Teacher ratings

vi. Key Stage 2 data
4.1 Demographic information

The demographic information collected within the study related to the sample characteristics of gender, age and whether participating pupils spoke English as their home language (EHL) or as an additional language (EAL). The distribution of these dynamics between the schools involved in the research was considered in order to understand how specific mediating variables might influence both the elicited results and their subsequent interpretation.

4.1.1 Gender

The numbers of male and female subjects were closely matched, as 48.2 % of the subjects participating in the study were male and 51.8 % female.

4.1.2 Age

The age of the pupils was recorded at the start of the Summer Term 2003. 17.5% of the pupils were 10 years old and 82.5% of pupils were 11 years old.

4.1.3 Pupils who speak EAL

16.7 % of the subjects who participated in the study spoke English as an additional language and a diverse range of family languages was recorded, including Polish, Italian, Punjabi, Urdu and Swedish. The picture of pupils speaking EAL was not evenly distributed between schools as can be seen by the percentages recorded in Table 1. This clearly demonstrates that a much higher proportion of pupils in School 3 spoke EAL than was observed in the other schools involved in this research and this figure comprised 52.6% of the
total number of EAL speaking pupils within the study. The discrepancy between the numbers of pupils speaking EAL is particularly marked between Schools 3 and 4 and the potential influences of this information upon the results of the study were considered during the analysis of the data. These observations will be explored further within Chapter 5.

<table>
<thead>
<tr>
<th>School</th>
<th>Percentage (%) of EAL pupils from school sample</th>
<th>Percentage of total from sample (n=114)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21.4%</td>
<td>31.6%</td>
</tr>
<tr>
<td>2</td>
<td>13.3%</td>
<td>10.5%</td>
</tr>
<tr>
<td>3</td>
<td>35.7%</td>
<td>52.6%</td>
</tr>
<tr>
<td>4</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>5%</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

4.1.4 Pupils who have special educational needs

19.3% of the subjects who participated in the study were considered by their schools to have special educational needs (SEN). Figure 3 displays the relative numbers of pupils (n=114), expressed as a percentage, and their recorded degree of special needs. This information relates to all pupils involved in the research including those who were reported to have no SEN, those placed at School Action, those at School Action Plus and those with Statements of SEN. The proportions recorded within the study reflect both national and local trends relating to expected numbers of pupils with SEN and
in this sense the sample can generally be considered as representative of the wider context in terms of SEN distribution.

**Figure 3: The percentage of subjects categorised by their degree of SEN**

Key

- Pupils with no recorded SEN
- Pupils placed at School Action (SA)
- Pupils placed at School Action Plus (SA+)
- Pupils with Statements of Special Educational Needs

A caveat to this finding was observed when considering the percentage of subjects from each of the individual participating schools who were recorded as having SEN. This group of pupils incorporates those pupils who were recorded as being placed at School Action, School Action Plus or with
Statements of SEN. Figure 4 clearly displays that the proportions of pupils with SEN was not equally distributed between the schools and the significance of this discrepancy will subsequently be explored further in light of the results elicited by this study.

Figure 4: The percentage of subjects from each of the participating schools who were reported to have special educational needs (SEN)

4.2 Data relating to VR scores

The Policy, Performance and Information Department of the County Council provided the VR data to the Researcher from the pupils' 11+ results. 105 VR scores were obtained for the 114 subjects who participated in the study (92.1%). Within this study the individual VR scores for the subjects ranged from 69 to 141, with the mean being 106.5 and the standard deviation being 18.0. This information is recorded in Figure 5 with a theoretical normal distribution included with the data for comparison with the elicited data.
The VR data from the study was positively skewed (skewness = 0.16) and
platykurtic (kurtosis = -0.70). This indicated that the distribution of the data was
skewed to the left of the mean and therefore clustered around the lower
scores of the 11+ results. Negative kurtosis suggested that the distribution
peaked at a lower level than would be expected within a normal distribution
curve. The results for tests of normality elicited a non-significant result
(Kolmogorov-Smirnov statistic = 0.052; p>0.05), which indicated that there
was no violation of the assumption of normality and therefore this part of the
data could be considered as having a normal distribution. For this reason, parametric testing was selected for use in explorations of the VR data.

From considering the VR data some interesting discrepancies were identified in the elicited results. From the sample provided there appeared to be a difference between the mean VR scores achieved by the pupils involved in the study according to the school that they attended. A one-way between groups analysis of variance was selected to explore this hypothesis using VR scores as the dependent variable. This method was selected because the data was normally distributed and the relationship under scrutiny comprised a continuous dependent variable and an independent categorical variable with more than three groups (school attended). The results of this analysis were found to be significant (F=10.9; p<0.0005), suggesting that within the sample there were significant differences in the mean VR scores achieved by pupils attending different schools. Post hoc tests using the Tukey HSD test revealed that the mean VR scores achieved by pupils in School 1 were statistically lower than those achieved by the other four schools in the study. Possible reasons for this discrepancy will be considered within Chapter 5.

Another aspect of the data that warranted close examination was that females appeared to achieve higher results in the VR examination than males. This observation was explored statistically using an independent samples t-test to compare the mean VR scores of males and females. This test was selected because the data being considered consisted of an independent categorical variable with two groups (gender) and a continuous, normally distributed
dependent variable (VR score). The results elicited a significant result ($t=-2.7; df= 103; p<0.05$) and this pattern was observed in each of the five schools used within the study. The results achieved by males and females in each of the five participating schools are reported graphically in Figure 6.

Figure 6: The relationship between gender, VR score and school attended

The relationship between the VR scores and teachers' rankings of pupils' intelligence through comparing their performance in Literacy, Numeracy and Science was explored through statistical analysis. The Spearman Rank Order Correlation was selected to explore the strength of this relationship because the data elicited from the teachers' ratings was ordinal (see Table 2). The results of the correlation indicated that teachers' rankings of pupils' intelligence
in these subject areas correlated strongly with pupils' VR scores. This suggested a relationship between teachers' perceptions of pupils' intelligence and related to Hypothesis 1 of this study; that teachers are able to make objective judgments and classifications relating to pupils' intelligence and to use this information to predict academic outcomes. This might be considered a predictable finding as the VR scores are considered to be an assessment of intelligence and the ranking scales developed for this study measured teachers' perceptions of pupils' intelligence in the three core subject areas. It is also important to state that whilst this correlation indicates that a relationship exists between these variables, causality should not be inferred.

Table 2: The relationship between VR data and teachers' rankings of pupils' intelligence

<table>
<thead>
<tr>
<th>Correlation coefficient (Spearman's rho)</th>
<th>VR score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers' literacy ranking</td>
<td>-0.67**</td>
</tr>
<tr>
<td>Teachers' numeracy ranking</td>
<td>-0.67**</td>
</tr>
<tr>
<td>Teachers' science ranking</td>
<td>-0.59**</td>
</tr>
</tbody>
</table>

** significant at p<0.05

Within the previous chapter, it was questioned whether the VR test could be considered a valid tool for use within a study for subjects who spoke English
as an additional language (see 3.7.4). It was hypothesized that a Verbal Reasoning test could be disadvantageous to pupils who speak EAL compared to those pupils who speak English as a home language (EHL) because of the fluency levels of language required to make the type of higher order inferences required by this particular assessment. This possibility was tested using an independent samples t-test to consider potential discrepancies between the mean VR scores achieved for pupils who spoke EAL and those who spoke EHL. A non-significant result was obtained (t = -0.10; df = 103; p > 0.05) and therefore within this sample there does not appear to be a discrepancy between the two groups. This information should be interpreted cautiously however due to the small numbers involved in the study and subsequently this would be an important area to consider in further research.

Another important area for consideration within this study was in examining potential relationships between the VR data and the CSA categories. This information related directly to the research question of whether teachers' perceive the pupils who learn in a verbal manner to be more intelligent than those who learn in a visual manner. Information from the literature suggested intelligence to be an independent construct and unrelated to cognitive style (see 1.6.2) and for this study it was important to eliminate interaction effects between the two factors.

The data was considered using a one-way between groups analysis of variance (one-way ANOVA). The continuous dependent variable used within this calculation was the VR data and the independent categorical variable was
the CSA category. No statistical link was discovered between the variables, supporting the view that cognitive style is a separate construct to intelligence. This information was vital in considering the particular elements within this study as any statistical relationships that linked teachers' perceptions of pupil intelligence to the CSA data would need to be independent of the VR scores and this was shown to be the case by this part of the analysis.

4.3 Data relating to the Cognitive Styles Analysis

4.3.1 Categories

The CSA elicits nine cognitive style descriptions by separating the ratio scores into categories. Boundaries between categories are identified to equalise the groups within a normal population and therefore it would be anticipated that in a representative sample the numbers of pupils in each category would be evenly distributed. This prediction was not supported by the data gathered from the study as within the sample many more pupils were recorded by the CSA as being 'wholists' than 'analytics'. The distribution of pupils within their CSA categories is recorded in Figure 7.
The Researcher questioned whether mediating variables from within the sample had influenced this atypical profile; the CSA Research Administration reports the tool to be an independent measure of cognitive style (Riding 2001) and therefore this is an area that requires further investigation. Within this study it should be observed that the frequency of some of the cells was rather low and therefore any attributions of causality would at this stage be based upon supposition rather than investigation or statistical analysis. More extensive research using a larger sample would be warranted to consider possible reasons for this particular profile being generated.
4.3.2 Ratio scores

The ratio scores elicited by the CSA indicate an individual's position on both the Wholist-Analytic (WA) and Verbal-Imagery (VI) dimensions. The ratio data was assessed for normality (see Table 3).

<table>
<thead>
<tr>
<th></th>
<th>Kolmogorov-Smirnov statistic</th>
<th>Significance level</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA Ratio</td>
<td>0.89</td>
<td>0.30</td>
<td>0.78</td>
<td>0.84</td>
</tr>
<tr>
<td>VI Ratio</td>
<td>0.10</td>
<td>0.01</td>
<td>1.03</td>
<td>1.58</td>
</tr>
</tbody>
</table>

The results indicated that the WA ratio data was normally distributed but that the VI ratio data violated the assumption of normality ($p<0.05$). The VI data was manipulated by means of a logarithm transformation in order that parametric testing might be used in exploring the relationships between this and other aspects of the generated data.

No significant differences were identified between the mean ratio scores achieved by subjects in different schools when considered using a one-way between groups ANOVA. Within this analysis, the dependent variable was the ratio score and the independent, categorical variable was the school attended.
Table 4 provides a profile of the mean ratio scores achieved between pupils in different schools.

<table>
<thead>
<tr>
<th>School</th>
<th>Mean W-A ratio score</th>
<th>Mean V-I ratio score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.03</td>
<td>1.04</td>
</tr>
<tr>
<td>2</td>
<td>1.06</td>
<td>1.10</td>
</tr>
<tr>
<td>3</td>
<td>1.02</td>
<td>1.10</td>
</tr>
<tr>
<td>4</td>
<td>1.09</td>
<td>1.06</td>
</tr>
<tr>
<td>5</td>
<td>1.04</td>
<td>1.08</td>
</tr>
</tbody>
</table>

The means displayed by the sample were rather different from those provided by the CSA Research Administration (2001) in which the overall mean for the Wholist-Analytic ratio was 1.25 (sd 0.45) and for the Verbal-Imagery dimension was 1.06 (sd 0.20). These discrepancies might explain the differences observed in the current study between the numbers of pupils placed in each of the nine style categories compared to those that might be generally predicted.

Within the CSA Research Administration (op. cit.) it was reported that a discrepancy was noted between the mean ratio scores of males and females on the Wholist-Analytic (WA) continuum (p=0.002), although this observation was described as being of no practical importance. Within this study an independent samples t-test was used to examine whether males and females
achieved significantly different results on either the WA or VI ratio scores of the CSA by comparing their mean scores. The results were not significant, suggesting that in this project, unlike the original sample, no such discrepancy was present.

An independent samples t-test was also used to consider whether a difference could be observed between the mean WA and VI ratio scores of pupils who spoke EAL compared to pupils who spoke EHL. No significant difference between the mean ratio scores of these groups was found within this sample. Similarly, a one-way between groups ANOVA indicated that no significant differences could be identified between the mean WA and VI ratio scores of pupils who were placed within different categories of SEN. This included all pupils, from those not recorded as being on the SEN register, to those pupils placed at School Action (SA), School Action Plus (SA+) and those with Statements of SEN.

By interrogating the ratio data further, information was elicited that related directly to the hypotheses contained within this study. One of the most important findings was that the WA ratio score displayed no significant correlation with teachers' ratings of pupils on the WA continuum and similarly, the VI ratio score did not correlate with teachers' ratings of pupils on the VI continuum when using the Pearson's product-moment coefficient. This evidence could suggest that the reported perceptions of pupils' cognitive styles from teachers within the sample were different to the descriptions of pupils' cognitive styles that were elicited by independent testing. If supported through
further research, this finding would contradict the proposal made in Hypothesis 2; that teachers can accurately classify pupils' cognitive styles through information collected in daily interactions such as observation and teaching. This finding may suggest that teachers are not able to identify pupils' cognitive styles through their daily interactions because no relationship was elicited between measures of teachers' perceptions of cognitive style and independent tests of cognitive style. The implications of this information are highly significant when considered within the context of the reports from the literature, which suggests that the matching of teaching style to cognitive style improves both the learning experiences and results of pupils. It therefore appears to be possible that teachers are wrongly identifying another factor, such as learning style or learning strategy, as cognitive style. If this theory was confirmed there could be an important role for educational psychologists working in schools to provide training for staff in both the assessment and curriculum modifications required to differentiate the learning environment appropriately for pupils with a range of cognitive styles. As a result of this study it is suggested that these possibilities warrant further consideration.

An alternative hypothesis to explain the finding that teachers’ ratings of cognitive style do not relate to independent tests of cognitive style could be that the CSA is not a valid tool for measuring cognitive style. It could be suggested that in generating cognitive style labels the CSA is measuring something other than cognitive style and this possibility has important implications for the validity of this tool in future research. From the data collected within this study, evidence was found to support the statements made within the CSA Research Administration (2001) in relation to its
suitability as a tool for psychological research. An example from within this study relates to the fact that the elicited CSA categories were independent of the VR data and therefore separate from an independent measure of crystallized intelligence. Similarly, using Spearman’s Rank Order Correlation, teachers’ rankings of pupils in literacy, numeracy and science did not correlate with either the WA ratio or the VI ratio of the CSA, which provides further evidence of the CSA being considered an independent measure to intelligence.

Using a Pearson product-moment coefficient (Pearson’s r), it was discovered that the WA ratio did not correlate with the VI ratio score, which potentially supports the claims within the CSA Research Administration (op. cit.) that the two continua are independent of each other. It was interesting to note that there was no correlation found between the WA ratio and the VI Speed index or the percentage of correctly answered items on either the VI or WA scales of the CSA when using the same test. Similarly, also using Pearson’s r, it was identified that the VI ratio of the CSA did not correlate with either speed index or the percentage of correctly answered WA or VI items. The implications of these findings will be considered further in Chapter 5.

4.3.3 Speed indices

The speed index scores were tested for normality and the results are displayed in Table 5.
Table 5: Testing for normality within speed indices

<table>
<thead>
<tr>
<th></th>
<th>Kolmogorov-Smirnov statistic</th>
<th>Significance level</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WA Speed Index</strong></td>
<td>0.11</td>
<td>0.05</td>
<td>0.77</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>VI Speed Index</strong></td>
<td>0.07</td>
<td>0.18</td>
<td>1.47</td>
<td>6.84</td>
</tr>
</tbody>
</table>

The results of these tests indicated that the WA and VI speed indices were normally distributed. It was therefore possible to use parametric testing on this part of the data without further manipulation.

Initial exploration of this data using a one-way between groups ANOVA uncovered no significant differences between the mean scores on the speed indices of the CSA between pupils attending different schools. Using an independent samples t-test, no differences were identified between the mean speed index scores of pupils who spoke EAL compared to their peers who spoke EHL. Similarly, comparisons between the mean speed index scores of males and females using an independent samples t-test suggested that there were no gender differences in the results achieved on either the WA or VI speed indices of the CSA as the result was not significant.
Significant differences were observed between the speed index scores of pupils placed at particular stages of SEN categorization. A one-way between groups ANOVA was used to explore the mean speed index scores for pupils who were not placed on the SEN register and for those who were placed at School Action, (SA), School Action Plus (SA+), and pupils with Statements of SEN. Significant differences were identified between these groups of pupils on both the WA speed index ($F = 6.66; p < 0.005$) and the VI speed index ($F = 7.51; p < 0.001$).

Figures 8 and 9 display the relationship between SEN categories and Speed Indices and this information suggests that pupils with SEN are more likely to have lower speed index scores than pupils who are reported to have no SEN. This might be considered as a straightforward finding if the pupils with SEN who were involved in the study all experienced a cognitive delay, but the subjects within the sample actually incorporated pupils with a range of different special educational needs labels. These included: emotional/behavioural difficulties, autistic spectrum disorders and sensory impairment, although the small numbers involved in the study mean that it is not possible to state whether there is a relationship between speed index and SEN within the wider population and therefore this question warrants some additional attention and investigation through further research.
Figure 8: The relationship between the VI Speed Index and SEN category

No* School Action School Action Plus

Position on SEN register

Figure 9: The relationship between the WA speed index and SEN category

No* School Action School Action Plus

Position on SEN register

*No = No SEN recorded by school
Other significant information that was elicited from this part of the data includes the finding that when using Pearson’s r to explore relationships between variables, the WA and VI speed indices correlated strongly with each other (r = 0.66; p< 0.01). This relationship suggests that pupils who generate high speed index scores on the VI items of the CSA would also be expected to elicit high speed index scores on the WA items, and vice versa.

Results using Pearson’s r also displayed positive correlations between both the WA speed index and VR data (r= 0.41; p<0.01) and between the VI speed index and the VR data (r = 0.45; p<0.01), indicating a positive relationship between pupils obtaining high speed index scores and high scores in the 11+ examination. Using the same test, a relationship was also identified between the WA speed index and the percentage of VI items answered correctly (r = 0.36; p<0.01) and the VI speed index and the percentage of both WA (r = 0.19; p< 0.05) and VI items answered correctly (r = 0.47; p<0.01). This information appears to indicate that some areas of the CSA relate to aspects of intelligence and therefore could be in conflict with the Research Administration of the CSA (2001). These relationships would require further investigation before causality could be inferred.

The speed indices were assessed to be independent of the CSA category descriptions using one-way between groups ANOVA with speed index as the dependent variable. Using a Spearman’s rho, which is appropriate for ordinal data, a negative correlation was generated between the WA and VI speed
indices and the teachers' rankings of pupils in literacy, numeracy and science (see Table 6). In this study, pupils given lower rankings were perceived to be of higher ability in a particular subject by their class teacher than those pupils who are given higher rankings. A pupil who was rated as being '1' was therefore considered to be the most able in the class and an individual rated as '2' was considered by the teacher to be the second most able. The finding indicates that pupils who were given a lower ranking by their teacher in a core subject (and thus considered to be more able) would be more likely to have a higher speed index score. This supports the results from this study that linked the speed index scores to both the VR scores and categories of SEN. This initial investigation appears to suggest that the speed index scores might be the area of cognitive style assessed by the CSA in which a relationship can be observed between cognitive style and general intelligence.

Table 6: The relationship between the WA and VI speed indices and teachers' rankings of pupils in literacy, numeracy and science (Spearman's rho)

<table>
<thead>
<tr>
<th>Teachers' rankings in literacy</th>
<th>WA Speed Index</th>
<th>VI Speed Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.43**</td>
<td>-0.54**</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teachers' rankings in numeracy</th>
<th>WA Speed Index</th>
<th>VI Speed Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.38**</td>
<td>-0.47**</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teachers' rankings in science</th>
<th>WA Speed Index</th>
<th>VI Speed Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.41**</td>
<td>-0.51**</td>
<td></td>
</tr>
</tbody>
</table>

**significant at the 0.01 level**
4.3.4 Items answered correctly on the CSA

The data relating to the number of items answered correctly on the WA and VI questions of the CSA was tested for normality and the results are displayed in Table 7. The results indicated that the assumption of normality was violated in both the WA and VI items and the data was subsequently manipulated by means of a reflect and square root transformation. This enabled parametric testing to be selected for use with this data.

<table>
<thead>
<tr>
<th></th>
<th>Kolmogorov-Smirnov statistic</th>
<th>Significance level</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA Items correct</td>
<td>0.18</td>
<td>0.0005</td>
<td>-0.49</td>
<td>-0.51</td>
</tr>
<tr>
<td>VI Items correct</td>
<td>0.10</td>
<td>0.017</td>
<td>0.48</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Using a one-way between groups ANOVA, significant differences were found between the percentage of items answered correctly on the CSA by pupils attending different schools. This was true of both the WA (F = 2.8; p < 0.05) and VI items (F = 5.24; p < 0.001). From considering the elicited means, School 4 achieved the highest percentages of correctly answered items on both dimensions. These differences can be observed by comparing the mean percentage of correct items on the WA and VI scales for each school, which are reported in Table 8.
Using an independent samples t-test, no significant differences were found between the mean scores of males and females on the percentage of WA or VI items answered correctly.

Significant differences were observed when using an independent samples t-test between pupils who spoke EHL and those who spoke EAL and the mean percentage of items answered correctly on both the WA and VI questions of the CSA. For WA items the results were: $t = -2.68; \text{df} = 105; p < 0.05$ and for the VI items the results were: $t = -2.8, \text{df} = 105; p < 0.005$. In both instances, pupils who spoke EAL achieved a significantly lower mean percentage of items answered correctly than their peers who spoke EHL. Within the WA task, this discrepancy was much less pronounced than in the VI items, (2.6% in the WA items compared to 8% in the VI items).

<table>
<thead>
<tr>
<th>School</th>
<th>% of correct items on the Wholist-Analytic scale</th>
<th>% of correct items on the Verbal-Imagery scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>93.42</td>
<td>75.29</td>
</tr>
<tr>
<td>2</td>
<td>94.13</td>
<td>74.31</td>
</tr>
<tr>
<td>3</td>
<td>93.64</td>
<td>80.84</td>
</tr>
<tr>
<td>4</td>
<td>96.47</td>
<td>87.26</td>
</tr>
<tr>
<td>5</td>
<td>93.65</td>
<td>81.50</td>
</tr>
</tbody>
</table>
Significant differences were also observed between the mean percentage of correctly answered items on the CSA and pupils placed in different categories of SEN. This effect was seen in both the percentage of WA items ($F = 3.64; p < 0.05$) and VI items answered correctly ($F = 10.25; p < 0.0005$), when using a one-way, between groups ANOVA. Figure 10 displays the relationship between SEN category and the mean percentage of VI items answered correctly whilst Figure 11 displays the relationship between SEN category and the mean percentage of WA items answered correctly.

**Figure 10: The relationship between SEN category and the mean percentage of correct VI items**

<table>
<thead>
<tr>
<th>Position on SEN register</th>
<th>Mean Percentage of correct VI items</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>82</td>
</tr>
<tr>
<td>School Action</td>
<td>72</td>
</tr>
<tr>
<td>School Action Plus</td>
<td>66</td>
</tr>
</tbody>
</table>
The percentage of WA items correct correlated positively with the percentage of VI items correct using Pearson's r ($r=0.40$; $p<0.05$), suggesting that individuals who achieved a high percentage of correct answers in one dimension would also achieve a high percentage of correct answers in the other. This relationship does not initially appear to be remarkable until it is considered that CSA items are reported to be separate to measures of intelligence and therefore this aspect of the research requires some further consideration through additional research and perhaps through further piloting of the CSA.
4.4 Teachers' rankings

The Teachers' Rankings data had been collected by requesting that teachers ranked the pupils within their class in order of ability in the three core subject areas and lower rankings suggested higher ability within the class. This measure was used to establish teachers' perceptions of comparative intelligence between class members.

A Spearman's rank order correlation was used to consider the ordinal data of the teachers' intelligence rankings of pupils within the study. Rankings of pupils' intelligence in literacy correlated significantly with teachers' rankings of pupils in both numeracy ($r= 0.80; p<0.01$) and science ($r= 0.84; p<0.01$). Similarly, teachers' rankings in numeracy and teachers' rankings in science correlated with each other ($r= 0.81; p<0.01$), suggesting that teachers rated pupils as having a fairly even pattern of skills in all three subject areas. Teachers' rankings in the core subjects correlated negatively with the percentage of items that the pupil answered correctly on both the WA and the VI items on the CSA and also negatively with the Speed Index for both WA items and VI items on the CSA (see Appendix 17). This relationship could indicate that pupils who were rated as being more able by their teachers were more likely to achieve more answers correct in the CSA questions than peers who teachers perceived to be less able. Pupils rated as being more able by teachers also achieved higher speed index scores and these potential relationships are considered further in Chapter 5.
Using 2-way ANOVA, there were no statistical differences discovered between teachers' rankings of pupils' skills in literacy, numeracy and science, based upon gender. The results generated by a Spearman's Rank Order Correlation suggested that teachers' rankings of pupil intelligence in the core subjects correlated positively with both their WA ratings and VI ratings (see Appendix 17). This relationship suggests that there is a relationship between teachers' perceptions of pupils' cognitive style and the teachers' perceptions of pupils' intelligence in literacy, numeracy and science. As the correlation was positive, the relationship proposed by this analysis can be reported in the following way; Where a teacher perceives a pupil to learn in a strongly wholist manner and is therefore rated as having a lower score on the WA teacher rating scale, they are also likely to be ranked with a lower number within the classroom in core subject areas. Pupils given a lower rank are considered to be more able in a particular subject, therefore a pupil who was considered to be number 1 in the class would be thought of as more able in a particular subject than their classmate who was ranked at number 2. This information is of great significance to this study as it indicates a relationship between teachers' perceptions of pupils' intelligence and teachers' perceptions of pupils' cognitive style. Even more important to this research was the finding that the teachers' ratings of pupils on the VI scale correlated positively with teachers' rankings of intelligence. This provides information in relation to the second research question central to the study; *Do teachers perceive pupils who learn in a verbal manner to be more intelligent than those individuals who learn in a visual manner?* The particular relationship uncovered by this aspect of the data suggests that this possibility might be affirmed, however as causality
should not be inferred from correlations, additional research and alternative explanations should also be considered. In addition to the relationship generated previously, it might also be proposed that pupils who are perceived to learn in a wholist manner are also perceived to be more successful in core classroom subjects by their class teachers and therefore be more intelligent than those individuals who learn in an analytic way. This relationship should be interpreted with the same caution as the previous finding as these tentative relationships require greater consideration and analysis.

These proposed relationships are not the same as comparing the relationship between teachers’ perceptions of intelligence and an independent test of cognitive style such as the CSA because it is the perceptions of cognitive style that are being considered by the teacher-completed WA and VI ratings scales rather than an absolute or independent measure of cognitive style. These results indicate that although pupils who learn in a verbal or wholist manner are not assessed to be more intelligent than other pupils on tests of potential and achievement, teachers perceive that they are more able than their peers.

4.5 Teachers’ ratings

Teachers’ ratings were collected to consider how teachers perceived pupils on two scales of cognitive style that had been developed for the research project. The scales related to the WA and VI dimensions of cognitive style proposed by the Riding and Cheema (1991) model and were developed to facilitate comparisons between teachers’ perceptions of cognitive style and information elicited by the CSA.
The mean ratings of pupils given by individual class teachers on both the WA and VI scales are recorded in Table 9. Some variation is present within the ratings provided by different class teachers and it is hypothesized that this could be explained by considering the influence of the teachers' own cognitive styles upon their ratings of other individuals. It was not possible to explore this relationship within the constraints of this research project however and therefore this is an area that would benefit from further consideration in future research.

Table 9: Mean WA and VI ratings by teachers

<table>
<thead>
<tr>
<th>School</th>
<th>Mean W-A rating from class teacher</th>
<th>Mean V-I rating from class teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.08</td>
<td>3.38</td>
</tr>
<tr>
<td>2</td>
<td>4.80</td>
<td>4.47</td>
</tr>
<tr>
<td>3</td>
<td>3.27</td>
<td>3.00</td>
</tr>
<tr>
<td>4</td>
<td>2.74</td>
<td>2.87</td>
</tr>
<tr>
<td>5</td>
<td>4.06</td>
<td>3.68</td>
</tr>
</tbody>
</table>

A Chi-Square test was used to consider information from this part of the data that related to the WA and VI ratings with other categorical variables. In considering the effects of these two variables with gender, EAL, CSA category descriptions and SEN, the assumption of a minimum expected cell frequency was violated and the results were not considered to be valid.
A one-way between groups ANOVA was conducted to explore the differences in VR scores between the teachers' ratings on the WA and VI scales. On the WA scale, a significant difference was generated between the mean scores (F=6.81; df = 5; p<0.0005) and on the VI scale a similar pattern was observed (F=3.92; df = 5; p<0.005). Pupils rated as a ‘1’ on the WA scale achieved significantly higher mean VR scores than their peers and pupils rated as a ‘6’ on this scale achieved the lowest means. In the VI rating scale, pupils rated as a ‘1’ and therefore those perceived to learn in a strongly verbal manner achieved higher VR scores than their peers and those pupils rated as a ‘6’ on this scale achieved the lowest mean VR scores. This suggests a relationship between pupils rated as learning in a wholist and verbal manner by their teachers and higher corresponding mean scores on the VR tests.

4.6 Data relating to Key Stage 2 (KS2) results

Two aspects of KS2 data was examined within the study, the total marks achieved by pupils in the English, Mathematics and Science tests and the levels that were assigned to the pupils as a result of the tests. Tests for normality using the marks achieved within the tests indicated that the assumption of normality was violated in all three subject areas (see 4.62). As a result of this finding, non-parametric tests were used to consider the data relating to KS2 results.

Due to the small sample size within the study, exploration of the data within the Key Stage levels was complex as the minimum cell frequency was violated in several of the Chi-Square tests used. The exploration of relationships...
between the areas in which this occurred was repeated using data from the Key Stage marks, upon which the levels are based. The KS2 marks provide continuous data and therefore different tests could be used to examine the variables without the cell violation being relevant to the statistical analysis.

4.6.1 Key Stage Levels

Using Chi-Square to explore the relationship between gender and the levels achieved in the KS2 English, Maths and Science tests, some significant findings were uncovered. Pupils achieving Level 2 in any of the three tests (total n = 6) were discounted within this aspect of the analysis in order to ensure that the frequency within each of the cells was greater than 5. This assumption would have been violated had the additional pupils been included and Chi-Square could not have been used for the analysis. As the numbers achieving Level 2 in each subject were small (3.8% of the whole in English, 1.8% in Maths and 0.9% in Science), these scores were viewed as outliers at this stage and therefore the results are reported using only data from Levels 3 to 5.

The proportions of males and females achieving levels 3 to 5 in English were significantly different ($x^2 = 14.02; \text{df}=2; p<0.001$) with 27.7% of boys achieving Level 3 in English as opposed to 16.4% of girls and 59.6% of boys gaining Level 4 compared to 36% of girls. Only 12.8% of boys achieved Level 5 in English from within the cohort compared to 47.3% of girls and therefore girls achieved 81.3% of the total Level 5 results in English. In Maths, no significant differences were found between the proportions of males and females
achieving Levels 3 to 5 ($x^2 = 2.91$; df =2; p>0.05), however further differences were found when exploring the results of the Science test. Within these results, 18.0% of boys achieved Level 3, 54.0% achieved Level 4 and 28.0% achieved Level 5. This compared unfavourably with the girls, where 12.1% achieved Level 3, 36.2% achieved Level 4 and 51.7% achieved Level 5, which was 68.2% of the total Level 5 scores. This difference was found statistically significant, using the Chi-Square test ($x$ squared = 6.26; df =2; p<0.05)

This information is displayed graphically in Figures 12, 13 and 14. Figure 12 shows the relationship between gender and the KS2 English levels achieved, Figure 13 displays the relationship between gender and the KS2 Maths levels achieved and Figure 14 displays the relationship between gender and the KS2 Science levels achieved.

**Figure 12: The relationship between gender and KS2 English levels achieved**
Figure 13: The relationship between gender and KS2 Maths levels achieved

Figure 14: The relationship between gender and KS2 Science levels achieved
Exploration of the relationship between the proportions of pupils from each of the five participating schools achieving particular levels in the KS2 tests was not possible using Chi-Square due to the assumptions of the minimum expected cell frequency being violated. From considering the information graphically some discrepancies appeared to be present between the KS Levels achieved between pupils from different schools and this information is illustrated in Figures 15, 16 and 17. In English and Maths, schools 4 and 5 appear to have more pupils achieving Level 5 than in schools 1, 2 and 3; whilst in Science, school 4 display the most Level 5 scores. The possibility of the proposed discrepancies being present was explored at a later stage using the data from the Key Stage marks (see section 4.6.2).

Figure 15 displays the relationship between KS2 English level achieved and school attended. Figure 16 displays the relationship between KS2 Maths level achieved and school attended and Figure 17 displays the relationship between KS2 Science level achieved and school attended.
Figure 15: The relationship between KS2 English level achieved and school attended

Figure 16: The relationship between KS2 Maths level achieved and school attended
Statistical exploration using Chi Square to examine whether a relationship was present between the KS2 levels achieved and other mediating variables was also complex due to the small numbers involved in the study. These variables included comparisons between pupils who spoke EAL and EHL, pupils with different degrees of SEN and teachers' ratings of pupils on both the WA and VI scales. Consideration of this data suggested that discrepancies are present between levels achieved within the KS2 tests and whether a pupil spoke EAL or EHL. This information was subsequently considered by examining the mark achieved by pupils within the KS2 tests prior to this information being categorized into KS2 levels. This is reported in section 4.6.2.

A positive correlation was generated between the VR data and the KS2 levels achieved. This is a predictable finding because the VR examination purports to
identify pupils’ predictive intelligence whilst the KS2 tests aim to consider pupils’ achievements. All available KS2 data was included (Levels 2 to 5) and tests to explore the relationships and differences between the data were selected. A positive correlation between the VR data and KS2 English Levels indicated that the relationship was significant \((r=0.74; p<0.01)\) using a Pearson product-moment coefficient, which is a parametric tool for correlation analysis suitable for continuous data. The same parametric tests elicited significant relationships between the VR scores and KS2 Maths Levels \((r=0.76; p<0.01)\) and the VR scores and KS2 Science Levels \((r=0.07; p<0.01)\). This relationship indicated that as the VR scores increased for individual pupils, so did the KS2 levels achieved in each subject area, although as stated previously, these elicited relationships are tentative and open to discussion and interpretation.

Although no relationship was discovered between the CSA categories and the KS2 levels, some significant relationships were found between aspects of the CSA results and KS2 levels using the Kruskal-Wallis test. A significant difference was found between pupils’ results on the WA Ratio and their KS2 English Levels \((H=7.94; df=3; p<0.05)\) and pupils achieving a Level 2 in English had the highest mean rank in terms of their WA ratio score. The small numbers involved \((n=4)\), and the fact that this result did not follow a trend within the rest of the data suggests that this is probably not valid but it is an aspect of research that could be examined in more detail within a larger cohort. No relationship was found between VI Ratio scores and KS2 data in terms of English Levels.
The Spearman's rho test was used to consider the relationships between KS2 Levels and the speed indices of the CSA. The results of these correlations are recorded in Table 10.

Table 10: The relationships between the levels achieved in KS2 tests and the speed indices of the CSA (Spearman's rho)

<table>
<thead>
<tr>
<th>KS2 English Level</th>
<th>KS2 Maths Level</th>
<th>KS2 Science Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WA Speed Index</strong></td>
<td>0.50**</td>
<td>0.45**</td>
</tr>
<tr>
<td><strong>VI Speed Index</strong></td>
<td>0.49**</td>
<td>0.4**</td>
</tr>
</tbody>
</table>

**significant at the 0.01 level**

There is a positive correlation between the two variables and this might indicate that pupils who gain higher speed index scores are also more likely to achieve higher levels in their KS2 tests. This possibility would suggest that some aspects of testing within the CSA may relate to pupils' intelligence, despite the reported independence of the two factors within the CSA Research Administration (CSA 2001). The data was also considered using the Kruskal-Wallis test, which indicated that there are significant differences in the mean speed index scores of pupils achieving different levels on KS2 tests (See Appendix 18). From considering the mean scores it appeared that there was a hierarchical relationship between pupils achieving particular scores on the speed indices and the KS2 levels achieved within each of the three core
subjects. These relationships are displayed within a model of the proposed relationships between the factors under scrutiny within this research project, which is reported in Chapter 5.

Significant differences were identified, using the Kruskal-Wallis test, between the mean percentage of items answered correctly on the CSA and KS2 levels achieved (see Appendix 18). From considering the mean scores generated by the computation, it appears that pupils who achieved higher KS2 English Levels also tended to answer a higher proportion of items correctly on both the WA and the VI items of the CSA. A strong correlation was identified when considering the relationship between teachers' rankings of pupils' intelligence and the pupils' performance in the KS2 tests. These relationships are described in Table 11.

<table>
<thead>
<tr>
<th>Teachers' ranking</th>
<th>KS2 English Level</th>
<th>KS2 Maths Level</th>
<th>KS2 Science Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literacy</td>
<td>-0.755**</td>
<td>-0.65**</td>
<td>-0.62**</td>
</tr>
<tr>
<td>Numeracy</td>
<td>-0.66**</td>
<td>-0.77**</td>
<td>-0.56**</td>
</tr>
<tr>
<td>Science</td>
<td>-0.69**</td>
<td>-0.66**</td>
<td>-0.64**</td>
</tr>
</tbody>
</table>

** significant at the 0.01 level
Some fascinating relationships were suggested between teachers' WA and VI ratings of pupils' cognitive styles, and KS2 levels. This information relates directly to Hypothesis 3; that pupils' academic outcomes are independent of teachers' perceptions of pupils' cognitive styles. It was anticipated that a Chi-Square test would be used to explore the relationships between Key Stage levels and teachers' cognitive style ratings. Due to the minimum cell frequency assumption being violated, this level of analysis was not possible. The results were therefore considered graphically, as reported in Figures 18, 19 and 20.

Figure 18: The relationship between teachers' WA ratings and the mean KS2 English level achieved

![Figure 18: The relationship between teachers' WA ratings and the mean KS2 English level achieved](image1.png)
Figure 19: The relationship between teachers' WA ratings and the mean KS2 Maths level achieved

Figure 20: The relationship between teachers' WA ratings and the mean KS2 Science level achieved
Within each core subject, this information appears to suggest a relationship between the positions at which pupils were rated on the WA scale by their teachers, and the levels that they achieved in their KS2 tests. In each instance, it is the pupils who are rated as a ‘1’ who achieved the highest mean levels in their KS2 tests and those rated as a ‘6’ who achieved the lowest mean scores. In this scale, pupils rated as a ‘1’ are perceived to learn in strongly wholist manner by their class teachers whilst those rated as a ‘6’ are perceived to learn in a strongly analytic fashion.

Figures 21 and 22 display the relationship between VI rating and KS2 levels in English and Science and indicate that pupils who are perceived to learn in a strongly verbal manner and are therefore rated as a ‘1’ on the VI scale are more likely to achieve higher KS2 levels in English and Science.
Figure 21: The relationship between VI rating and KS2 levels in English

Figure 22: The relationship between VI rating and KS2 levels in Science
The relationship was also identified in maths, but to a lesser degree. These relationships were considered further when using the Key Stage Marks, which offered more statistical flexibility through not being reliant on categorical data.

4.6.2 Key Stage Marks

Results of the assessments of normality are reported in Table 12. The assumption of normality in each of the tested areas was violated because \( p < 0.05 \).

Table 12: Results of the tests for normality within KS2 SATS Marks

<table>
<thead>
<tr>
<th></th>
<th>Kolmogorov-Smirnov statistic</th>
<th>Significance level</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>0.09</td>
<td>0.03</td>
<td>-0.26</td>
<td>-0.85</td>
</tr>
<tr>
<td>Maths</td>
<td>0.11</td>
<td>0.01</td>
<td>-0.25</td>
<td>-0.11</td>
</tr>
<tr>
<td>Science</td>
<td>0.10</td>
<td>0.01</td>
<td>-0.59</td>
<td>-0.43</td>
</tr>
</tbody>
</table>

A Mann-Whitney U test was used to explore the relationship between the means achieved in the KS2 tests by males and females. This test was selected because the means of two different groups of individuals (males and females) were being compared on a continuous variable (KS2 mark) that was not normally distributed. No significant relationships were discovered in any of
the three subjects tested. This provided a different picture to the exploration of
the data in the KS2 Levels in which a relationship was found between gender
and KS2 results in English and Science. This is likely to be because the marks
achieved in the tests are standardized as KS2 levels to provide information to
schools and parents about the achievements of individual children compared
to age-related norms. By manipulating the data in this way, continuous
variables are arranged as categorical variables and therefore cannot be
explored in the same way. Chi-Square was selected as being an appropriate
test to consider KS2 levels, as this test requires categorical data, whereas the
continuous data of the KS2 marks necessitated a test to compare means of
the two variables. The method by which the data was scrutinized therefore
drew alternative conclusions in relation to the differences in performance
between males and females in KS2 tests.

Significant differences were elicited when examining the KS2 marks achieved
between each of the schools that participated in the study. Using a Kruskal-
Wallis test, these relationships can be summarized as follows: English (H
=17.55; df= 4; p<0.005), Maths (H = 17.20; df= 4 ; p< 0.0005) and Science (H
= 29.81; df = 4; p < 0.0005). The mean ranks displayed as part of the Kruskal-
Wallis test used suggested that School 1 achieved the lowest marks in all
three subject areas and School 4 consistently achieved the highest marks.
This information may relate to the VR data in which pupils in School 1 elicited
the lowest mean scores in the 11+ examinations and pupils in School 4 displayed the highest mean scores.
Using a Mann-Whitney U test, significant differences were found between the KS2 marks of pupils who spoke EAL and EHL in English (Z=-2.45; p<0.05) and Science (z=-2.96; p<0.005). The statistic was not significant in Maths (z=-1.68; p>0.05).

When pupils' positions on the SEN register were considered in relation to their KS2 marks using the Kruskal Wallis test, significant differences were found for all three subject areas, however the numbers of pupils involved were extremely small and this information should be treated cautiously. This information can be summarized as follows: English (H = 34.34; df = 3, p<0.0005), Maths (H = 35.83; df = 3, p<0.0005) and Science (H = 24.90; df = 3, p<0.0005). In the English mark, pupils who were not placed on the SEN register achieved the highest overall marks, whilst in Maths and Science the 'non-SEN' group achieved higher rankings than those pupils placed at SA and SA+. It was interesting to note that the only pupil to have a Statement of SEN within the sample achieved the highest mean rank for both the KS2 Maths and Science marks and this pupil also gained a VR result of 118. These results may initially appear to be surprising, although the categories of SEN within the sample were not separated out due to the small sample size and the pupil with the Statement of SEN had needs relating to his diagnosis of Autistic Spectrum Disorder (ASD). From discussion with his class teacher it was revealed that he displayed a strong ability in non-verbal problem solving activities although, as might be expected from his ASD diagnosis, he found verbal tasks much more challenging.
No significant relationships were discovered between the CSA categories and the KS2 marks achieved using Spearman’s rho, which could support the supposition that CSA category is separate to that of tested ability. Using the same test, no correlation was discovered between pupils’ marks in English, Maths or Science and the WA ratio or VI ratio of the CSA.

A series of correlations were conducted using Spearman’s rho in order to explore the strength and direction of relationships between the KS2 marks and other variables (see Appendix 19). A positive correlation was found between the results of the three core subjects in the KS2 tests and the VR data, indicating a relationship between this test of predictive intelligence and pupil outcomes at KS2. Significant, positive correlations were also observed between KS2 marks in English, Maths and Science and both the speed indices and the percentage of items answered correctly on the two dimensions of the CSA. Teachers’ rankings of pupils’ intelligence in literacy correlated significantly with pupils’ KS2 marks in English, Maths and Science. Similarly, teachers’ rankings of pupils’ intelligence in Numeracy and Science correlated with the other subject areas.

A significant correlation was identified between the marks achieved in the KS2 English test and teachers’ ratings of pupils on the WA continuum. This finding suggests that there is a relationship between teachers’ perceptions of pupils’ cognitive style on the WA continuum and their performance in English KS2 tests. The direction of this correlation could indicate that the pupils who are perceived by teachers to learn in a wholist manner tend to gain higher marks.
in KS2 English tests than those who learn in an analytic manner. The essence
of these findings was also replicated in the KS2 Maths and Science test
marks, the results of which are recorded in Table 13.

Table 13: The correlation between KS2 test marks and teacher’s ratings on the WA continuum

<table>
<thead>
<tr>
<th>Correlation coefficient</th>
<th>KS2 English Mark</th>
<th>KS2 Maths Mark</th>
<th>KS2 Science Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson’s r</td>
<td>-0.43**</td>
<td>-0.39**</td>
<td>-0.35**</td>
</tr>
<tr>
<td>Spearman’s rho</td>
<td>-0.45**</td>
<td>-0.41**</td>
<td>-0.37**</td>
</tr>
</tbody>
</table>

**significant at the 0.01 level

This data was also explored using the Kruskal-Wallis test using KS2 mark as
the dependent variable. Significant relationships were found between the mark
achieved in English and teachers’ WA ratings (H =20.62; df = 5; p<0.001) and
also between the WA rating and both the Maths mark achieved (H =20.16; df =
5; p<0.001) and the Science mark achieved (H =16.25; df = 5; p<0.001). This
data suggests that there is a difference in the mean marks achieved in the
KS2 English, Maths and Science tests by pupils rated at different positions of
the WA continuum by their teachers. As indicated by the graphs displayed by
the KS2 levels, it appears from considering the mean ranks elicited by the data
that there is a direct relationship between pupils rated as learning in a wholist
manner on the WA continuum and KS2 marks. The relationships relating to the KS2 marks are displayed in Figures 23, 24 and 25.

Figure 23: The relationship between WA rating and mean KS2 English mark

![Diagram showing the relationship between WA rating and mean KS2 English mark.](image)
Figure 24: The relationship between WA rating and mean KS2 Maths mark

![Graph showing the relationship between Teacher's WA Rating and Mean Maths mark. The graph indicates a decreasing trend as WA rating increases.]

Figure 25: The relationship between WA rating and mean KS2 Science mark

![Graph showing the relationship between Teacher's WA Rating and Mean Science mark. The graph also indicates a decreasing trend as WA rating increases.]
A significant correlation was also found between the marks achieved in the KS2 tests and teachers’ ratings of pupils on the VI continuum. This finding relates directly to the research question at the heart of the study that asked whether teachers’ perceive pupils who learn in a verbal way as being more intelligent than pupils who learn in a visual way. The correlation suggests that there is a relationship between teachers’ perceptions of pupils’ cognitive style on the VI continuum and their performance in English KS2 tests. The direction of this correlation could suggest that the pupils who are perceived by teachers to learn in a verbal manner gain higher marks in KS2 tests than those pupils who are perceived to learn in a visual manner and this was true in each of the three subject areas tested, (see Table 14). It would be important for further work and analysis to be conducted to ascertain the strength and nature of this relationship.

Table 14: The correlation between KS2 test marks and teachers’ ratings on the VI continuum

<table>
<thead>
<tr>
<th>Correlation coefficient</th>
<th>KS2 English Mark</th>
<th>KS2 Maths Mark</th>
<th>KS2 Science Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson’s r</td>
<td>-0.47**</td>
<td>-0.34**</td>
<td>-0.41**</td>
</tr>
<tr>
<td>Spearman’s rho</td>
<td>-0.45**</td>
<td>-0.35**</td>
<td>-0.42**</td>
</tr>
</tbody>
</table>

**significant at the 0.01 level**
Further analysis using the Kruskal-Wallis test revealed significant relationships between the VI rating and the mark achieved in English ($H = 26.75; df = 5; p < 0.0005$), Maths ($H = 17.00; df = 5; p < 0.0005$) and Science ($H = 20.68; df = 5; p < 0.001$). These relationships are displayed graphically in Figures 26, 27 and 28.

**Figure 26: The relationship between VI rating and mean KS2 English mark**

![Graph showing the relationship between VI rating and mean KS2 English mark](image-url)
Figure 27: The relationship between VI rating and mean KS2 Maths mark

Figure 28: The relationship between VI rating and mean KS2 Science mark
4.7 Summary and Conclusions

The study aimed to explore the research questions relating to the concepts of cognitive style, teacher perceptions and pupil intelligence, and to test both the core hypotheses and the sub-hypotheses that considered the potential interaction effects between these factors and other, mediating variables. In doing so, the results appear to have raised some tantalising findings regarding potential relationships between particular factors which could have significant implications for understanding how teachers' perceptions of pupils' cognitive styles have a direct influence upon pupil outcomes within the classroom. The findings will be discussed in detail in Chapter 5, however the key findings are summarised below.

4.7.1 Research questions

At the heart of the study was the question of whether teachers' perceptions of pupils' intelligence are significantly influenced by pupils' cognitive styles. One of the most significant findings of this study was that a correlation was found between teachers' perceptions of pupils' intelligence and teachers' perceptions of cognitive style.

The research questions also raised the possibility of whether teachers perceive pupils who learn in a verbal manner to be more intelligent than those individuals who learn in a visual manner. The results of this study suggested the possibility that where a pupil is perceived by a teacher to be a verbal learner, they are also perceived to be more able than a peer who learns in a visual way. In addition to this finding, a relationship was found between
teachers' perceptions of whether a pupil learns in a wholist or analytic way and their intelligence. This could indicate that pupils who were perceived to learn in a wholist manner were perceived to be more able than their analytic peers by their class teachers.

These findings do not relate to whether the pupil is actually classed as a verbal/visual or wholist/analytic learner as assessed by an independent measure of cognitive style and a significant factor therefore appears to be the teacher's perceptions of the pupil's cognitive style rather than the pupil's actual cognitive style.

The third research question raised the issue of whether there is a relationship between teachers' perceptions of pupils' intelligence and pupils' learning outcomes. The evidence gathered within this study supported this premise and these results provoked two different interpretations. Firstly, this finding may be non-controversial and reassuring, as it could indicate that teachers are able to make objective judgements and classifications relating to pupil intelligence and to use this information to predict academic outcomes as stated in Hypothesis 1. Secondly, this information may indicate a causal relationship between teachers' perceptions of pupils' intelligence and pupils' learning outcomes, suggestive of earlier research such as 'Pygmalion in the Classroom' (Rosenthal and Jacobson 1968). This is particularly important to consider in light of the findings that teachers' perceptions of pupils' cognitive styles appear to influence their perceptions of pupils' abilities.
4.7.2 Hypotheses

The first hypothesis stated that teachers are able to make objective judgements and classifications relating to pupil intelligence and to use this information to predict academic outcomes. The key to this hypothesis is the word *objective*. The results of this study suggest that teachers are able to judge the comparative intelligence of pupils within their classrooms but what appears to be at question is the evidence upon which the judgements are made.

The second hypothesis proposed that teachers can accurately classify pupils' cognitive styles through information collected in daily classroom interactions such as observation and teaching. The results of this study suggest that teachers do not appear to be able to identify pupils' cognitive styles through their daily contact with them. This assertion was based upon the evidence that no correlation was discovered between the positions of pupils on the WA and VI ratios of the CSA and teacher ratings of pupils on the WA and VI scales. This finding has implications for developing an understanding of how teachers are able to match the learning environment to pupils' cognitive styles if specific assessments are required to identify individuals' cognitive styles within the classroom.

The third hypothesis considered whether pupils' academic outcomes are independent of teachers' perceptions of pupils' cognitive styles and the evidence gathered from this study does not support this proposition as
teachers' perceptions of pupils' cognitive styles appear to relate to assessments of pupils' potential and achievement, as assessed by the VR and KS2 scores. This is perhaps the most contentious finding from the study and will be subjected to careful consideration within Chapter 5.

4.7.3 Sub-hypotheses

The sub-hypotheses related to possible mediating factors within the research design and these raised some interesting questions in relation to the demographic data that was gathered. This included the discrepancy between the mean VR results for males and females and the fact that no affects were observed within the VR data for pupils who spoke EAL, a factor that might be expected to influence scores on a verbal reasoning test. In relation to pupils with SEN, the speed indices of the CSA provided some important information in relation to pupils' positions on the SEN register. These factors correlated significantly and therefore this is also an area for further consideration in research studies.

The data collected within this project generally supported the information held within the Research Administration of the CSA (Riding, 2001) that the WA and VI continua are independent of each other and of other constructs, such as intelligence and factors such as gender. Within the project, relationships were identified between the speed indices of the CSA and areas of both tested and perceived intelligence, a finding that contradicts Riding's assertion that the CSA is an independent measure of cognitive style. Some questions were also raised in terms of whether an even distribution of categorization is generally
expected within the CSA or whether there is a hierarchy of categories, with the majority of individuals positioned into one particular area.

The results and questions raised by this study should be interpreted carefully due to the small numbers involved, however some exciting questions and intriguing questions have been raised which warrant further scrutiny and these will be considered further in Chapter 5.
Chapter 5: Discussion

5.0 INTRODUCTION

5.1 FRAMEWORK

5.2 KEY THEMES FOR DISCUSSION

5.3 MODEL OF INTERACTION EFFECTS

5.4 CONSTRAINTS AND LIMITATIONS OF THE STUDY

5.5 IMPLICATIONS FOR POLICY AND PRACTICE

5.6 RECOMMENDATIONS FOR FURTHER RESEARCH

5.7 DISTINCT CONTRIBUTION OF THIS RESEARCH

5.8 CONCLUSIONS
5.0 Introduction

Some tentative answers, and indeed further questions were generated by the results of this study. In particular, some complex issues were raised regarding potential interaction effects between the three main areas of psychological theory that were under consideration; teacher perceptions, cognitive style and pupil intelligence. An iterative model was developed to summarise these effects and key issues arising from the research are discussed hereafter.

5.1 Framework

Five key themes were identified for discussion and these were recorded as follows:

- The influence of teachers' perceptions upon pupils' educational outcomes
- The relationship between teachers' perceptions and pupils' cognitive styles
- The identification of pupils' cognitive style by teachers within the classroom
- The contribution of mediating variables upon perceptions of pupil intelligence and cognitive style
- The concept of cognitive style and related models within the classroom
5.2 Key themes for discussion

5.2.1 The influence of teachers' perceptions upon pupils' educational outcomes

The results of this study suggest that aspects of the Rosenthal Effect (Rosenthal and Jacobson, 1968) continue to be evident within today's classroom. This represents a period of almost forty years after the influence of the Effect was initially identified as potentially affecting pupil attainments and this observation reinforces the necessity for a revival of interest into research in this area.

The data collected within this study suggests that teachers' constructs relating to the factors that constitute pupil intelligence are stable across different academic subjects and are also those that are assessed to represent success in tests of both pupil outcomes and predictive ability. The obvious benefits of this finding, in terms of a shared theoretical understanding between front line teaching staff and those companies who research and market tests of achievement and potential should be acknowledged, but also regarded within a wider context. Whilst the first hypothesis within this study proposed that teachers are able to make objective judgments and classifications relating to pupils' intelligence and to use this information to predict academic outcomes, one aspect of this hypothesis that requires further consideration is the level of objectivity upon which teachers' judgments are made. Attribution Theory (Weiner, 1986) proposes that individuals actively process available stimuli and
subsequently make inferences in order to understand their environment. Within an educational context, the stimuli available to the teacher that allows them to form a perception about a pupil depends upon the amount of contact that they had with that individual. The teachers that were involved in this study had all taught the pupils over a nine month period, and it is likely that their perceptions would have been developed from a wide range of information, including the child's social skills, cognitive development and approach to learning. It is the latter of these three areas that relates most closely to the concept of cognitive style.

Within this study, two key factors correlated with both teachers' perceptions of pupils' intelligence and the results of assessments of potential and educational achievement. These were; the speed at which information was processed and responded to, and the accuracy of the given response. Whilst it should not be concluded that a causal link is present between these factors, the data suggests that the potential influence of teachers' perceptions upon pupils' educational outcomes should be explored within the context of other studies. The hypothesis that these two factors are related to human intelligence reflects traditional views on the subject that are neither surprising nor innovative within the study of this area. Deary (2001) records that reaction time has been linked to the concept of intelligence since the 17th Century, whilst the ability to give correct responses to particular questions is a frequently used mechanism within attainment and intelligence testing. Whilst the strengths and weaknesses of these approaches are debatable, an additional and important issue arising from the results of this study was that
other factors were identified that also appeared to influence teachers' perceptions of pupils' intelligence. This importantly included a correlation between teachers' perceptions of pupils' cognitive styles and their perceptions of pupils' intelligence, a relationship that had previously not been considered within published literature.

In addition to the above finding, the results also indicated that pupils' academic outcomes correlated with teachers' perceptions of pupils' cognitive styles and therefore the importance of teachers' perceptions in potentially influencing pupils' educational outcomes should not be underestimated. There is however, a necessity for the results of this small-scale study to be considered with some caution and for further research to be conducted in this area. An alternative hypothesis to the above finding might be that pupils' intelligence is not independent of tests of cognitive style as the literature suggests (Riding and Rayner, 1998) and this reflects findings from contemporary research into the relationship between aspects of working memory and cognitive style (Riding et al., 2003). Part of the data from this study also supports this possibility, as significant relationships were identified between the selected measures of intelligence, and elements of the CSA results. This is clearly an area that justifies further exploration and research.
5.2.2 The relationship between teachers’ perceptions and pupils’ cognitive styles

One of the most potentially controversial findings generated by this research study was that significant relationships were uncovered between teachers’ perceptions of pupils’ cognitive styles, teachers’ perceptions of pupils’ intelligence and tests of pupils’ outcomes and potential. Using a one-way ANOVA, it was found that pupils who were perceived by their teachers to learn in a wholist or verbal way achieved higher results in tests of potential and achievement than their peers who were perceived to learn in an analytic and visual way. Moreover, it was the teachers’ perceptions of the pupils’ cognitive styles that were of significance to this relationship because there was no evidence to suggest that pupils who were assessed to learn in a wholist or verbal way through independent measures of cognitive style achieved different academic outcomes to their analytic or visual-learning peers.

These results initially suggest that the answer to the overarching research question of whether teachers’ perceptions of pupils’ intelligence are influenced by pupils’ cognitive styles can be affirmed, as can the more specific question of whether teachers perceive pupils who learn in a verbal manner to be more intelligent than those individuals who learn in a visual manner. Whilst it may be attractive to infer causality between these relationships, it is also important to consider alternative explanations for these results. At the beginning of the research process it was hypothesized that pupils’ academic outcomes [were] independent of teachers’ perceptions of pupils’ cognitive styles, but this was
not supported by the results of the study. Although the reasons for these outcomes can only be speculated upon, it might be suggested that teachers perceive wholists to be more intelligent than their analytic counterparts due to the wholists’ ability to assimilate and process large amounts of information in a single session, compared to an analytic learner who would be more likely to request for information to be broken down into smaller sections. For this reason, teaching staff might perceive the wholist learner to be less demanding of their time and more independent in their approach to learning than an analytic learner. Similarly, it could be suggested that verbal learners make themselves appear to be more prominent within the classroom through oral and written interactions with teaching staff. Little research evidence has been found to explore this possibility, although Riding and Read (1996) considered how pupils’ learning preferences relate to their cognitive styles. The results of their study indicated that analytic learners ask more questions than wholists, which would support the proposal that teachers might perceive these individuals as being less independent within the classroom.

Another explanation for teachers perceiving pupil verbalisers as being more intelligent than imagers could relate to the rate at which these individuals are perceived to process information. It is possible that teaching staff may believe the processing skills of verbalisers to be more rapid than in their visual counterparts because oral responses to questions are usually more immediately obvious to an observer. Research findings within this study indicate that teachers perceive processing speed to be an important factor in
forming a perception of pupils' intelligence levels (see 4.3.3) which could provide an explanation for the origins of this construct.

The theories proposed in order to explain these results are purely speculative and warrant further scrutiny. Within the context of the research, 11 to 14 year old wholists and imagers have been reported as being academically less successful than analytics and verbalisers at mathematical tasks (Riding and Rayner, 1998) although at the age of 16 the same authors reported that it was the wholist-verbalisers who achieved the highest results in mathematics GCSE. Recent evidence has suggested that the performance of individuals assessed as being an analytic or a visualiser is significantly affected by the capacity of working memory (Riding et. al., 2003) and that this relationship is less apparent in wholists and verbalisers. This could provide an indication of why teachers' perceptions of pupil intelligence relate to this particular cognitive profile.

5.2.3 The identification of pupils' cognitive style by teachers within the classroom

Within this study it was hypothesised that teachers can accurately classify pupils' cognitive styles through information collected in daily classroom interactions such as observation and teaching. The assumption that teachers are able to execute this activity successfully is made by both the LEA in which the study was conducted and within reported research (Riding, 2002). The
matching of pupils’ learning environments to their cognitive styles is considered to have positive implications for pupils’ learning outcomes, and this is reported within the SEN handbook developed by the LEA involved in this study and from more widely reported literature (Riding and Watts, 1997).

A significant finding from this study was therefore, that the teachers’ identification of pupils’ cognitive style within the classroom did not correlate with the cognitive style labels generated by the CSA. If further research indicated this relationship to be causal, this information would have wide reaching implications as it suggests either that teachers are either not able to identify pupils’ individual cognitive styles through classroom observation, or that the CSA is not measuring cognitive style. If the former possibility was supported by further evidence, it could suggest that teachers are identifying learning style or learning strategy as cognitive style. This finding would subsequently maintain the need for teachers to engage in training to help them to identify pupils’ cognitive styles within the classroom. This would be particularly relevant for school staff working with pupils who have learning difficulties, who find it most difficult to adopt flexible learning strategies when provided with materials that do not match their own cognitive styles (Riding, 2002). If research indicated that the CSA is measuring factors other than cognitive style, research studies that have used this tool would be subject to concerns regarding their validity. In addition to the findings from these studies being reconsidered, the further development of more accurate measures of cognitive style would be necessary. It is not possible within the scope of this
study to consider which of these hypotheses is likely to be true and more research is recommended to explore these issues further.

5.2.4 The contribution of mediating variables upon perceptions of intelligence, pupil attainment and cognitive style

The sub-hypotheses within this study related to the influence of possible mediating factors upon pupil intelligence and cognitive style, including: gender, SEN, pupils' home language and the school that the pupil attended.

5.2.4.1 gender

Within the sample females achieved significantly higher results on the VR exam than males, which is an important finding both for interpreting the results of the study and also for the LEA in which the study took place. Research has indicated that gender differences can be observed in children's learning preferences, with females preferring more discussion and language based activities and boys responding to practical and problem solving tasks (Riding and Rayner, 1998). It could be suggested by the discrepancy between the scores that the VR examination, as a test of verbal reasoning, is more suited to assessment styles of females and therefore places males at a disadvantage in this particular assessment. The implications of this finding are important in ensuring that the VR examination is not biased towards particular groups of students and therefore further investigation of this issue is recommended as a result of this research study.
In addition to the above finding, it was also observed that males and females achieved significantly different results in the KS2 levels achieved. In KS2 English, males displayed a peak at Level 4 whereas the female scores continued to rise steadily to Level 5. An identical picture was observed in Maths and Science, a fact that begs the question of why boys appear to be consistently underachieving within these tests and why girls' scores are skewed towards Level 5. Potential reasons for this phenomenon could include the organisation of the learning environment, sociological factors, genetic factors or the structure of the test materials. This is clearly an area in which considerable research is required in order to ensure equal opportunities for all pupils.

From the data collected within this it appears that gender effects are present in tests of pupil attainment and achievement, but not in tests of cognitive style and this supports the information held within the Research Administration of the CSA (Riding, 2001). Current literature proposing that some gender interactions may be present on the VI scale has so far proved inconclusive (Riding, 2002) and further research is warranted in this area.

5.2.4.2 SEN

The Researcher did not regard as controversial the finding of this study that pupils with SEN achieved lower scores on tests of achievement and potential than their peers who had no recorded SEN. Some interesting discrepancies were observed however, in the performance on specific areas of the CSA amongst this group of pupils. The results suggested that relationships are
evident between general processing speed and aspects of the CSA, and also that pupils placed on the SEN register answered fewer questions correctly on the CSA than peers without SEN. These areas displayed particular profiles for pupils placed in different categories of SEN, which appeared to follow the pattern that is recorded in Table 15.

Table 15: The observed pattern between SEN and % of correctly answered items on the CSA

<table>
<thead>
<tr>
<th></th>
<th>% of items answered correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VI Scale</td>
</tr>
<tr>
<td>No recorded SEN</td>
<td>High</td>
</tr>
<tr>
<td>Pupils placed at School Action</td>
<td>Low</td>
</tr>
<tr>
<td>Pupils placed at School Action Plus</td>
<td>Low</td>
</tr>
</tbody>
</table>

It is assumed that these results would be dependant on the type of SEN reported, for example that pupils with specific literacy difficulties would find it more difficult to respond to the written information contained within the first subtest of the CSA rather than the pictorial images displayed in subtests two and three. The data was not refined in this level of detail because the numbers were too small to warrant analysis, although it is acknowledged that this would be an area to consider within a larger sample of pupils.
5.2.4.3 Pupils' home language

It was an encouraging that no evidence was found to suggest that pupils who speak EAL have lower 11+ scores than their EHL speaking peers. This finding should be treated with caution however due to the small numbers of pupils involved in the study who spoke EAL.

The ability to read English was a requirement for participating in the CSA tasks, which would have excluded pupils who were new to learning English, and introduced bias within the sample. Bias was also suggested by the CSA data from the study as differences were observed between the EAL and EHL pupils. Pupils who spoke EHL achieved considerably higher mean scores in the percentage of correctly answered items on the CSA than peers who spoke EAL. This effect was greater on the VI dimension than the WA dimension which is likely to result from the VI dimension requiring the use of higher order language skills, such as inference, to respond appropriately to individual questions. These higher order skills represent the later competencies that develop in individuals who are learning a new language, which could account for this discrepancy in the results.

5.2.4.4 School attended

Significant differences were identified between both the VR scores and KS2 results achieved by the pupils attending different schools, with School 1 having statistically lower scores in both sets of tests than the others used in the
sample. The reasons for this are not clear although the demographic information gained within the study might suggest some possible explanations for this finding. The pupils in School 1 had a high proportion of pupils with SEN and also have the second highest number of pupils who spoke EAL in the sample although this does not explain why the pupils in School 3, which contained both the highest number of EAL pupils and comparable numbers of pupils with SEN to School 1 did not reveal similarly lowered VR scores. One explanation for these differences could be the influence of the school ethos and culture, which research has shown to impact upon teachers' perceptions and expectations of pupils (Miller, 2003).

Staff in the Policy, Planning and Information team of the LEA monitor the 11+ results of each school through the County database, but the results of this study suggests that further research could be conducted into the factors that promote success within this examination. This would help to ensure that groups of individuals from different backgrounds have equal opportunities to achieve success within the VR selection process.

5.2.5 The concept of cognitive style and related models within the classroom

At the beginning of this study and at the heart of the research process was the overarching research question of whether teachers' perceptions of pupils' intelligence are influenced by pupils' cognitive styles. The data suggests evidence of a relationship between these constructs, as pupils who process...
information in a wholist manner were perceived to be more intelligent than
their analytic counterparts, and verbalisers were perceived to be more
intelligent than visualisers. Teachers' perceptions of intelligence also
correlated with tests of pupils' potential and educational achievements.

The consideration of research into the concept of intelligence presented a
particular challenge for this study because this is an area of psychology that
has provoked much controversy in its definition and measurement (Slavin
2003). Some aspects of the study of intelligence link closely to work on
cognitive style, particularly where multiple intelligences are considered
(Gardner and Hatch, 1989). Within this study it was important to clarify the
differences between these areas whilst remaining aware of potential
conceptual links between the individual constructs.

The accuracy at which teachers in the study were apparently able to classify
the intelligence levels of pupils strongly contrasted with their ability to
accurately identify pupils' cognitive styles. The results appear to indicate that a
rather rigid view of intelligence is still evident within British classrooms, with
teachers being readily able to place pupils within a hierarchy of intelligence
within the class. This is perhaps not surprising within the current educational
climate, where successes for schools are largely measured upon the basis of
Key Stage test results, which are subsequently reported in league tables.
Within the context of the study, the perceptions generated by the teachers
may have been particularly dogmatic, as the Authority in which the work was
conducted retains the use of the 11+ examination to select children for particular schools.

The Author suggests that a more inclusive perspective is required in British schools to allow value to be awarded to individuals with different strengths. One way of encouraging a cultural change in this area could be to reframe peoples' understanding of the concept of intelligence in order to emphasize successes in different curricular areas.

Another way to support a philosophical change in schools would be to promote the concept of cognitive style within the classroom. This removes the emphasis from the pupil of being considered as intelligent or unintelligent and defers responsibility towards the teacher for providing the pupil with successful learning opportunities. In order to consider this possibility it would be necessary to broaden the current research that exists in relation to cognitive style. Considerable theoretical information is available about this area, although much of it has been conducted by Richard Riding and this should be treated with some caution in terms of considering how issues of reliability and validity, for example through flawed methodologies, might be repeated throughout his many studies. One aspect of research into cognitive style that is not favoured by Riding is that of kinaesthetic and activity-centred learning, because the Riding and Cheema (1991) model considers cognitive style to be a bipolar construct of two dimensions. Activity-centred learning is described within the Riding and Cheema (op. cit.) paradigm as being related more to learning style and learning strategy than to cognitive style. This belief may be
superseded by current interest in dynamic assessment and teaching techniques that rely upon the demonstration and rehearsal of skills to achieve greater fluency. This active involvement of pupils within their learning environment appears to have more in common with the kinaesthetic approaches to learning than the rather rigid notion of a fixed cognitive style in which an individual has little control over their responses to external stimuli. This study emphasized the necessity for more divergent thinking within education, although it acknowledges that an important consideration when undertaking real-world research is the necessity to balance creative problem solving against practical constraints.

5.3 Interaction effects

Following the original review of the literature, a model was developed to propose how the relationship between teacher perceptions (Core dimension A), pupil intelligence (Core dimension B) and pupil cognitive style (Core dimension C) might affect pupils' learning outcomes (X). At that time it was proposed that it was the combination of interactions between Dimensions A, B and C that related to pupil outcomes, although, as has been identified by the results of this study, the relationships between the dynamics are extremely complex. A model to explain these relationships in light of the findings of this study was subsequently developed and is displayed in Figure 29.
Figure 29: A model of the relationship between cognitive style in relation to teachers' perceptions of pupils' intelligence, tested intelligence and teachers' perceptions of cognitive style

Key:
- ••••• positive correlation
- ••••• negative correlation
- ••••• Statistically significant correlation (large)
- ••••• Statistically significant correlation (medium)
- ••••• Statistical significance between groups (1 way ANOVA)
* CSA data
The presented model displays statistically significant relationships between different factors that were considered within the research process. This relates primarily to correlation data, with the strength of the relationship indicated by different colours. Although correlation strength can be difficult and controversial to define, guidelines developed by Cohen for that purpose (Cohen, 1988) were selected for use with this model.

Negative correlations in this model all relate to teachers' perceptions of pupils' comparative intelligence, measured using the ranking exercise. In this study, pupils given lower rankings were perceived to be more intelligent than their peers with higher rankings and the pupil who was ranked as number 1 in the class was considered to be the most intelligent. A negative correlation was therefore present between pupils given lower rankings and higher scores in VR and KS2 assessments. The correlations between teachers' perceptions of intelligence and cognitive style were positive because the pupils given lower scores on the cognitive style rating measure were considered to be strongly verbal or strongly wholist learners. A relationship was generated between these individuals and pupils who were perceived to be more intelligent in the class, who were given lower rankings.

The model demonstrates that teachers' perceptions of pupils' cognitive style correlate with their perceptions of pupils' intelligence. A relationship was also identified between teachers' perceptions of pupils' cognitive styles and predictive intelligence as described previously (see 5.2.2). Whilst teachers'
perceptions of cognitive styles do not correlate with the cognitive style categories elicited from the CSA data, the model displays how these two factors share some of the same common dynamics. In particular, teachers' perceptions of cognitive style and the accuracy of the pupils' responses on the CSA correlated independently with the academic achievement (KS2) test results. This correlation was stronger between the VI items and achievement results than in the WA items and achievement results, which could indicate that the CSA is assessing some aspects of intelligence when it purports to independently measure cognitive style. These results should therefore be considered with some caution.

The correlations generated by the study relate to an initial exploration of the data to ascertain the validity of further work in this area. From examining the data, it is clear that research into teacher perceptions is overdue a revival of interest and that the implications of this information are relevant within the modern educational climate. The model provides a tentative exploration into the relationships between teachers' perceptions of pupils' cognitive styles and pupils' intelligence although it is acknowledged that it requires further consideration in the light of more extensive research. In particular, mediating variables such as gender, age, SEN, EAL and school-based factors have not been included within the model as the numbers within the research were too small to be able to formalize these relationships. This area of research has the potential for additional investigation in order to explore whether these variables influence teachers' perceptions of pupils' intelligence and pupils' cognitive styles.
5.4 Constraints and limitations of the study

The investigation of the hypotheses presented a challenge in terms of both the theoretical knowledge base underpinning the study and the practical and methodological constraints of undertaking an applied research study.

In terms of research into teacher perceptions and attributions, much of the work that had been conducted in this area was not current, and use of this dated information sat uncomfortably within a study that sought to offer cutting edge and alternative views to established work on cognitive style. Work into person perception, attribution and intelligence relies closely upon the place and time in which the research was conducted and historical and cultural trends are likely to significantly influence the results; An example of this can be observed by considering the perceptions of educators towards children with special educational needs in the UK over the past century. Some of the information gathered in relation to this study would be unlikely to retain validity over time and had to be viewed with caution.

Another difficult element of developing and implementing the study resulted from the abstract nature of the theories behind the work. This aspect of the project created challenges for the research design in terms of considering how data might be gathered to measure teachers' perceptions, intelligence and cognitive style. The investigation of each of these areas was open to bias through subjectivity, and awareness of this factor was important both when
considering the literature relating to the subject and in planning the methodology for the study.

The study incorporated a relatively small sample size, particularly when exploration between subgroups within the sample was necessitated. This limitation made it difficult to infer relationships from the data and was important to consider when suggesting causal relationships between the different constructs. An example of this related to the aspects of the CSA data that categorised pupils according to their cognitive style. Within this study there was little variety observed between the numbers of pupils placed within each of the nine style categories, which raised the question of whether the results were influenced by the subjects' ages. The author of the CSA maintains that the age of individuals completing the CSA does not influence the generated results, but it is notable that the individuals contained within the standardisation sample of the CSA (n=999) represented a demographically different cohort than those within the study sample, particularly in terms of subject age. Out of the subjects within the standardisation sample, only 17% were 11 years old, with a range from 11 years to 65 years. Some further work is therefore necessary to consider whether an age-related bias is present within the CSA, or if the study sample is simply skewed from that which would be expected. In order to generalize the findings of the study onto a wider population much larger numbers would be required within the sample to minimize the possibility of error and sampling bias.
Another constraint of the study related to the tools selected within the methodology. Detailed critique of these tools is contained within Chapter 3 (see 3.7), however on completion of the study some additional limitations were also evident. Two of the five class teachers involved in the Teachers' Rankings exercise stated that they found it difficult to rank pupils' intelligence in terms of their skills in literacy, numeracy and science as they felt that these subject descriptions were too broad. This was not anticipated at the onset of the study, despite the fact that the teacher involved in the pilot study had stated that subject categories would support her categorization of pupils into comparative ability. Both of the teachers involved in the main study who found this task difficult stated that they would have benefited from these categories being broken down into smaller descriptions of skills, for example, 'spelling', or 'computation'. Further piloting of the materials used in the study would be proposed if they were to be used in future research to ensure that they would be accessible to the majority of respondents. Within the context of this study it could be suggested that individuals who found it difficult to respond to broad categorization tasks in this way could themselves be described as learning in an analytic manner because they appeared to benefit from processing small chunks of information. This premise could not be explored further because formal testing of the teachers' cognitive styles was not possible within the time constraints of this research project, and therefore additional future research in this area could seek to extend understanding in this field.

In spite of the constraints and limitations of this study, the results indicate that there is a reason to consider this area of psychological theory further and to
raise awareness in relation to the important issues of how teacher perceptions may influence classroom life. The research does not provide conclusive answers to the question of whether there is a relationship between teachers’ perceptions of cognitive style and their perceptions of pupils’ intelligence, but suggests some relationships are evident that warrant further investigation. This study represents an important and distinct piece of research that has implications for psychological policy and practice.

5.5 Implications for policy and practice

5.5.1 Policy

This study raises some important issues for educational policy relating to how intelligence is perceived and measured within both the national and local context. It suggests that certain behaviours and learning patterns are more valued in British classrooms than others and that pupils’ outcomes might depend upon how individuals are perceived to approach their school based learning.

It can be argued that in Britain today, intellectual success is largely perceived as being determined by examination results and the longevity of an individual’s formal educational career. Whilst it could be suggested that Government initiatives are trying to challenge this view through the development of specialist secondary provision, including sports colleges and academies for the visual arts, the emphasis placed upon regular, normative testing during a
pupils' education is suggestive of a traditional model of understanding the concept of intelligence within national educational policy.

Whilst there is popular and often financial recognition for skills-based competencies, such as those that can be observed in top athletes, in our culture these are not perceived as intellectual activities. The adoption of an alternative model of intelligence within educational policy could promote success in much broader terms within the classroom. An example of this might include Sternberg's triadic theory of successful intelligence (Sternberg, 2004), in which analytical, creative and practical abilities are equally utilized to achieve successful intelligence.

Even within the conceptually narrow understanding of intelligence that prevails today within society, it is likely that the policy of using tests of intellectual potential within certain authorities will continue to cause controversy within the field of education. This is likely to be particularly where those tests are used to segregate pupils into different educational environments. The use of the 11+ examination, which is used for that purpose, has provoked considerable debate. Recent research in this area has focused upon how successfully VR tests predict the future academic achievements of pupils from different ethnic groups (Fredrickson and Petrides, submitted for publication). More work in this area is clearly warranted to unpack the concept of ethnicity and to explore the attainments of pupils who speak English as an additional language within these examinations. Many of the pupils within the study reported within this thesis who described themselves as being from a 'White, UK' background
spoke a variety of different languages at home, and this would need to be accounted for in validating such a study. Many research projects assume that linguistic diversity is linked to ethnicity and although this is partially true, the additional factor of home languages spoken should also be recorded within the data. Other important factors relating to tested intelligence might include the gender differences between the observed VR scores established within this study and exploration of the factors that promote success in VR exams. This work is essential to ensure that if this manner of segregation is to continue within today's educational system that the selection methods used should be valid and reliable.

5.5.2 Practice
For psychologists working within an LEA, the results of this research suggest a number of important practical implications. Within the area of cognitive style, this study raised a number of opportunities for future research which practicing EPs could undertake. Most significantly, the issue of whether teachers are able to identify the cognitive style of pupils within their classroom was questioned and there are subsequently implications for EPs in supporting teachers in providing learning environments that match pupils' cognitive styles. EPs could play an important role in considering how teachers may accurately assess the range of pupils' cognitive styles within their classes and to utilize this information to assist in supporting pupils' learning.

The matching of pupils' cognitive styles to their learning environment is an area that is particularly relevant when working with pupils who have learning
difficulties as research indicates that these are individuals who may find it more difficult to adapt to teaching styles that do not reflect their preferred mode of working. Training teachers about the importance of differentiating for cognitive style within the classroom, particularly in terms of the implications of this approach for pupils with special educational needs, could be an important role for LEA psychologists. In addition to raising awareness about pupils' cognitive styles, information could be disseminated in relation to how teachers' own perceptions of pupils might affect educational outcomes. Educational psychologists could play an important role in training teachers about these aspects of classroom management.

Further research into this subject is essential and this is an area in which psychologists from different disciplines could combine their skills to explore the results generated by this study.

5.6 Recommendations for further research

The recommendations for further research that were highlighted by this study are reported in terms of the three key areas; person perception/attribution, intelligence and cognitive style.

5.6.1 Person perception/attribution

One potential benefit resulting from the fact that this area of research has enjoyed little attention in recent years is that there are many opportunities for studies to take place to explore the field. Of particular interest to this project would be additional work into the subject of teachers' perceptions of pupils and
more specifically, research into how teachers' perceptions are influenced by pupils' cognitive styles. Additional research opportunities could relate to how teachers' form their perceptions of pupils with SEN as this would also provide a fascinating insight into an under researched area. The question of whether individuals' cognitive styles affect their personal attributions has not been addressed within the literature and therefore a study to examine this relationship is warranted to generate data potentially linking these areas together.

One of the major difficulties in considering the subject of person perception and attribution was the fact that the knowledge base in this area is dated and subsequently the research suffers from antique methodologies and research tools. A revival of research in this field is clearly overdue and it is anticipated that the results of this study may help to verify the need for a renewal of interest in this area. One particular study could consider how teachers' perceptions of pupil intelligence are formed, although further work would be necessary with the individual teachers involved, perhaps in considering their personal constructs in relation to pupil intelligence.

Some comparatively recent research conducted by Burnett (1999) considered the relationship between children's self-talk and academic self-concept. By considering how pupils' perceptions of their own intelligence might affect academic outcomes, empirical knowledge in this area could be extended. There also appears to be little research into the effects of raising teacher awareness into expectancy effects and attributions. Consequently the implications of how and to whom this information is imparted should be studied.
carefully to ensure that its potential outcomes are positive for both teachers and pupils. It could be argued that in today's pressurized and litigious educational climate, increasing the expectations made upon teachers without additional support could increase their stress levels and raise anxiety levels which in the longer term may actually be detrimental for pupils.

5.6.2 Intelligence

One of the difficulties in considering the construct of intelligence is that the development of tools that purport to measure particular skills is confined by the philosophical arguments about what is actually being measured. This study has aimed to examine interaction effects between intelligence and cognitive style in a different manner to which it has previously been considered, for example by using tests of both predictive intelligence and outcomes. It is acknowledged that this research is not comprehensive and there is enormous scope for these relationships to be broadened out to encompass other theories of the component parts of intelligence and how they relate to factors such as cognitive style.

5.6.3 Cognitive style

One important recommendation arising from this research is that the CSA requires considerable updating as an assessment tool to encompass the benefits of current technology. In addition to this, the assumptions under which the CSA was developed require further consideration to ensure that this measure is reliable and suitable for psychological research.
In using the CSA, some specific relationships were uncovered that might have implications for the way in which this assessment tool is used. In particular, relationships were identified between CSA scores on the speed index, the number of correct answers on the CSA and SEN categorization. This suggests there to be some links between the CSA results and pupil intelligence, which draws into question its validity in terms of being a measure of an independent construct. As stated previously, the CSA design appears to have been developed upon a number of assumptions that require rigorous investigation. One such example of this is whether individuals classed as verbalisers actually do respond better to text than their visualising counterparts.

The results of this study suggest that teachers are not able to identify cognitive style though their daily interactions with pupils and a question arising from this premise might explore the factors that are currently being identified as cognitive style within the classroom. Research in this area could consider which pupil behaviours influence teachers in making judgments about pupils’ cognitive styles and also which behaviours and assessments provide a more accurate indication of pupils’ cognitive processing. It could also be questioned whether it actually matters whether a teacher is identifying cognitive style as learning style within the class because it is likely that a teacher who is already differentiating the curriculum appropriately will be accounting for all pupils’ learning preferences. Any additional benefits of reporting on how to identify cognitive style could subsequently be minimal. An area of more relevance might be in conducting specific research into the cognitive styles of pupils with particular special educational needs as it is this cohort of pupils who are
reported to be less able to establish a range of learning styles and strategies to cope with a cognitively hostile environment. Some work has been reported about the cognitive distribution of special school pupils and the relationship between pupils who display particular emotional and behavioural difficulties and cognitive style (Riding and Rayner 1998) but it is clear that this area warrants much greater attention and investigation.

As a result of this study suggesting that teachers perceive pupils with verbal and wholist cognitive styles to be more able than their peers, one fascinating research project could consider whether these views are also replicated by pupils within the classroom. Additionally, international studies of cognitive style could explore whether the teachers' judgments revealed by this research would be replicated cross culturally whilst historical research might reveal the types of social judgments that have previously been made about pupils of different cognitive styles in societies where different values were promoted. In Victorian society where children were encouraged to be 'seen and not heard', pupils who learned through verbal means might be considered more problematic than in today's culture in which verbal confidence and competence are encouraged through the National Curriculum's Speaking and Listening targets. In those times, the visual learner may have been perceived as being more successful than their verbal counterparts.

5.7 Distinct contribution of this research

The most distinct contribution of this research study is that the results that have been generated provoke debate. The questions raised within the research in relation to the objectivity of teachers' judgements within the
classroom are of interest not only to educational psychologists, but also to individuals involved in developing educational policy, LEA staff, teachers, parents and the pupils themselves.

An important question for debate generated by this study is whether teachers' perceptions of pupils' cognitive styles may directly influence their perceptions of pupils' intelligence. If this were affirmed through further research, the implications would be wide reaching for all individuals working in education as this question elicits particular concerns in relation to equal opportunities. The possibility that teachers perceive children with good verbal ability to be more intelligent than their peers had been previously considered within the literature through small scale, unpublished research (Nunes and Pretzlik, 2000), but this hypothesis continues to require considerable investigation. The effects of cognitive representation, that is whether the pupil learns in a wholist or analytic manner, upon teachers' perceptions of intelligence had not been previously considered within research. This debate has subsequently been opened by this research project.

Another important area for discussion provoked by this study is the challenge to the assumption that teachers are able to identify pupils' cognitive style through their daily interactions. This debate is particularly relevant within the local context of this study, but as research indicates that the appropriate matching of classroom materials to cognitive style has implications for classroom outcomes (Riding and Rayner, 1998) there are also implications for National policy. The question was raised of whether GCSE studies are biased
towards pupils with particular cognitive styles because of the particular mode of delivery and assessment within secondary classrooms, and this area is clearly important to consider.

Potentially, the most controversial debate arising from this study was the suggestion that a diametric relationship may exist between teachers’ perceptions of pupils’ cognitive styles and tests of both educational potential and predictive intelligence. This finding may be considered highly contentious, as this information implies that pupils’ outcomes may be dependent upon the perceptions that are formed by their teachers in relation to pupils’ cognitive styles. This suspicion clearly warrants considerable investigation but in suggesting this possibility this project has unearthed a unique perspective within psychological research and sought to provoke further discussion.

In implementing the study, traditional debates such as the concept of intelligence and person perception were revisited alongside more cutting edge research, such as that of pupils’ academic self-concepts. The study aimed to marry three areas of psychology that had previously not been combined in order to explore an area in which a research vacuum had been identified. In doing so, the study elicited some intriguing findings concerning the relationships between teachers’ perceptions of pupils’ cognitive styles and aimed to generate discussion about this area.

At the heart of the research into cognitive style there is a desire to promote equal opportunities for all and to ensure that the educational system is
unbiased in the possibilities that it offers. This study has made a significant contribution to extending the knowledge base in this area in four ways:

- Highlighting potential inequalities within the current system
- Suggesting many opportunities for future research in this area
- Developing awareness of the issues
- Promoting the development of a psychological knowledge base into connecting how teachers' perceptions of pupils' intelligence might be influenced by pupils' cognitive styles

In summary, this study has provided a distinctive contribution to the development of psychological theory and research by combining three distinct conceptual areas of psychology to address an original research question. In doing so, additional hypotheses have been developed that would benefit from further scrutiny in order to develop a comprehensive and current knowledge base in this area.

5.8 Conclusions

This study has synthesized theories from different fields of psychology in order to consider the research questions and to test the hypotheses and sub-hypotheses. In doing so, further issues have been raised for both educational psychologists working in applied settings and for future research.

From considering the literature it appears that this study has made a unique attempt to consider the research questions, providing a fresh contribution to the psychological knowledge base. The information elicited by this study and
the critical thinking behind the research questions has also contributed to the
originality of this work

Some intriguing questions have been raised by the results of this research and
it is suggested that further exploration of this area would be beneficial. This is
an area in which psychologists from social, cognitive and educational fields
could collaborate in order to share expertise.

Implications for educational psychologists (EPs) working within an applied
setting were raised as well as for those individuals working in research
settings. A useful training package for teachers that could be developed by
applied EPs would show how cognitive style could be assessed within the
classroom. This package could also consider how teachers' knowledge of
pupils' cognitive styles might influence differentiation of the learning
environment. This is of particular importance when it is considered that the
matching of pupils' cognitive styles to their educational context is considered
to be highly significant in promoting positive learning outcomes and in
removing barriers to educational inclusion. The research study does not
attempt to provide a body of evidence that is exhaustive or conclusive, rather it
seeks to stimulate attention and promote interest in this area.
Chapter 6: References


determination of learning styles as an aid to individualised computer-based

personality in 12 year old children. *British Journal of Educational Psychology,
65*, 113-24.


presentation on learning performance. *British Journal of Educational
Psychology, 63*, 297-307.

children's detection of changes in prose passages. *Educational Studies, 9*,
159-68.


Addison-Wesley Publishing Co: Reading, Massachusetts.

Pearson Education Inc: Boston.


Sternberg, R.J. and Detterman, D.K. (Eds.) (1986). What is intelligence?


Additional information:

Microsoft Excel available from www.microsoft.com

Microsoft Windows available from www.microsoft.com

SPSS available from www.spss.com
APPENDICES
### Chapter 7: Appendices

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ONE</strong></td>
<td>Parental consent letter (pilot)</td>
</tr>
<tr>
<td><strong>TWO</strong></td>
<td>Report to parents (pilot)</td>
</tr>
<tr>
<td><strong>THREE</strong></td>
<td>The dimensions of cognitive style</td>
</tr>
<tr>
<td><strong>FOUR</strong></td>
<td>Classroom Observation Scale- information</td>
</tr>
<tr>
<td><strong>FIVE</strong></td>
<td>Classroom Observation Scale- interaction</td>
</tr>
<tr>
<td><strong>SIX</strong></td>
<td>Classroom Observation Scale- activity types</td>
</tr>
<tr>
<td><strong>SEVEN</strong></td>
<td>Classroom Observation Scale- settings</td>
</tr>
<tr>
<td><strong>EIGHT</strong></td>
<td>Classroom Observation Scale- manner</td>
</tr>
<tr>
<td><strong>NINE</strong></td>
<td>Results from the CSA (pilot study)</td>
</tr>
<tr>
<td><strong>TEN</strong></td>
<td>Initial contact (main study)</td>
</tr>
<tr>
<td><strong>ELEVEN</strong></td>
<td>Summary of research</td>
</tr>
<tr>
<td><strong>TWELVE</strong></td>
<td>Parent permission letter</td>
</tr>
<tr>
<td><strong>THIRTEEN</strong></td>
<td>Feedback report</td>
</tr>
<tr>
<td><strong>FOURTEEN</strong></td>
<td>Ranking proforma</td>
</tr>
<tr>
<td><strong>FIFTEEN</strong></td>
<td>VI rating scale</td>
</tr>
<tr>
<td><strong>SIXTEEN</strong></td>
<td>WA rating scale</td>
</tr>
<tr>
<td><strong>SEVENTEEN</strong></td>
<td>Correlations between teachers’ rankings and CSA scores</td>
</tr>
<tr>
<td><strong>EIGHTEEN</strong></td>
<td>Recorded differences in the mean scores between KS2 levels and other variables</td>
</tr>
<tr>
<td><strong>NINETEEN</strong></td>
<td>Correlations between KS2 marks and other variables</td>
</tr>
</tbody>
</table>
Appendix One: Parental consent letter for the pilot study (anonymised)

Dear Parent/Guardian,

Re: Educational Psychologist’s visit

I am writing to you as the link Educational Psychologist for School X.

As part of my doctorate studies, I am looking at children's learning. In order to gain information for my pilot study, I would like to make an observation of some of the pupils in your child’s class and to work on a short computer task with a few individuals, who will be chosen at random. This will take place towards the end of next week and will not interfere with your child’s normal lessons.

I anticipate that the children selected for the computer task will find it enjoyable; it will also provide some information about your child’s learning. Parents of the children who complete the computer task will receive a short report describing the work completed during the session and any conclusions that were made from their approach to the computer tasks.

The children who are observed and who complete the task will only be known to me. They will not be identified in my reporting of the study and the name of the school will not be mentioned. You may therefore be assured that my observations and work with the children will remain confidential.

If you are not happy for your child to be involved in the study, please could you complete and send the slip below to Mrs X before Tuesday 3rd July. I will be happy to answer any questions that you might have on (telephone details).

Julia Clark
Chartered Educational Psychologist

________________________________________________________________________

Name of Pupil:

I do not wish my child to be considered for the Educational Psychologist's study.

Parent/Guardian Signature
Appendix Two: Report to parents- anonymous (pilot study)

Dear Mr and Mrs X,

You may remember that I wrote to the parents of all of the children in Mrs Y’s class regarding my research studies. At that time, I asked whether you would be happy for Z to be selected to work with me, in order to gain information for the pilot study for my Doctorate in Educational Psychology.

I am sure that Z has now told you that he was asked to take part in the study, which involved him completing a short computer task after I had made an observation of the pupils within his class. I would now like to let you know what I found out about Z’s learning from the work that he completed.

Using a computer program called the Cognitive Styles Analysis (CSA), I was able to gain information about Z’s cognitive style, both in terms of how he represents and structures information. The ‘representation’ part considers whether Z responds more effectively to verbal or visual information. The ‘structure’ part looks at whether he views new information in separate parts, or as a whole.

Z’s performance on the CSA shows that he can be described as a (x)
This means

Verbal/Imager dimension:

Wholist/Analytic dimension:

I am sure that Z will be interested in this information and would suggest that you discuss these findings with him.

May I take this opportunity to thank you for allowing Z to take part in this study and to reassure you that the information that I have collected is confidential. Please contact me if you would like any further information.

Yours sincerely,

Julia Clark
Chartered Educational Psychologist
Learning Support
Appendix Three: Cognitive style labels elicited by the CSA (CSA Research Administration 2001)

<table>
<thead>
<tr>
<th>Wholist-Analytic Dimension</th>
<th>Analytic Verbaliser</th>
<th>Analytic Bimodal</th>
<th>Analytic Imager</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1.02 &amp; &lt;=1.35</td>
<td>Intermediate Verbaliser</td>
<td>Intermediate Bimodal</td>
<td>Intermediate Imager</td>
</tr>
<tr>
<td>&lt;=1.02</td>
<td>Wholist Verbaliser</td>
<td>Wholist Bimodal</td>
<td>Wholist Imager</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verbal-Imagery Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.98</td>
</tr>
<tr>
<td>&gt;0.98 &amp; &lt; 1.09</td>
</tr>
<tr>
<td>&gt;1.09</td>
</tr>
</tbody>
</table>
Appendix Four: Classroom Observation Schedule (Waxman et al., 1988)

The Classroom Observation Schedule (COS) (Waxman et al., 1988), is a method of observing children's behaviours within a classroom setting. It has been used across the educational age ranges and a summary of its applications can be found in the Psychology in Education Portfolio (Fredrickson and Cameron (Eds.), 1999). Behaviours are considered within six categories: Interaction, Selection of Activity, Activity Types, Setting, Manner and Language Used. The observations therefore elicit data describing pupil interactions with adults or peers within the classroom, whether the activity is teacher or pupil-led, the learning context and materials used within the lesson, groupings, application to task and languages used within the setting. The COS has been used to consider and monitor classroom climate and organisation.

The COS can be used with up to six pupils in each observation period and each pupil is observed in turn over a 30-second period. When one observation cycle is complete, the six pupils are observed in turn again, until ten observation cycles have been completed. After the 30 second observation period, the observer records what they have seen within the framework provided by the COS. Five of the six categories allow only one record per category and therefore the main behaviour or setting is recorded. Within the 'Activity Types' section, a range of activities could be observed within a 30 second period and the schedule includes opportunities for recording sixteen
possible activities including; working on written assignments, getting or returning materials and tutoring peers.

The process of completing a COS observation cycle takes approximately forty-five minutes in total, allowing for observation and recording time. The scoring methods recommended by the COS Administration consider total percentages of types of behaviours for the group of pupils, rather than individual interactions. This cannot subsequently be translated to consider individual children's styles of learning and the scoring method was adapted to suit the purposes of the observation, which was to consider individual pupil's behaviours. For each pupil, the number of interactions exhibited within a behavioural category was tallied and this allowed a profile to be developed in relation to the type of interactions preferred by that pupil. It was anticipated that within the main study this profile could be compared to the child's recorded cognitive style to consider the correlation between the child's classroom behaviours and personal cognitive style.
## Appendix Five: Classroom Observation Schedule Data (interaction)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>IC1</th>
<th>IC2</th>
<th>IC3</th>
<th>IC4</th>
<th>IC5</th>
<th>IC6</th>
<th>IC7</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>P2</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>P3</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>P4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>P5</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P6</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Category Codes

IC1: No interaction/Independence
IC2: Interaction with teacher - instructional
IC3: Interaction with teacher - managerial
IC4: Interaction with teacher - personal
IC5: Interaction with support staff
IC6: Interaction with other pupils - instructional
IC7: Interaction with other pupils - personal
The *Interaction* data records that during the observation period, the pupils predominantly worked independently with some instruction from the class teacher. There was no personal interaction with the class teacher or contact with the learning support assistant, who was situated at the back of the room preparing materials for another session. Contact between pupils was personal rather than instructional in nature. It is perhaps not surprising that the pupil who was recorded as working with the least level of independence also required the most instructional interaction with the class teacher, although they also had the most personal contact with peers.
# Appendix Six: Classroom Observation Schedule Data (activity types)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Activity Type Categories (AC)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC 1</td>
</tr>
<tr>
<td>P1</td>
<td>1</td>
</tr>
<tr>
<td>P2</td>
<td>1</td>
</tr>
<tr>
<td>P3</td>
<td>3</td>
</tr>
<tr>
<td>P4</td>
<td>0</td>
</tr>
<tr>
<td>P5</td>
<td>4</td>
</tr>
<tr>
<td>P6</td>
<td>2</td>
</tr>
</tbody>
</table>

*Activity Type Codes:

- **AC1**: Working on written assignments
- **AC2**: Interaction – Instructional
- **AC3**: Interaction - Social
- **AC4**: Watching or listening
- **AC5**: Reading
- **AC6**: Getting or Returning Materials
- **AC7**: Painting, drawing or creating graphics
- **AC8**: Working with technology
- **AC9**: Working with manipulative materials/equipment
- **AC10**: Viewing videos/slides
- **AC11**: Playing games
- **AC12**: Presenting/acting
- **AC13**: Tutoring peers
- **AC14**: Not attending to task
- **AC15**: No activity/transition
- **AC16**: Other
The data generated as a result of considering Activity Types within the observation reflected the rather traditional teaching style of the class teacher. The activity was teacher selected throughout the observation, which was undertaken during a history lesson. Following a period of adult instruction delivered as a class, pupils were required to consider a passage within a textbook and then provide written answers to questions on a worksheet. This situation emphasised the fact that the nature of the data elicited by the COS is highly dependent on the task that is being undertaken during the observation process. A more successful session in terms of this observation might have been achieved if pupils had worked collaboratively on a problem solving activity.

Out of the sixteen category types provided on the record form of the COS, seven were used during the observation of the session. The interactions recorded within this category, as for the ‘selection of activity’ category, were dependent on the type of task presented. It was acknowledged that the data elicited by the COS was limited in this type of classroom activity and a more interactive session would have been preferred for the purposes of this piece of research. The activity commanding the greatest number of recordings for all pupils was AC2 (Interaction – Instructional), with pupil P6, who was the individual placed on the SEN register, having the highest number of recordings as ‘No activity/transition’. This may have implications for the class teacher in terms of how pupils with SEN are supported within the classroom but cannot be linked to cognitive style as part of this very small sample size.
### Appendix Seven: Classroom Observation Schedule Data (setting)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Whole Class</th>
<th>Small Group</th>
<th>Pairs</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>P2</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>P3</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>P4</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>P5</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>P6</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Within the Setting category the observations on all the pupils elicited the same data. This was due to the nature of the task, because there was an instructional introduction by the class teacher followed by a period of independent working.
Appendix Eight: Classroom Observation Schedule Data (manner)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Manner Category</th>
<th>On task</th>
<th>Waiting for teacher</th>
<th>Distracted</th>
<th>Disruptive</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td></td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P2</td>
<td></td>
<td>6</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P3</td>
<td></td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P4</td>
<td></td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P5</td>
<td></td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P6</td>
<td></td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Out of the five categories relating to pupil manner, 98% of the observations related to two categories, as pupils tended to be either 'on task' or 'distracted'.

225
# Appendix Nine: Results from the Cognitive Styles Analysis (pilot study results)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Age</th>
<th>Sex (M/F)</th>
<th>Cognitive Style Category</th>
<th>WA Ratio</th>
<th>VI Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>10</td>
<td>M</td>
<td>Analytic-Bimodal</td>
<td>1.38</td>
<td>1.07</td>
</tr>
<tr>
<td>P2</td>
<td>10</td>
<td>M</td>
<td>Wholist-Bimodal</td>
<td>0.82</td>
<td>1.01</td>
</tr>
<tr>
<td>P3</td>
<td>10</td>
<td>F</td>
<td>Wholist-Verbaliser</td>
<td>0.60</td>
<td>0.97</td>
</tr>
<tr>
<td>P4</td>
<td>10</td>
<td>M</td>
<td>Intermediate-Imager</td>
<td>1.11</td>
<td>1.21</td>
</tr>
<tr>
<td>P5</td>
<td>9</td>
<td>F</td>
<td>Wholist-Imager</td>
<td>0.62</td>
<td>1.18</td>
</tr>
<tr>
<td>P6</td>
<td>10</td>
<td>F</td>
<td>Wholist-Verbaliser</td>
<td>0.84</td>
<td>0.96</td>
</tr>
</tbody>
</table>
Dear Mrs X,

Forgive me for contacting you out of the blue, but colleagues have recommended you to me as a head teacher who is keen on new initiatives and research-based practice.

I am an EP working for the LEA and am currently undertaking my doctorate in Educational Psychology. The reason for this letter is to ask whether it would be possible to conduct some of my research in your school, later this academic year.

I have devised a summary sheet, which outlines my research proposal and also details my level of involvement with the school, should you agree to my request. I enclose this for your information.

I will contact you later this term to see whether you and your staff are happy for me to conduct my research at (school 1). I am aware of the immense pressures on school staff at the current time and therefore will understand if you do not feel able to commit to this additional demand at the current time. I would be delighted if this is possible however and look forward to talking to you soon.

Please contact me if you have any questions,

Yours sincerely,

Julia Clark
Chartered Educational Psychologist
Educational Psychology Service
Special Educational Services
Appendix Eleven: Summary of research for participating schools

Brief Overview

As part of my Doctorate in Educational Psychology (DEdPsy) I am looking at the link between children’s learning styles, their tested intelligence and how teachers find them in class.

To do this, I have a computer program that identifies individual children’s learning styles, and will compare this information to independent measures of intelligence (pupil’s 11+ scores and end of Key Stage Data) and a teacher’s rating of each child’s intelligence. I am questioning whether there is any link between these factors.

Q: Which groups of children would be involved?

Due to the age and literacy levels required to complete the computer program, I would like to work with one class (per school) of children in the current Year 6 (2002-2003).

Q: When do you want to do the research?

In the summer term of 2002-2003, on days that are convenient to school.

Q: What are the implications for school and staff?

I (or an Assistant) would like to spend 3 days in school. This would involve taking each child out of class for approximately 10 minutes to complete the computer program. In addition to this, I would be completing a short ‘ratings scale’ exercise with the Year 6 class teacher and requesting pupil data from the LEA.

Q: How will it benefit the school?

Each child who participates in the research will receive a short report that will be given to school and parents, describing the child’s learning style. In addition to this, I would be happy to come to school to talk to the Year 6 teacher and other interested staff about learning styles and pupil performance in school, if they would find this helpful.

Q: Do the parents have to give permission?

Yes. In order for the children to participate in this research, parents would have to give permission and a sample letter would be given to the school to be copied onto school headed paper. The information sought from County has been approved under the Data Protection Act for my use.

Q: What else do I need to know?

Information that contributes to my thesis will be anonymous, therefore there will be no means of the school or individual pupils being identified.
Appendix Twelve: Suggested parental permission letter (main study)

Dear Parent/Guardian,

FREE PRIZE DRAW!

The pupils in Year 6 at X School have been chosen to take part in a study that will help us to understand more about how children learn. In order for your child to take part in the study, the permission slip at the bottom of this letter should be completed and returned to school.

As a 'thank you' for returning the permission slip, all returns will be placed in a Prize Draw whether you wish your child to take part in the study or not. One name will be picked at random from all those returned and will receive a large tin of chocolates for their family.

The study involves each child working on a computer program for about 10 minutes during the school day. Children who have completed this work in other schools have really enjoyed the activity. Information about each child’s attainments will also be asked for from teachers at school and from County Hall, including their 11+ results and recent SATs results.

The results of the study are confidential. Names of the children are not reported and the school is also not identified.

Please complete the permission slip below and return to school by (date).

Yours sincerely,

I do / do not * want my child to take part in the study of children’s learning at X School

Signed................................................................. (parent/guardian)
Appendix Thirteen: Feedback report (main study)

To the Parent/Guardian of:

Thank you for allowing your child to take part in the study of pupil’s learning at X School.

The computer program used in the study is called the ‘Cognitive Styles Analysis’ and it describes the particular way that your child prefers to learn within the classroom. Cognitive Style is not linked to intelligence.

The Cognitive Styles Analysis looks at two different areas of your child’s learning, firstly whether they prefer to learn in a visual or verbal way and secondly whether they like to learn things in ‘small chunks’ or to have a complete piece of information before working on a task. After completing the computer program, your child’s cognitive style was identified as being:

**Verbaliser- Bimodal – Imager Scale**

If your child is described as an ‘**Verbaliser**’, they learn in a verbal way, and like to listen to, read, or take in information using words

If your child is described as an ‘**Imager**’, they learn in a visual way, from pictures, videos and visual materials

Children who can learn in both a verbal and visual way, and do not prefer one or the other are described as ‘**Bimodal**’.

**Wholist – Intermediate – Analytic Scale**

If your child learns in a **Wholist** way, they like to have a complete piece of information in front of them before they start a task.

If your child learns in an **Analytic** way, they prefer to have information given to them in ‘small chunks’.

Children who can learn in both a **Wholist** and an **Analytic** way, and do not prefer one or the other are described as ‘**Intermediate**’.

Please contact me if you have any questions about this information.

Julia Clark
Chartered Educational Psychologist
Special Educational Services
Appendix Fourteen: Ranking proforma

<table>
<thead>
<tr>
<th></th>
<th>Literacy</th>
<th>Numeracy</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix Fifteen: Verbal-Imagery Rating Scale

The following scale has been developed to consider your views about the different ways that the pupils in your class take in and process information in their learning. This scale specifically considers the extent to which you feel that individual children learn in either a Verbal or a Imagery (visual) manner.

Children who learn in a Verbal manner are likely to show a preference for oral instruction and discussion in class, whilst children who learn using Imagery are likely to respond better to pictures, diagrams and charts.

For each pupil on the list below, please consider the degree to which you believe that they learn in either a Verbal or a Imagery way. Please then circle the number that you feel best represents your view. If therefore you consider a child to learn in a very strongly Verbal manner, you may circle a ‘1’. If you feel that a pupil processes information in a strongly Imagery way, your response is likely to be a ‘6’. Responses in between 1 and 6 will reflect the degree to which you feel a pupil learns in a verbal or visual way. If you do not know the preferred manner in which a child takes in and processes information in their learning, please circle ‘DK’ (‘Don’t Know’).

<table>
<thead>
<tr>
<th>Verbal</th>
<th>Imagery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 DK</td>
</tr>
<tr>
<td>Pupil Name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6 DK</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6 DK</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6 DK</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6 DK</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6 DK</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6 DK</td>
</tr>
</tbody>
</table>
Appendix Sixteen: Wholist-Analytic Rating Scale

The following scale has been developed to consider your views about the different ways that the pupils in your class take in and process information in their learning. This scale specifically considers the extent to which you feel that individual children learn in either a Wholist or an Analytic manner.

Children who learn in a Wholist way prefer to have a whole piece of information presented to them before they tackle a task. Children who learn in an Analytic manner prefer information to be broken down into small sections before it is presented to them.

For each pupil on the list below, please consider the degree to which you believe that they learn in either a Wholist or an Analytic way. Please then circle the number that you feel best represents your view. If therefore you consider a child to learn in a very strongly Wholist manner, you may circle a ‘1’. If you feel that a pupil processes information in a strongly Analytic way, your response is likely to be a ‘6’. Responses in between 1 and 6 will reflect the degree to which you feel a pupil learns in a wholist or analytic way. If you do not know the preferred manner in which a child takes in and processes information in their learning, please circle ‘DK’ (‘Don’t Know”).

<table>
<thead>
<tr>
<th>Wholist</th>
<th>Analytic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6</td>
<td>DK</td>
</tr>
</tbody>
</table>

Pupil Name

1 2 3 4 5 6 DK

1 2 3 4 5 6 DK

1 2 3 4 5 6 DK

1 2 3 4 5 6 DK

1 2 3 4 5 6 DK

1 2 3 4 5 6 DK

1 2 3 4 5 6 DK

1 2 3 4 5 6 DK

1 2 3 4 5 6 DK
Appendix Seventeen: Correlations between teachers' rankings and other scores

Test used: Spearman's rho

<table>
<thead>
<tr>
<th>% correct</th>
<th>Speed indices</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WA</td>
<td>VI</td>
</tr>
<tr>
<td>T rank I</td>
<td>-0.29**</td>
<td>-0.65**</td>
</tr>
<tr>
<td>T rank n</td>
<td>-0.30**</td>
<td>-0.57**</td>
</tr>
<tr>
<td>T rank s</td>
<td>-0.34**</td>
<td>-0.61**</td>
</tr>
</tbody>
</table>

** significant at the 0.01 level

Key:

T rank I = Teachers' ranking in literacy

T rank n = Teachers' ranking in numeracy

T rank s = Teachers' ranking in science
Appendix Eighteen: Recorded differences in the mean scores between KS2 Levels and other variables

Test used: Kruskal-Wallis
H values reported

All statistics within this table are significant at p < 0.05

<table>
<thead>
<tr>
<th></th>
<th>English Level</th>
<th>Maths Level</th>
<th>Science Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speed Index</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WA</td>
<td>26.62</td>
<td>22.00</td>
<td>22.37</td>
</tr>
<tr>
<td>VI</td>
<td>38.58</td>
<td>34.46</td>
<td>32.64</td>
</tr>
<tr>
<td><strong>% Correct</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WA</td>
<td>8.24</td>
<td>15.29</td>
<td>12.40</td>
</tr>
<tr>
<td>VI</td>
<td>51.71</td>
<td>41.76</td>
<td>50.44</td>
</tr>
</tbody>
</table>
Appendix Nineteen: Correlations between KS2 marks and other variables

Test used: Spearman's rho

All correlations are significant at $p < 0.001$

<table>
<thead>
<tr>
<th></th>
<th>English Mark</th>
<th>Maths Mark</th>
<th>Science Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>VR Scores</td>
<td>0.82</td>
<td>0.80</td>
<td>0.77</td>
</tr>
<tr>
<td>Speed Index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WA</td>
<td>0.52</td>
<td>0.49</td>
<td>0.45</td>
</tr>
<tr>
<td>VI</td>
<td>0.64</td>
<td>0.62</td>
<td>0.58</td>
</tr>
<tr>
<td>% Correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WA</td>
<td>0.33</td>
<td>0.34</td>
<td>0.33</td>
</tr>
<tr>
<td>VI</td>
<td>0.77</td>
<td>0.69</td>
<td>0.78</td>
</tr>
<tr>
<td>Teachers' ranking literacy</td>
<td>-0.77</td>
<td>-0.67</td>
<td>-0.68</td>
</tr>
<tr>
<td>Teachers' ranking numeracy</td>
<td>-0.72</td>
<td>-0.79</td>
<td>-0.66</td>
</tr>
<tr>
<td>Teachers' ranking science</td>
<td>-0.73</td>
<td>-0.67</td>
<td>-0.72</td>
</tr>
</tbody>
</table>