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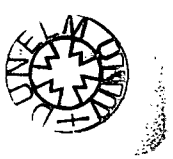

The Prevalence, Attainment and Progress of Severely Inattentive, Hyperactive and Impulsive Young Children

Christine H. Merrell

Abstract

Some children exhibit inattentive, and perhaps also hyperactive and impulsive behaviour in the classroom at a very frequent and severe level. These behavioural characteristics are reflected in the criteria for the diagnosis of Attention Deficit Hyperactivity Disorder (ADHD). Children with ADHD have been found to achieve lower grades at school than their peers. This study investigated the extent to which pupils with severe ADHD symptoms, but not necessarily diagnosed with the condition, were at risk of similar academic outcomes. The effect of different teaching and classroom management strategies on the concentration and attention of these children were also explored.

The reading and mathematics achievements of a large sample of pupils were assessed at the start of reception, the end of reception and then again at the end of key stage 1. Class teachers assessed the behaviour of these pupils at the end of reception using a rating scale based upon the diagnostic criteria for ADHD in Version 4 of the Diagnostic and Statistical Manual for Mental Disorders (American Psychiatric Association, 1994).

The proportion of children with severe ADHD symptoms was found to be similar to previous estimates of the prevalence of children with each sub-type of ADHD derived from teacher assessments, but higher than the rates of prevalence of ADHD published by the American Psychiatric Association (1994).

The reading and mathematics attainment and value-added of children with severe ADHD symptoms were found to be educationally and statistically significantly lower than their peers. The data replicated previous studies that had investigated the achievement of children with ADHD.

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List of Abbreviations

ADD	Attention Deficit Disorder
ADHD	Attention Deficit Hyperactivity Disorder
ALIS	Advanced Level Information System
ANOVA	Analysis of Variance
BASIS	Basic Achievement Skills Individual Screener
CEM	Curriculum Evaluation and Management Centre
CPT	Continuous Performance Test
DfEE	Department for Education and Employment
DSM	Diagnostic and Statistical Manual of Mental Disorders
DSM-II	Diagnostic and Statistical Manual of Mental Disorders Version 2
DSM-III	Diagnostic and Statistical Manual of Mental Disorders Version 3
DSM-III-R	Diagnostic and Statistical Manual of Mental Disorders Version 3 - Revised
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders Version 4
EBD	Emotional and Behavioural Difficulties
ES	Effect Size
FSIQ	Full Scale Intelligence Quotient
ICD-10	International Classification of Diseases Version 10
IQ	Intelligence Quotient
MTA	Multimodal Treatment of ADHD
NIMH	National Institutes of Mental Health
PIPS	Performance Indicators in Primary Schools
QCA	Qualifications and Curriculum Authority
SAT	Scholastic Aptitude Test

SES	Socio Economic Status
WAIS-R	Wechsler Adult Intelligence Scale – Revised
WCST	Wisconsin Card Sorting Test
WDI	Wechsler Deterioration Index
WISC-III	Wechsler Intelligence Scale for Children Third Edition
WISC-R	Wechsler Intelligence Scale for Children-Revised
WRAT-R	Wide Range Achievement Test-Revised
WRMT-R	Woodcock Reading Mastery Test-Revised

Declaration

I confirm that the material in this thesis has not previously been submitted for a degree in this or any other university.

Signed .....

Acknowledgements

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Chapter 1

Introduction to the Study

Background to the Study

Children who exhibit inattentive or hyperactive and impulsive behaviour at school are not uncommon. Naturally, young children tend to be more inattentive, hyperactive and impulsive than older ones. As they grow up, children learn to concentrate on tasks for longer periods of time and lots of physical activity leads to the improvement of motor skills. However, some young children display an exceptionally severe level of inattentive or hyperactive and impulsive behaviour compared with others of the same age, developmental level and gender, and this exceptional behaviour does not always improve with age. Although this behaviour might be a consequence of one of several factors, it is possible that these children have the condition known as Attention Deficit Hyperactivity Disorder (ADHD).

Children with ADHD can be difficult in the classroom when their behaviour disrupts their own learning and that of others. Their long-term outcome is frequently poor. They are more likely to display delinquent, antisocial behaviour as adolescents and achieve lower grades at school than their peers (Barkley, Fischer, Edelbrock and Smallish, 1990; Barkley, Anastopoulos, Guevremont and Fletcher, 1991; Nussbaum, Grant, Roman, Poole and Bigler, 1990; Zentall, Smith, Lee and Wieczorek, 1994).

Around the time when this study commenced, although public awareness of ADHD was increasing, many teachers had still not heard of the condition, let alone understood why children with ADHD behaved as they did, how their behaviour in the classroom could be dealt with and their academic

achievement and progress improved. As a newly qualified classroom teacher in the early 1990's, I was faced with the challenge of teaching one particular boy (JD) who was inattentive, hyperactive and impulsive. Other members of staff warned me about JD's behaviour before I even met him. A classroom assistant supervised him in some lessons, such as science, where his behaviour was considered to be a potential danger to other children. The teachers and the special needs co-ordinator recognised that JD had behavioural problems but were not aware that they might have been caused by ADHD and therefore did not know to employ the kind of teaching strategies recommended for such children. On meeting JD, his behaviour certainly set him apart from other boys in the year group and sadly as well as presenting the teachers with problems it meant that he had very few friends. Most teachers struggled to find teaching strategies that enabled them to cope with handling JD at the same time as a class of equally deserving pupils. If information about ADHD and effective teaching strategies for children with the condition had been more widely available at that time, JD might have attained greater academic success and just as importantly, been more readily accepted by his peer group. This was obviously not an isolated situation in one school and was echoed in the media at about that time. In a report by Roger Bushby in the Times Educational Supplement (June 14, 1996), consultant paediatrician Dr Rashmin Tamhne, was quoted as saying that "ADHD is a rising problem. Teachers need to be told what things to look for so that an ADHD sufferer is not just dismissed as an ill-behaved kid".

The diagnosis of ADHD is complex and its treatment, particularly the use of stimulant medication, is controversial. Again, around the time that this study began, the Times Educational Supplement (May 26, 1995) published an article titled 'Temper or trauma? Controversy in Great Britain over using drugs in the treatment of ADHD.' in which it was claimed that 'The treatment of ADHD by the drug Ritalin is threatening to divide parents, teachers, psychologists and doctors in Great Britain.... a paediatrician in Sussex believes that up to five percent of children suffer from ADHD and that their treatment could dramatically reduce disruption in Britain's schools. However, there are teachers and general practitioners who are sceptical with the diagnosis, treatment, and the existence of the disorder and who are uncomfortable about administering psychological drugs.'

If five percent of children in Britain have ADHD, this amounts to potentially one child in every class taking prescribed stimulant medication to improve severe behavioural problems associated with inattention and/or hyperactivity/impulsivity. To many, this statistic seemed quite shocking. Smelter, Rasch and Fleming (1996) expressed concern about potentially damaging effects of labelling children as suffering from ADHD due to there being no definitive test for the condition and no concrete proof that the condition existed. They suggested that educators and the medical profession should 'downplay the diagnosis of ADHD, the potential benefits of medication, and the absolution that such a diagnosis affords the patient from responsibility for poor behaviour'.

The previous paragraphs have provided a taste of the kind of ignorance and controversy that existed in association with ADHD, particularly in the field of education, in the early 1990's. Although children who displayed severe symptoms of inattention, hyperactivity and impulsivity did exist, whilst some professionals advocated the identification of those with ADHD and the provision of appropriate help, many others were concerned about the potentially harmful effects of labelling children with a condition that had no proven scientific cause or unequivocal method of diagnosis, and of treating them with medication that might have undesirable side effects.

It had been reported that children with ADHD tended to achieve lower grades at school than their peers. However, many of the studies which investigated the outcomes of children with ADHD were small-scale, used out-dated diagnostic criteria or focused on children in the upper primary years or older. A recent study by Tymms, Merrell and Henderson (2000) found that in general, children made an enormous amount of progress during the reception year and it has a lasting long-term impact. But before the present study, little research had been conducted on the attainment and progress of very young children, particularly in their reception year, with severe inattentive and/or hyperactive/impulsive behaviour. Whether or not the behaviour of such children persists and they eventually receive a formal diagnosis of ADHD, the extent to which their behavioural problems prevent them from making the best possible start at school merits investigation. After the impact of severe inattentive and/or hyperactive/impulsive behaviour of young children has been measured, the effect of various treatments can then be systematically

assessed with the ultimate aim of identifying the most successful interventions.

Aims of the Study

The aims of the study were as follows:

- To estimate the proportion of children displaying severe inattentive and/or hyperactive/impulsive behaviour in the reception classes of successive cohorts of nationally representative samples of schools in England and to compare the findings with previously published estimates of the prevalence of ADHD. Although establishing the proportion of children in reception classes with ADHD symptoms over successive years cannot be assumed to represent the proportion of young children with the disorder of ADHD itself, it could provide a useful indication of whether or not inattentive, hyperactive and impulsive behaviour is becoming more widespread. Determining the proportions of children in reception classes of a school-based population of young children who exhibited either predominantly inattentive behaviour, predominantly hyperactive/impulsive behaviour or a combination of both would add to existing knowledge.
- Having identified children in reception classes with severe behavioural problems relating to inattention and/or hyperactivity/impulsivity, the next aim was to quantify the impact of this behaviour on their academic achievement and progress during the first three years at school although a long-term follow up study to track these pupils through primary school and beyond would have been ideal. At the time of starting the study, much of the research had focused on the impact of

interventions on behaviour and it did not necessarily follow that a reduction in behavioural problems automatically leads to an improvement in academic skills. Gathering initial information on the achievement and progress of children with ADHD symptoms before interventions are implemented gives an indication of the current state of affairs. The systematic quantification of the effectiveness of interventions on achievement and progress, which should be a future priority if all children are to be offered appropriate educational experiences, can be pursued with this knowledge in mind. In order to gain accurate information, it was thought to be important to investigate the possibility of differences between children with each type of behavioural problem. Therefore again, the results for children displaying predominantly inattentive behaviour, predominantly hyperactive/impulsive behaviour or a combination of both will be presented separately and analysing successive cohorts will support any trends found. The results of this study will be compared with the findings of previous studies of the academic achievement of children with ADHD. If similarities are found, this suggests that children with severe inattention and/or hyperactivity /impulsivity but no formal diagnosis of ADHD are likely to suffer similar risks to children formally diagnosed as having ADHD and perhaps they can be helped by some of the strategies that are useful for children with ADHD.

- An exploratory investigation into the kinds of teaching strategies perceived to be effective with children with each type of behavioural problem described in the previous paragraph will be undertaken and

the results discussed in relation to the theory of the nature of ADHD. Teachers will be asked to rate the effectiveness of a range of strategies on improving the attention and concentration of individual children and their ratings analysed in relation to behaviour. Although the data collected will relate to an improvement in behaviour and not necessarily academic achievement, the findings will be useful because they will relate to young children at school whereas much of the previous research has been conducted on older children. It could be used to inform future research into the effectiveness of various teaching and classroom management strategies on the improvement of achievement and progress of children who display ADHD symptoms in the classroom.

- A further aspect of the study will be to monitor the behaviour of a small number of children over time. It is essential that the behaviour assessment used in this research is reliable and valid if the results are to be used as a basis for further research. The behaviour of a small number of children will be assessed at two time points by different teachers. Some children will be selected as case studies for more in-depth investigation where their behaviour will be assessed at two time points by different teachers, qualitative data will be gathered and they will complete an objective test of attention. Their achievement and progress will be discussed in relation to the information about their behaviour gathered from the range of sources described.

By fulfilling the aims of the study, I intend to produce a source of reliable and valid information that firstly adds to the existing body of knowledge about the prevalence, achievement and progress of young children with severe behavioural problems relating to inattention, hyperactivity and impulsivity. Secondly, it should be possible to use the findings from this study as a baseline for monitoring future trends and with which to compare the results from future research into the effectiveness of teaching and classroom management strategies designed to improve the academic achievement and progress of children who are severely inattentive and/or hyperactive/impulsive.

Organisation of the Thesis

The thesis is organised into fifteen chapters. Their contents are summarised below.

Chapter 1

Introduction To The Study

The background and aims of the research are discussed. The organisation of the thesis is described.

Chapters 2 to 7 consist of the literature review. This study will be investigating children who exhibit severe behavioural problems in the classroom of the type characterised by the symptoms of ADHD. It is unlikely that they will all have received a diagnosis of ADHD at such a young age but their behaviour may mean that they are nevertheless at risk of similar outcomes to children diagnosed as having the condition. The behaviour of the children participating in the study was assessed using a rating scale based on the diagnostic criteria for ADHD published by the American Psychiatric Association (1994), the prevalence of children with severe problems relating to inattention, hyperactivity and impulsivity, their academic achievement and behaviour in the classroom are all compared to previous research on children with ADHD. It is therefore essential to understand the condition. The aim of this literature review is intended to provide an overview of ADHD and explain relevant research completed to date.

Chapter 2

The Definition and History of Attention Deficit Hyperactivity Disorder

The literature review begins in Chapter 2 by describing the historical development of ADHD and its diagnostic criteria. The history of the widely recognised diagnostic criteria published by the American Psychiatric Association in their Diagnostic and Statistical Manual of Mental Disorders (DSM) and the version used for the teacher rating scale in this study (DSM-IV) are discussed. The diagnostic criteria of the three sub-types of ADHD currently recognised (children who are predominantly inattentive, children who are predominantly hyperactive/impulsive and children with a combination of behavioural problems) are explained. Possible causes of ADHD are reviewed and common co-morbid disorders described.

Chapter 3

The Prevalence of Attention Deficit Hyperactivity Disorder

This chapter reviews the estimated rates of prevalence of ADHD in different populations. A range of diagnostic criteria have been used with samples of various ages in the studies reviewed.

Several recent studies, which assessed the prevalence of ADHD using DSM-IV criteria, are included. The effect of gender, culture and age on the estimated rates of prevalence of ADHD are discussed.

Chapter 4

Understanding Attention Deficit Hyperactivity Disorder from a Biological and Psychological Perspective

The symptoms of ADHD are believed to be a consequence of impaired executive functions. This chapter examines the proposed underlying biological causes of ADHD and their psychological consequences.

Chapter 5

The Assessment of Attention Deficit Hyperactivity Disorder

The issue of diagnosing ADHD is explored. The merits and problems associated with both subjective and objective methods of assessment are discussed.

Chapter 6

Attention Deficit Hyperactivity Disorder from an Educational Perspective

Studies of the educational achievement of children with ADHD are discussed (and related to the current theory of ADHD where appropriate) in relation to ability, academic achievement, long-term outcomes and specific problems in reading and mathematics.

Chapter 7

The Treatment of Attention Deficit Hyperactivity Disorder

This topic could easily form a literature review in its own right, particularly in relation to the medication prescribed to relieve the symptoms of ADHD. Although the treatment of ADHD is not the primary focus of this study, the

perceived impact of teaching and classroom management strategies are investigated in Chapter 14 and these results could have implications for future research. To be able to construct the questionnaire used to collect that data and interpret the findings, recent studies, particularly those assessing the impact of classroom interventions, are reviewed.

Chapter 8

Method

The research design and data collection procedures are explained.

Chapter 9

Reliability and Validity of the Measures

The reliability and validity of the behaviour rating scale and the assessments used to measure attainment are reported. High reliability and validity are important if the outcomes of the research are to be (a) believed, and (b) used as a basis for future research.

The results of the study are presented and discussed in Chapters 10 to 14.

Chapter 10

Results 1 – The Distribution of Scores from the End of Reception Behaviour Rating Scale

The analysis of the scores from the behaviour rating scale used by teachers to assess the behaviour of children at the end of reception from 3 successive cohorts is presented. The behaviour rating scores were analysed at three

levels. Initially the scores of all the children in each cohort were reported. Secondly, in order to look at trends over time, and begin to address the issue of ADHD becoming increasingly common, the scores of children in schools common to all cohorts were analysed. Thirdly, in order to provide the closest possible approximation to an estimated rate of prevalence of ADHD in England, a nationally representative sample of schools was drawn from each cohort and the data analysed. The results from this study were compared to the rates of prevalence of ADHD reported in the literature.

The ratio of boys to girls highlighted with a high number of ADHD symptoms in the classroom, the ratio of the sub-types of ADHD symptoms described earlier, differences in behaviour between children with English as their first language and children for whom English was an additional language are reported and discussed.

Chapter 11

Results 2 – The Stability of Inattention, Hyperactivity and Impulsivity Over Time

This chapter includes a more detailed look at the data gathered for the test/re-test reliability, analysing it by ADHD sub-type and discussing the results in relation to previous research findings which suggested that ADHD tends to decline with increasing age.

Chapter 12

Results 3 – Achievement and Progress in Reading and Mathematics

Having identified children in reception classes with severe inattention, and/or hyperactivity/impulsivity, this chapter reports their attainment and progress during the first three years at school compared with children who did not meet any criteria on the behaviour rating scale at the end of reception.

Chapter 13

Results 4 – Case Studies

The academic achievement, progress and behaviour of a few particular children was analysed in greater detail using data gathered from a range of different sources.

These case studies added a further dimension to the reliability and validity measures reported in earlier chapters. When children's behaviour changed, or their achievement or progress was different to that expected, these uncharacteristic results were often explained when the extra information gathered in the case studies was considered. The case studies also demonstrated that using information from a variety of sources is essential when making a diagnosis of ADHD and that once that diagnosis has been made, the usefulness of functional analysis in deciding the most appropriate course of action.

Chapter 14

Results 5 – A Survey of Teaching Methods used with Children with High Scores on the Behaviour Rating Scale and their Effectiveness

The results of the survey are analysed and interpreted in relation to the theory of ADHD.

Chapter 15

Conclusions

The results and discussions from Chapters 10 to 14 are considered and conclusions drawn.

To summarise:

The study considers the following questions –

- What proportion of children in reception classes in England are considered to by their teachers to have severe behavioural problems related to inattention and/or hyperactivity and impulsivity?
- Are there differences in behaviour by gender, first language or age?
- Is there a link between behaviour and socio-economic status?
- Are the results of this study similar to previously reported rates of prevalence of ADHD?
- Did the proportion of children considered to by their teachers to have severe behavioural problems related to inattention and/or hyperactivity and impulsivity increase over successive years?
- Was the behaviour rating scale used in this study reliable and valid?
- Were these behavioural problems stable over time?
- What impact did these behavioural problems have on the academic achievement and progress of children?
- What teaching and classroom management strategies did teachers find to be effective in improving the attention and concentration of young children with these behavioural problems?

Chapter 2

The History and Definition of Attention Deficit Hyperactivity Disorder

Introduction

Attention Deficit Hyperactivity Disorder has been the subject of much media attention in recent years with debate of issues such as whether or not it is becoming increasingly common and the controversial medication used to treat the symptoms. This intense focus of attention has given the impression that ADHD is a recent phenomenon. Although there is still much to be learned about the precise cause and mechanisms of the disorder, the behavioural problems that it characterises have been documented for centuries. This chapter begins by reviewing the historical development of the definition of ADHD. The formulation of diagnostic criteria, their reliability and validity are then discussed and the possible causes of ADHD are investigated. The term 'ADHD' encompasses a range of behaviours and it has recently been divided into three different sub-types. Later in the chapter, evidence is presented which suggests that these sub-types may yet be further sub-divided. Finally, the range of common comorbid disorders are described and the issue of this further complicating factor in the diagnosis of ADHD addressed.

The Historical Development of ADHD

The condition of ADHD is usually first diagnosed in childhood or adolescence. Individuals with the disorder are described in version four of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), published in 1994 by the American Psychiatric Association, as displaying 'a persistent pattern of inattention and/or hyperactivity that is more frequent and severe than is typically observed in individuals at a comparable level of development'. Barkley (1990) found that these behavioural problems lead to individuals with

ADHD experiencing problems with rule-governed behaviour and maintaining continuous work performance over time.

Although perceived as a relatively recent phenomenon particularly in the United Kingdom, ADHD is a term which has evolved and been redefined in the light of research over many years to encompass the symptoms which are used to diagnose the behaviour described above.

Possibly the earliest record of the collection of symptoms, now recognized as ADHD, was made by a British physician, Dr Alexander Crichton, in 1798. In their account of his work, Palmer and Finger (2001) noted that Crichton described all the essential features of the current 'Predominantly Inattentive' sub-type of the disorder, described in DSM-IV. In 1902 the paediatrician Frederick Still identified a group of children who displayed symptoms of the syndrome now recognised as ADHD (Still, 1902). Shortly after the publications by Still, Tredgold (1908) suggested that some forms of impaired attention might stem from early brain damage. In later years, similar behaviour to that reported by Still and Tredgold was observed in children who survived the widespread encephalitis epidemics between 1917 and 1918. The disease left some children impaired in the areas of attention, memory and impulse control. This cluster of behaviours was known as post-encephalitic behaviour disorder (Palmer and Finger, 2001). Research conducted as early as 1938 into the association between viral diseases, birth trauma, lead toxicity, childhood head injuries and subsequent behavioural problems indicated that changes in the brain, perhaps in the frontal lobe area,

underpinned inattentive and hyperactive behaviour (Levin, 1938). This general belief held in the 1930's that behavioural symptoms of motor restlessness in children were a result of brain injury resulted in the widespread use of the descriptor 'Brain Injured Children'. Over the following years as there was no evidence of physical neurological injury in many of the children displaying the symptoms associated with the disorder, its title was changed to 'Minimal Brain Damage' and then later to 'Minimal Brain Dysfunction'. Kessler (1980) gave a detailed account of the history of minimal brain dysfunction. In the late 1960s it became evident that the term 'Minimal Brain Dysfunction' encompassed a heterogeneous collection of symptoms not necessarily arising from a single disorder. The term 'Minimal Brain Dysfunction' was gradually replaced by 'Hyperkinetic Syndrome' to characterise a subset of children who displayed attention problems and poor impulse control (Chess, 1960). This marked the beginning of a difference of opinion between clinicians in North America and those in Euorope. European clinicians continued to view Hyperkinetic Syndrome as a relatively rare condition of extreme over-activity often associated with mental retardation or organic brain damage. Two separate sets of diagnostic criteria were established. The World Health Organisation published criteria for the diagnosis of Hyperkinetic Disorder in the International Classification of Diseases, a classification system favoured by European clinicians. The American Psychiatric Association published diagnostic criteria in their Diagnostic and Statistical Manual of Mental Disorders. A comparison of the two classification systems is made in Chapter 3 - The Prevalence of Attention Deficit Hyperactivity Disorder. The development of the criteria in the DSM

used to diagnose the disorder currently named 'Attention Deficit Hyperactivity Disorder' is described below.

The Development of Diagnostic Criteria for ADHD by the American Psychiatric Association

The first definition of Attention Deficit Disorder in Version two of the DSM published by the American Psychiatric Association in 1968 referred to the disorder as 'Hyperkinetic Reaction of Childhood'. This title represented a change in thinking towards defining the disorder in terms of a description of the symptoms displayed by the children rather than the unsubstantiated reasons for the cause of the disorder. The diagnosis was not very reliable because clinicians had to decide whether a particular case matched the published description of the disorder rather than meeting a list of criteria.

When the second version of the DSM was published, problems with hyperactivity were thought to be the major feature of the disorder. Later, Douglas (1972) argued that children labelled as being hyperactive also exhibited problems of impulsiveness and inattention leading the American Psychiatric Association to rename the disorder of 'Hyperkinetic Reaction of Childhood' to 'Attention Deficit Disorder with or without Hyperactivity' (ADDH and ADD respectively) in the third version of the DSM. The assessment was broadened in this version by specifying a set of criteria to be met for a case to be diagnosed. Increasing the number of criteria was intended to improve the reliability of the assessment.

In their discussion of the scientific basis and educational implications of diagnosing ADHD using DSM criteria, McBurnett, Lahey and Pfiffner (1993) described some of the criticisms voiced by researchers over the criteria in the third version of the DSM. One area of criticism was the complexity of the assessment procedure. The criteria describing the symptoms had been assigned to the three broad categories; inattention, impulsivity and hyperactivity in line with the thinking of Douglas (1972). Specific numbers of criteria had to be met in each of these categories, which was thought to be confusing. A subject was required to meet at least three out of a possible five criteria for inattention, three out of a possible five criteria for impulsivity and two out of a possible four criteria for hyperactivity to receive a diagnosis of attention deficit disorder with hyperactivity. There were also concerns about the validity of the 'Attention Deficit Disorder without Hyperactivity' classification. These concerns influenced the development of the diagnostic criteria to be included in the revised edition of the third version of the DSM (DSM III-R) (American Psychiatric Association, 1987). When the revised version was published there was insufficient evidence to justify grouping the criteria into categories, so a single scale of fourteen items was constructed. If an individual met at least eight of the criteria, a diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) was made. The previous sub-type of 'Attention Deficit Disorder without Hyperactivity' was now referred to as 'Undifferentiated Attention Deficit Disorder' and was considered as a separate category.

Still the debate concerning the true definition and the root cause of the disorder continued. Three features of the syndrome had now emerged: hyperactivity, inattention and impulsiveness. The American Psychiatric Association (1994) described the development of the fourth version of the DSM. The initial step in this revision process was to review all of the published literature relating to the diagnosis of the disorder. Some of the data gathered in the reviewed studies were re-analysed in order to clarify issues. A revised set of criteria was then assessed in a field trial using clinic referred children between age 4 and 17 years from a range of ethnic, social and geographical backgrounds. Information was gathered from parents, teachers and children in relation to DSM III-R and DSM-IV criteria along with measures of academic achievement. An experienced clinician assessed each individual and provided a diagnosis. The clinicians were allowed to use any of the information gathered from teachers and parents alongside their own diagnostic scheme. From these results the criteria currently in use were formulated. The criteria were divided into three sub-types. Within the overall term Attention Deficit Hyperactivity Disorder, individuals are now diagnosed as:

Combined Type

This is the most common sub-type. The individual displays symptoms of both inattention and hyperactivity/impulsiveness.

Predominantly Inattentive Type

The individual mainly displays symptoms of inattention.

Predominantly Hyperactive/Impulsive Type

The individual mainly displays symptoms of hyperactivity and impulsiveness. Inattention may also be apparent in this type but to a lesser degree than the combined type.

Diagnostic Criteria

When making a diagnosis, the following criteria must be met:

The sub-type should be based on the behaviour displayed during the preceding six months.

Some impairment should be present in two or more settings.

Some symptoms causing the impairment should have been present before the individual was seven years of age.

The DSM-IV advises that to be diagnosed as having ADHD (Combined type), in addition to meeting the clauses described above, the individual should meet six or more of the criteria relating to inattention and six or more of the criteria relating to hyperactivity-impulsivity.

To be diagnosed as having ADHD (Predominantly Inattentive type), in addition to meeting the clauses described above, the individual should meet six or more of the criteria relating to inattention but need not meet any of the criteria relating to hyperactivity-impulsivity.

To be diagnosed as having ADHD (Predominantly Hyperactive/Impulsive type), in addition to meeting the clauses described above, the individual should meet six or more of the criteria relating to hyperactivity/impulsivity but need not meet any criteria relating to inattention.

An individual may change to a different sub-type over time.
McBurnett, Lahey and Pfiffner (1993) reviewed the analysis of the DSM-IV field trial data. They included the results of a comparison between the clinicians' diagnoses and the ADHD sub-type assigned to each of the subjects using the criteria from DSM-IV. Almost eight per cent of children who were not diagnosed as having ADHD by the clinicians received a diagnosis of ADHD (Predominantly Inattentive Type) using the DSM-IV criteria. Again children assigned to the 'Predominantly Hyperactive' DSM-IV sub-type were sometimes not diagnosed as having ADHD by clinicians. Further analysis revealed that many of the children assigned to this group were under school age and therefore may not have encountered a structured environment where inattention is more apparent. It was suggested that this sub-type might therefore prove to be important in the early diagnosis of very young children.

Validity and Reliability of the DSM-IV Criteria

Other researchers have examined the reliability and validity of the diagnosis of ADHD comparing versions III, III-R and IV of the DSM. This is important in view of the changes that have been made to each new version.

Analysing some of the data derived from the DSM-IV field trial, Lahey *et al.* (1994) found that 93.3% of the individuals who met the required number of criteria for one of the two sub-types of attention deficit disorder in DSM-III also met sufficient criteria for a diagnosis of ADHD using DSM-III-R. However, a third of the individuals who met sufficient criteria for attention deficit disorder without hyperactivity using DSM-III no longer met sufficient criteria using DSM-III-R to be diagnosed as ADHD. When DSM-III and DSM-IV were compared, the number of individuals receiving a diagnosis on both versions was high (97.4%). There was a strong connection between the sub-types of each version. A high number of individuals (88.3%) diagnosed as having attention deficit disorder with hyperactivity using DSM-III were diagnosed as combined or hyperactive/impulsive types using DSM-IV. 91.7% of individuals diagnosed as having attention deficit disorder without hyperactivity using DSM-III were diagnosed as the predominantly inattentive sub-type using DSM-IV. However, some individuals (23.3%) diagnosed as predominantly inattentive and predominantly hyperactive/impulsive types using DSM-IV did not meet sufficient DSM-III criteria to qualify for a diagnosis.

When DSM-III-R and DSM-IV were compared, there was an increase of 15% of individuals being identified by DSM-IV (all types). A large number these

new cases were girls who were diagnosed as predominantly inattentive and younger children (aged 4 and 5 years) who were diagnosed as predominantly hyperactive/impulsive.

Morgan *et al.* (1996) also compared the validity of DSM-IV ADHD criteria with DSM-III and DSM-III-R. The participants of this study were a group of children who had already received a diagnosis from a previous DSM version. Retrospective diagnoses against the DSM-IV criteria were carried out. Some children were excluded from the study at this stage because they did not meet the criteria in DSM-IV. The findings of Morgan *et al.* were consistent with those of Lahey *et al.* (1994) in suggesting that the DSM-III diagnoses of ADHD with and without hyperactivity corresponded fairly closely with DSM-IV diagnoses (combined and predominantly inattentive types). However, some of the other findings of Morgan *et al.* (1996) conflicted with those of Lahey *et al.* (1994) which the authors suggested may be due to the way the sample was selected.

In addition to validating the concordance of the diagnosis of ADHD between different versions of the DSM, researchers have also investigated the reliability and validity of the three sub-types. The reasons for this are twofold; firstly the inter-rater reliability and the test/re-test reliability for each sub-type should be acceptable. Secondly, if the sub-types of the disorder are essentially different, the symptoms characterizing each one should be stable. When discussing the validity of the DSM-IV sub-types of ADHD, Willcut, Chhabildas and Pennington (2001) quoted the results from a study under

review at that time, conducted by Wilcutt, Pennington and DeFries. The study had followed up the initial DSM-IV ADHD parent ratings of 357 children (9 with ADHD) after a period of 18 months. The test/re-test correlations were 0.87 for the inattention symptoms and 0.78 for the hyperactive/impulsive symptoms. Willcut *et al.* suggested that the results provided support for the reliability of the DSM-IV sub-types of ADHD when rated by a single adult. Inter-rater reliability has been found to be lower (Gomez *et al.*) on all ADHD sub-types (for more details of this study see Chapter 3 - The Prevalence of Attention Deficit Hyperactivity Disorder). This might have been due to directly comparing behaviour within the constrained classroom environment to the home environment where a child has more freedom to choose his/her own activities and can change tasks when they become un-stimulating.

This brief review of the history of ADHD illustrates the difficulties of defining, diagnosing and validating the condition. Over the last sixty years the term ADHD has evolved and is gradually being clarified through research. The criteria in the DSM-IV reflect the results of the research and field trials conducted in the area of ADHD. Several studies have investigated the reliability and validity of the diagnostic criteria In the DSM-IV and although some of the results have been contradictory, there is some evidence to show that the criteria do appear to be reliable and valid.

Following the publication of the DSM-IV, Anastopoulos, Barkley and Shelton (1995) voiced some of the problems that continue to exist and suggested ways in which the criteria may be further refined. They highlighted the area of

impulsiveness as one such problem and suggested that the assessment of this should be further developed. They felt another important consideration was that the number of criteria that had to be met for an individual to be diagnosed as having ADHD was not related to age. They argued that the symptoms were present to a much greater degree in young children than adolescents and adults. Evidence from longitudinal studies has suggested that the behaviour of individuals assigned to different sub-types follows different developmental courses, (Lahey *et al.*, 1994). Inattention appears to remain relatively constant whereas hyperactivity and impulsivity appear to decline substantially with increasing age. In the current version this is not taken into account, nor is there a lower age limit to which the criteria apply although the American Psychiatric Association, (1994) do agree that an individual may change from one sub-type to another over time.

This review of the historical development of the understanding of ADHD has revealed that clinicians and researchers have struggled to characterise the disorder. Discovering the cause of ADHD has been an underlying feature of the development of the diagnostic criteria. Over the decades it has been attributed to brain damage caused by a variety of factors. The debate continues to the present day. Although researchers are still not entirely certain about the precise cause, recent studies have provided evidence of a genetic contribution. Ideas about what causes ADHD are discussed in the next part of this chapter.

The causes of ADHD

Jenson, Mrazek, Knapp, Steinberg, Pfeffer, Scowalter, and Shapiro, (1997) examined the concept of ADHD in relation to evolutionary theories of biology and psychology and suggested that individuals with symptoms associated with ADHD must at some time have been at an evolutionary advantage in specific situations. Individuals with ADHD could be described as 'response ready'. They are very alert, able to scan rapidly, pounce quickly and extremely active; the very qualities required for successful hunting and survival in adverse environments. Therefore, thousands of years ago, before the advent of agriculture, individuals with these characteristics would have thrived by hunting for their food. The development of industry and agriculture has reduced the need for such behaviour. Nevertheless, they argued that these traits still exist in certain individuals. Barkley (2000) rejected the theory postulated by Jensen *et al.* (1997) and a similar idea from Hartmann (1993). He argued that "ADHD cannot have been a successful adaptation from the perspective of biological evolution... People with ADHD are not the descendents of those who had their hunting hey-day in an earlier era of human evolution when hunting, foraging, or warfare may arguably have been more important to human survival." He suggested that Jensen *et al.* and Hartmann should present evolutionary evidence to prove their theories before a conclusion can be drawn.

How does an individual come to have ADHD? Barkley (1997) stated that the precise cause of ADHD is still unknown. There was no evidence to show that ADHD was the result of abnormal chromosome structure. Instead, research

evidence pointed to ADHD being a trait, which is highly hereditary in nature. Barkley (1997) discussed the results of studies by Biederman *et al.* (1990, 1992) and Faraone *et al.* (1993) that showed that between 10% and 35% of the immediate family members of children with ADHD are also likely to have the disorder. If a parent has ADHD, the risk of their offspring also having ADHD is 57% (Biederman *et al.*, 1995). These figures of the incidence of ADHD within families suggest that the cause is hereditary.

Studies of twins have provided further evidence for a genetic contribution to the cause of ADHD. Levy, Hay and McStephen, (1997) investigated the heritability of ADHD and whether the disorder was a continuum rather than categorical. They recommended that ADHD should be viewed as the extreme of a behaviour, which changes genetically throughout the whole population, rather than as a disorder that an individual either does or doesn't have. In other words, everyone has ADHD to varying degrees of severity. The results of a study of twin boys by Sherman, Iacono and McGue (1997) also indicated that genetic factors made a significant contribution to the expression of inattention, hyperactivity and impulsiveness.

Recent developments in the study of molecular genetics have enabled researchers to identify specific genes not just for single gene traits but also for traits influenced by multiple genes and multiple environmental factors. When a trait is governed by a number of genes rather than a single gene, the chance of inheriting that trait widens into a continuum. Instead of either having the disorder or not, because many genes and their interaction with the

environment are involved, the result is a syndrome which is present in many individuals within a population to a varying degree. At a recent conference, Plomin (1998) stated that ADHD would appear to be one such disorder.

Studies of adopted children as well as twins have indicated that environmental factors can also be the cause of ADHD although to a far lesser degree (Levy *et al.*, 1997).

Barkley (1997) discussed how environmental factors, for example the interaction between parents and children may contribute to the continuity of behavioural problems. The importance of interactions and relationships between children with ADHD and their parents and teachers could have important implications for the future lives of these children. Although ADHD appears to be inherited, if the severity of the behaviour is influenced by environmental factors, it should be possible to improve the long – term prospects of individuals with the disorder. This issue will be addressed later when the impact of intervention programmes are discussed.

At the same time as Barkley (1997) admitted that the precise cause of ADHD is still unknown, Conners (1997) also posed the crucial question: "If ADHD is a disease, why haven't we found its cause?"

Conners (1997) discussed the problems surrounding the efforts of researchers to find the exact cause of ADHD. He described reviews of studies which have investigated the cause of ADHD at several levels:

psychological, anatomical, biochemical and genetic. While it was common to find differences between subjects with ADHD and controls, these findings were often inconsistent with those of other studies and so to date it had not been possible for any researcher to present a full explanation of the cause of ADHD. Conners argued that "there is too much heterogeneity and vagueness in the symptom clusters and explanatory constructs we have settled upon". Current diagnostic criteria include several forms of activity level. For example when considering the category of inattention, children who are described as being inattentive because they respond to every sensory stimulus might be very different to those children who struggle to sustain their attention on a boring task or one which is too difficult for them. However, they are all regarded as a single group at symptom level. Conners suggested that any research to find a common cause is unlikely to be successful as long as the behavioural symptoms are regarded as constituting a single disorder rather than several. In an effort to demonstrate this heterogeneity and vagueness of symptom clusters, Conners undertook a small study. A sample of 278 children aged between 6 and 16, all diagnosed as having ADHD were given a task which involved copying a complex figure and then also drawing the same figure from memory. These drawings were analysed using 32 objective scoring criteria. Based on their scores, the children were assigned to one of four groups. Children in Group 1 demonstrated greater accuracy and neatness and less rotation than the other groups. Group 2 was similar to group 1 showing a slightly lower degree of accuracy. Group 3 was the most impaired and Group 4 was similar to Group 3 demonstrating poor memorising skills but less dramatic difficulty with fragmentation, presence and accuracy.

He then moved on to consider the other characteristics of these groups and found that children in Group 1 displayed less externalising hyperactive/impulsive behaviours than the other groups. Groups 2, 3 and 4 appeared to be similar in terms of symptoms and intellectual profiles. Conners went on to consider whether there were other differences between all four groups with respect to neurocognitive processes related to attention. His results showed that the attentional processing of the four groups differed, demonstrating the point that the large group of children diagnosed as suffering from ADHD was a heterogeneous group both with respect to the neurophysiological processes involved in copying and remembering and also in their selective visual spatial attention. Consequently, what appears to be a single attention disorder might, in fact, be many. Conners argued that if children diagnosed as having ADHD were to be subdivided into further groups with distinctive patterns of attention function, similar to those groups in his study, this would increase the likelihood of identifying specific deficits at the anatomic, neurochemical or neurophysiological level. Although some of the distinguishing features between groups were reactions that took place in a fraction of a second on a specific task, Conners believed that the current diagnostic criteria could be refined in the light of these findings so that it would still be possible to make a diagnosis based on the observation of behaviour. For example it is possible through interviews to probe in detail into exactly what a teacher or parent means by the term inattention. The term inattention may be used to describe the behaviour of a child who is very responsive to every environmental stimulus, or a child who actively seeks out stimuli that are novel and interesting. Alternatively, a child who has an extremely low

arousal level may be described as being inattentive. So too may a child whose response to reward is so low that rewards are required. He suggested that ultimately, ADHD should be subdivided into several attention disorders.

Conners' suggestions have been echoed by Willcutt, Chabildas and Pennington (2001). After finding that children with either the Predominantly Inattentive sub-type or Combined sub-type demonstrated similar academic impairment and neurocognitive deficits, they suggested that this might be explained by the DSM-IV diagnostic criteria for inattention. These criteria were found to correlate highly with the hyperactive/impulsive criteria and many of the inattention criteria reflected lack of behavioural inhibition rather than pure inattention e.g. makes careless mistakes, failure to finish school work. They suggested that a separate cluster of symptoms describing sluggish, slow to respond, easily confused behaviour, could identify a meaningful group within the ADHD Predominantly Inattentive sub-type.

Bonafina, Newcorn, McKay, Koda and Halperin (2000) also suggested that rather than ADHD being a single, clearly defined disorder, children currently diagnosed as having ADHD formed a heterogeneous group. They conducted a study designed to empirically identify distinct cognitive/academic achievement patterns in children with ADHD through the use of cluster analysis. The results provided support for the hypothesis that within the broad diagnosis of ADHD, homogeneous subgroups can be identified. Although all children in their sample (n = 54, mean age = 8.9 years, standard deviation = 0.9) appeared inattentive and hyperactive, four distinct clusters that differed

considerably with regard to other behavioural, cognitive and biological characteristics were identified.

Results such as these begin to explain some of the contradictory results found in studies of the behavioural and/or cognitive characteristics of children with ADHD. They have important implications in the fields of medicine and education. Research may show that the drugs that are currently widely used for the treatment of the symptoms of ADHD are more effective with some groups than others, and also that certain teaching and learning styles are more effective with some groups than others. By dividing the disorder into three sub-types in the DSM-IV, the American Psychiatric Association had already begun to address some of the issues raised by the findings of past research, which have shown that ADHD is not simply a disorder of inattention but also of hyperactivity and impulsiveness. The research described above indicates that yet further categories might lie within the overall term of 'inattention' and demonstrates the extent to which the explanation of the cause of ADHD remains unclear.

Comorbid disorders are a further complicating factor in the classification and diagnosis of ADHD. The next section describes how individuals with ADHD often have other problems that make a diagnosis more difficult.

ADHD and comorbid disorders

Research has indicated that over 50% of individuals with ADHD also meet the diagnostic criteria for at least one other psychiatric or learning disorder. (Brown,1997). Sometimes the second disorder is masked by the symptoms of ADHD and in other cases the second disorder may mask the symptoms associated with ADHD. The term 'comorbid' is used to describe two or more disorders occurring concurrently in an individual. Brown (1997) discussed many disorders that are often comorbid with ADHD. These included disruptive behaviour disorders (such as oppositional defiant disorder and conduct disorder), anxiety and mood disorders, learning and communication disorders, Tourette's syndrome and Asperger's syndrome. Goldstein (1997) discussed the comorbid relationship between childhood depression and ADHD. He noted that Beiderman (1986) estimated the incidence of individuals suffering from the two conditions as being as high as 25% at any one time. In their longitudinal study, Barkley, Fischer, Edelbrock and Smallish (1990) monitored a group of children with and without ADHD over an eight – year period into adolescence. Sixty per cent of the group diagnosed as having ADHD had also received a diagnosis of oppositional defiance disorder or conduct disorder by the end of the study period.

The frequency of comorbid disorders adds a further complicating factor to the diagnosis and treatment of ADHD. In terms of diagnosis, this results in children with ADHD actually forming a heterogeneous group, within which, individuals differ with regard to psychiatric comorbidities, cognitive and academic function, and long – term outcome. Bonafina, Newcorn, McKay,

Koda and Halperin, (2000) noted that "attempts to construct and validate a diagnosis of ADHD characterised by unique behavioural and neuropsychological functioning, neurochemical substrates, or common psychiatric, psychosocial, and/or neuropsychological outcomes have shown limited success". This may be partly due to the common presence of comorbid disorders.

In terms of providing effective treatment plans, Brown (1997) discussed the problems associated with deciding whether some symptoms are caused by ADHD or a comorbid disorder. For example, in the case of an individual with learning difficulties, ADHD and a further disorder, the difficulty in determining whether or not learning difficulties are the product of ADHD whether they are the product of a comorbid disorder. If depression is diagnosed, is this a result of the frustration and problems associated with having ADHD or is it a comorbid disorder? Clearly, comorbid disorders and the complex issues associated with their diagnosis are a further element, which should be taken into consideration in the diagnosis of ADHD.

To summarise:

- ADHD is a complex disorder whose definition has developed and been clarified in response to continuing research over many decades.
- There is increasing evidence to suggest that the three different sub-types currently recognised may be further sub-divided in future.
- The presence of comorbid disorders frequently complicate diagnosis.
- The precise cause of ADHD remains unknown but studies of twins have provided evidence of a genetic contribution.

Chapter 3

The Prevalence of Attention Deficit Hyperactivity Disorder

Introduction

Chapter 2 focused on the complex issues surrounding the definition of ADHD and the reliability and validity of the widely used diagnostic criteria. The next logical step is to find out how widespread ADHD appears to be. Studies that have estimated the rate of prevalence of ADHD and factors affecting these estimates will be reviewed in this chapter.

Estimates of Prevalence

Estimates of the prevalence of ADHD are dependent upon how it is defined, the population studied and the geographical location surveyed. The following studies demonstrate this. The proportion of children diagnosed as having ADHD in America and Canada has been estimated to be between 2 and 10% of the population when studies have assessed samples using the diagnostic criteria in DSM-III (Costello, 1989, Szatmari, Offord and Boyle, 1989). The estimated figure in Great Britain was considerably less at 1.5% of seven year-old boys in inner cities and between 0.5% to 1% of the child population (Taylor *et al.*, 1991). The discrepancy between the North American and the British estimates was presumably partly due to differences in the assessment criteria that had been used in Britain and across Europe in the past which were from the diagnostic systems of the International Classification of Diseases (ICD) published by the World Health Organisation for Hyperkinetic Disorder.

There have been marked differences between the diagnostic criteria in past versions of the DSM and ICD and although the diagnostic criteria in the two classification systems are now converging, some differences still remain. Both systems agree that the condition should be present in early childhood (6 years of age for ICD, 7 years of age for DSM). Symptoms must have persisted for at least six months and be present in more than one setting.

One of the differences between the two classification systems is the facility in DSM-IV to divide ADHD into sub-types, which is not available in ICD - 10. A diagnosis of Hyperkinetic Disorder requires an individual to show some symptoms of inattention, hyperactivity and impulsiveness. In contrast, DSM-IV makes provision for a diagnosis of the Combined type of ADHD if symptoms in all three groups are present, or for a diagnosis of Predominantly Hyperactive/Impulsive or Predominantly Inattentive if some symptoms are not present. Also, as the DSM-IV includes 6 symptoms of hyperactivity and 3 of impulsivity, it is possible that children without any symptoms relating to impulsivity could still fulfill the diagnostic criteria for ADHD (Combined and Predominantly Hyperactive/Impulsive sub-types). Interestingly, this would appear to conflict with current scientific opinion which points towards the underlying cause of ADHD as being a deficit of impulse control. However, differences between the two classification systems exist which confuse this argument, such as one of the DSM-IV criteria, 'often talks excessively', being defined as a symptom of hyperactivity, whereas ICD-10 classifies a similar but

more specific description of behaviour 'often talks excessively without response to social restraints' as a symptom of impulsivity. Thus if an individual met all six of the DSM-IV criteria relating to hyperactivity, but none of the three relating to impulsivity, it may not be strictly true to conclude that s/he displays no symptoms of impulsivity if the ICD-10 diagnostic criteria were to be applied.

Loeber, Keenan, Lahey, Green and Thomas (1993) suggested that hyperactivity and impulsivity symptoms are typically the earliest to arise in the developmental course of ADHD, usually during the preschool years, making it possible to reach a diagnosis of ADHD (predominantly hyperactive impulsive type) using the DSM-IV criteria in young children but not necessarily arrive at the same conclusion using ICD-10. Hence the DSM-IV criteria may well lead to an apparent increase in the incidence of ADHD in future years because these young children would not have met sufficient criteria necessary for a diagnosis in previous versions of the DSM or ICD-10. One question then to be asked will be 'Is ADHD actually becoming more widespread or are the diagnostic criteria changing to incorporate more individuals who would be previously left undiagnosed?' In recent years, many children have been considered to have Emotional and Behavioural Difficulties (EBD). This term describes children who display patterns of behaviour and/or emotions that have a negative effect on their learning. Perhaps some of these children would be diagnosed as having ADHD if they were assessed with the DSM-IV criteria.

Although it is generally agreed that the symptoms of ADHD should have been present in an individual from an early age, the actual age when an individual is assessed is not currently taken into account in the DSM or ICD diagnostic systems. It has already been noted that the symptoms associated with ADHD and their severity change with the age of the individual. Some children grow out of the condition, however it does continue in 50-80% of adolescents and 30-50% of adults who were first clinically diagnosed in childhood (Barkley, Fischer, Edelbrock and Smallish, 1990). The factor of age needs to be considered when estimating the prevalence of ADHD across a population.

Swanson, Sergeant, Taylor, Sonuga-Barke, Jensen and Cantwell (1998) reviewed several studies in order to assess the prevalence of ADHD and Hyperkinetic Disorder in relation to different countries, and diagnostic procedures. Studies which used diagnoses based upon a single rating or unconfirmed interview from one point in time, estimated a rate of prevalence of between 10% and 20% across populations, the lowest rates being recorded in the United Kingdom and India, the highest rate being recorded in the USA. Studies which used psychiatric diagnoses based upon DSM (III) and DSM (III-R) diagnostic criteria including the age of onset and duration of the disorder reported rates between 5% (England) and 9% (Puerto Rico). Studies that used diagnoses based upon the ICD criteria reported rates between 1% (Hong Kong) and 4% (Germany). These results demonstrated large differences in reported rates of prevalence in relation to different diagnostic criteria and relatively small

differences between countries when stringent diagnostic procedures were followed. There was a clear difference between the numbers of individuals diagnosed using the DSM and the ICD criteria supporting the previous discussion.

The problems associated with defining and diagnosing ADHD create a significant hurdle in efforts to obtain accurate prevalence information. Several recent studies have investigated the prevalence of the different sub-types of ADHD based upon the DSM-IV diagnostic criteria. The results of five such studies are summarised in Table 1 on the following page.

Table 1 Summary of prevalence of ADHD from studies using DSM-IV diagnostic criteria

Authors	Overall prevalence rate	Predominantly Inattentive (PI) sub type	Combined (C) sub-type	Predominantly Hyperactive/Impulsive (PH/I) sub-type	Ratio between sub-types (PI : C : PH/I)
Baumgaertel, Wolraich and Dietrich (1995) Teacher ratings of German school children.	17%	9%	4.8%	3.9%	2.3 : 1.2 : 1
Gaub and Carlson (1997) Based on school population of low SES Hispanic children.	8.1%	4.5%	1.9%	1.7%	2.7 : 1.1 : 1
Gomez, Harvey, Quick, Scharer and Harris (1999) Teacher and parent ratings of school children in Australia.	Teacher rating = 9% Parent rating = 10% Teacher/parent agreement = 2.4%	Teacher rating = 6% Parent rating = 4% Teacher/parent agreement = 1.6%	Teacher rating = 2% Parent rating = 3% Teacher/parent agreement = 0.6%	Teacher rating = 1% Parent rating = 3% Teacher/parent agreement = 0.2%	Teacher rating = 6 : 2 : 1 Parent rating = 1.3 : 1 : 1 Teacher/parent agreement = 8 : 3 : 1
Wolraich, Hannah, Pinnock, Baumgaertel and Brown (1996) Teacher ratings of school children in USA.	11.4%	5.4%	3.6%	2.4%	2.5 : 1.5 : 1
Wolraich, Hannah, Baumgaertel and Feurer (1998) Teacher ratings of school children in USA.	16.1%	8.8%	4.7%	2.6%	3.4 : 1.8 : 1

Gaub and Carlson (1997) suggested that the lower prevalence rates found in their study could reflect their stringent criteria used for symptom presence. Despite differences in the rates of prevalence, all three studies found similar ratios between sub-types with the Predominantly Inattentive sub-type being the most prevalent and the Predominantly Hyperactive/Impulsive the least in non-referred populations.

Gaub and Carlson (1997) commented that the ratios of Combined : Predominantly Inattentive sub-types and Combined : Predominantly Hyperactive/Impulsive differed between their study based on non-referred subjects and other studies which were based on clinic-referred subjects such as the studies by Lahey *et al.*, (1994) and McBurnett *et al.*, (1995) which found the Combined sub-type to be much more prevalent than the Predominantly Inattentive sub-type, (Combined : Predominantly Inattentive ratios of 2.1 : 1 and 3.5 : 1 respectively). Also compared with the findings of Gaub and Carlson (1997) the studies by Lahey *et al.* (1994) and McBurnett *et al.* (1995) found a difference in the ratio between the Combined sub-type and the Predominantly Hyperactive/Impulsive sub-type of 3.0 : 1 and 4.3 : 1 respectively. It is likely that being based on a non-referred population, the figures reported by Gaub and Carlson (1997) presented a more accurate estimate of the prevalence of ADHD than do the figures derived from studies based on clinic-referred populations. However there were limitations to this study, which may affect the reliability of the results. The diagnosis was made on the basis of a teacher rating scale with no information about the age of onset or impairment in situations other than the classroom. The teacher ratings themselves may have been biased. Additionally, although the sample was selected from the community rather than clinic-referred cases, it was still limited and therefore the authors advised caution in relating this to an overall population.

Gomez, Harvey, Quick, Scharer and Harris (1999) gathered teacher ratings and parent ratings to estimate the prevalence of ADHD amongst Australian primary school children. Whilst the estimated rates of prevalence from teacher and parent ratings alone were within the range reported by other studies, when the two sources had to be in agreement to be included, the estimated rates of prevalence of ADHD dropped to 2.4% overall. This study demonstrated the importance of gathering information from a variety of sources when considering a diagnosis of ADHD.

Gender differences

There is a marked difference between the incidence of ADHD in males and females. The DSM-IV reported male : female ratios ranging from 4 : 1 to 9 : 1 depending on the setting. Taylor, Sandberg, Thorley, and Giles (1991) reported that boys attended ADHD clinics more frequently than girls with a ratio of 2.5 : 1. The reported difference in incidence between males and females may be due to adult's perceptions of acceptable behaviour for the two sexes. Or maybe the nature and behaviour of boys is different to girls and this should be taken into account. Perhaps the DSM-IV should stipulate that for a criteria to be met the behaviour should be worse than other individuals of the same developmental level and gender.

Diagnosis of ADHD across different cultures

The DSM-IV stated that ADHD occurs in various cultures. It assumed that the variation in prevalence reported in Western countries is due to different diagnostic practices. A further factor, which may contribute to variation in prevalence between countries and cultures, is the bias of the clinicians and teachers who are making the diagnoses. This bias may be a result of clinicians from different cultures holding different ideas about what exactly constitutes a disorder (Surawicz and Sandifer, 1978) or a result of clinicians diagnosing children from different cultures differently even when they display the same symptoms to the same degree of severity (Townsend, 1979).

In their study of teacher ratings of the behavioural deviance of native 'English' and West Indian children living in inner city areas, Rutter, Yule, Berger, Yule, Morton and Bagley (1974) noted that the behaviour of over 40% of West Indian children compared with less than 20% of native 'English' children was rated as 'deviant' by teachers. Many of the parents of the West Indian children disagreed with the teacher ratings. The study had used responses from questionnaires completed by teachers and parents. The main disadvantage of this approach is that it was subjective. It required the respondents to set their own standard of acceptable behaviour. Teachers and parents will have observed the children in different environments where the types activity and therefore resultant behaviour are different. They will also have had different perceptions of acceptable behaviour.

One way to measure whether or not ethnic bias does exist in the diagnosis of ADHD is to compare subjective teacher assessments with objective measures of the pupil's actual behaviour. A study by Sonuga-Barke, Minocha, Taylor and Sandberg (1993) did just this. They investigated the relationship between subjective ratings of hyperactivity and attention in groups of children classified as being of Asian or English origin, attending primary schools in one London Borough. Based on the responses of an initial questionnaire completed by teachers, the children were assigned to a control group or a persistently hyperactive group. Teachers then completed a second questionnaire and gave structured interviews about the behaviour of the selected children. At the same time, objective measures of the activity and attention of these children were taken. Based on the ratings from the initial questionnaire, teachers perceived Asian and English children to be equally hyperactive. However, differences were found in the objective measures between the English and Asian groups. The scores derived from the objective measures of those Asian children who were considered to be hyperactive by their teachers were actually equal to (or in some cases just a very small amount above) the scores of the English control group. The scores derived from the objective measures of the children in the Asian control group were all much lower than the scores of the children in the English control group. Sonuga-Barke *et al.* concluded that teachers appeared to over estimate the Asian children's levels of activity relative to those of the English children. Based on their findings, the authors could have concluded that teachers were biased in their ratings between English and Asian children.

However, they questioned the validity of the objective tests. They suggested that the unnatural conditions in which the tests were conducted may have distorted the results and so they conducted a second study where classroom observation by trained English and Asian observers was used instead of the previous objective tests. Once again, results showed that teachers appeared to overestimate the levels of activity and inattention in Asian children. One suggested explanation of the results was that teachers' views about levels of acceptable behaviour differed between English and Asian children. Teachers may have held the opinion that stricter standards of behaviour were expected within the Asian community than the English families and applied this in their subjective ratings.

Whatever the true reason, the results of the study by Sonuga-Barke *et al.* raise questions about the validity of using rating scales in a multi-cultural setting. This has implications for research such as the present study, which relates teacher ratings of ADHD to academic performance. Ratings based on the opinion of more than one teacher may improve the validity, or conversely, if bias is present in many teachers, the bias would simply be confirmed.

Age and ADHD

Hill and Schoener (1996) reviewed studies that had investigated whether or not a diagnosis of ADHD was retained from childhood into adulthood.

Their search yielded 9 studies in which cohorts of children with the disorder were formed and then re-examined 4-16 years later to determine the level of retained ADHD. The age of children at the start of each study varied between 4 and 12 years. The studies differed in methodology and diagnostic standards. Some individuals were diagnosed using criteria from DSM-II (some individuals even pre-dated this). Outcome measures were sometimes self or parent-reports rather than a clinical assessment. Using data from the studies reviewed, the authors calculated that the rate of prevalence of ADHD in a given age group beyond childhood declined by 50% every five years. Barkley (1997) challenged the outcome of Hill and Schoener's review. His argument included several points. The diagnostic criteria in DSM-II were used in 3 studies and these were not reliable or valid in their diagnosis of ADHD as it is defined today. The studies did not correct for the unreliability of the measurement of ADHD over time. Only one study (Manuzza *et al.*, 1993) followed up individuals into adulthood, and the authors of this study changed their methods of assessing ADHD between the adolescent and adult assessments from parent-reports to self-reports. Barkley had previously found that self-report measures underestimated the prevalence of ADHD in comparison to parent-reporting and therefore the reliability of the outcomes of the study by Manduzza *et al.* was questionable. A further point associated with this particular study was that the authors only followed up boys.

Finally, Barkley stated that Hill and Schoener did not analyse the data from six other published follow up studies which demonstrated higher rates of prevalence than those included in the review. Whilst the rate of decline of the prevalence of ADHD with age calculated by Hill and Schoener is questionable when considered alongside Barkley's arguments, each study (and others) did note a decline in the prevalence of ADHD with increasing age.

This decline may have been due to reasons other than increasing age, such as an original misdiagnosis. The perceived decline in the prevalence of ADHD with increasing age might also be partly explained by the theory of the nature of ADHD proposed by Barkley, 1997. (See Chapter 4 - Understanding ADHD.) He suggested that individuals with ADHD are unable to prevent themselves from reacting immediately to a stimulus and that behavioural inhibition is a necessary first step for the effective performance of four further executive functions, which work to construct a considered, goal directed response. The executive functions develop during the first few years of life. Barkley argued that whilst executive functions are not a product of education and social interaction, these factors do play a part in their development. The noisy and boisterous behaviour displayed by many young children could be a result of the incomplete development of their executive functions. Such children may not have learned to internalize their speech and behaviour. The process of growth is not uniform. Individuals develop at different rates, which may be why the prevalence of ADHD is observed to decline with increasing age. The inattentive, hyperactive and

impulsive behaviour displayed by some young children may be a symptom of immature executive functions rather than a psychological disorder. It could also be a symptom of lack of socialization. If children have not attended nursery or playgroup, they have not gained the same level of experience of how to behave in the school setting as other children. They might be inattentive, hyperactive or impulsive until they have gained the necessary experience.

ADHD and Socioeconomic Status (SES)

Pineda, Ardila, Rosselli, Arias, Henao, Gomez, Mejia and Miranda (1999) estimated the prevalence of ADHD symptoms in the general preschool and school population and analysed the influence of gender, age, and SES. Their sample comprised 540 children chosen at random from a population of 80,000 preschool and school children living in Manizales, Colombia. Socioeconomic status was divided into three groups (low, medium and high). They found that ADHD symptoms were more frequent in 6 to 11 year-old, low SES boys. The higher prevalence of ADHD symptoms among boys from low SES backgrounds compared with boys of the same age from high SES backgrounds might be attributed to their parents (particularly fathers) also having ADHD. The long-term outcome for children with ADHD is frequently poor. They are more likely to display delinquent, antisocial behaviour as adolescents and achieve lower grades at school than their peers (Barkley, Fischer, Edelbrock and Smallish, 1990; Barkley, Anastopoulos, Guevremont and Fletcher, 1991; Nussbaum, Grant, Roman, Poole and Bigler, 1990; Zentall, Smith, Lee and Wieczorek,

1994). When these children mature, although the symptoms of ADHD might diminish or be treated, they are still likely to encounter problems sustaining employment, resulting in low SES. ADHD is thought to be a hereditary condition and therefore the children of adults with ADHD, from a low SES background are also likely to have ADHD. The rates of prevalence of ADHD are likely to differ between geographical regions and this could be one reason why.

To summarise:

- The rate of prevalence of ADHD is dependent on the way in which it is defined, the population studied and the geographical location studied.
- Of the two widely used diagnostic systems (DSM-IV and ICD-10), studies that have assessed subjects using the ICD-10 diagnostic criteria have tended to report lower rates of prevalence.
- Age has been shown to be an important factor in the developmental course of ADHD. The DSM-IV and ICD-10 classification systems recognize that symptoms should be present before the ages of 7 and 6 years respectively but the factor of the age of the population assessed should be taken into consideration when interpreting prevalence studies.
- Although the DSM-IV stipulated that symptoms should be present across at least two settings, when teachers have assessed pupils' behaviour in the classroom, the rates of prevalence of ADHD have been estimated to be between 8 and 17%
- The ratio of males:females diagnosed with ADHD ranges between 4:1 to 9:1.

Chapter 4

Understanding Inattentive, Hyperactive and Impulsive Behaviour and the Condition of ADHD

Introduction

In order to appreciate the implications of educating children with ADHD symptoms, it is helpful to understand the nature of the disorder from a biological and a psychological perspective.

The discussion of the historical development of ADHD in Chapter 1, 'The Definition and History of ADHD', demonstrated its complexity. Not only is there a continual revision of the name of the condition and the criteria for diagnosis, the precise cause of ADHD also remains unresolved.

This chapter considers the mechanisms in the brain that are believed to give rise to the types of behaviour displayed by individuals with ADHD and the theories that have been proposed to explain how these mechanisms could be impaired.

Recent research that has involved scanning the brains of children with and without ADHD has found differences in the activity of certain areas in the brain of the two groups (e.g. Casey *et al.*, 1997, Pliszka, Liotti, M, Woldorff, M.G., 2000, Rubia *et al.*, 1999). These scans have been performed whilst the subjects were undertaking activities known to stimulate particular areas of the brain. The tasks commonly required the inhibition of a motor response. Deficits in the activity of the prefrontal systems responsible for higher-order motor control were frequently reported in children with ADHD suggesting that ADHD does have a biological foundation.

Researchers are still searching for the precise theory that explains the mechanisms in the brain that result in the set of symptoms displayed by those individuals diagnosed as having ADHD.

Until recently there has been little research to explain the link between the three main characteristics of ADHD (inattention, impulsiveness and hyperactivity). Barkley (1996) and Anastopoulos, Barkley and Shelton (1995) suggested that an important issue to be addressed if the nature of ADHD is to be fully understood is the impairment of executive functions. These functions are generally believed to occur in the prefrontal area of the brain. As discussed above, evidence from brain scans has been accumulating over recent years showing the same area to be impaired in individuals with ADHD when they attempted to perform certain tasks. This evidence strengthens the possibility of inattentive, hyperactive and impulsive behaviour being the result of impaired executive functions.

Attention and Executive Functions

The ability of animals to react to a stimulus from their environment is essential for their survival. An individual needs to be able to absorb, process and react to information concerning changes in their surroundings and circumstances. An environmental stimulus and response may not necessarily be external. A reaction may not necessarily involve muscle movements or outward actions. It may be a cognitive or internal action. Attention therefore refers to the functional relationship between environmental events and an individual's

response to them. At the cognitive level, information is encoded and processed to produce an output response.

Executive functions are closely linked to attention. For almost all animals, attention involves behaviour directed to the immediate context. Barkley (1996) described the process of attention as: *'environmental stimulus – response – consequence'*. This chain of events is more sophisticated in humans and some of the other higher primates. In between the *environmental stimulus* and the *response* lies a further set of processes referred to as 'executive functions'. These are the functions, which inhibit and delay an initial response to an event or message, organise the information, relate it to past experiences and develop a response based on reflection rather than reflex. Instead of reacting spontaneously to a stimulus, executive functions enable an individual to adapt their behaviour towards a desired outcome. They are cognitive, self-directed actions that contribute to the management of behaviour with the ultimate aim of improving an individual's long-term outcomes.

Barkley (1996) summarised past research about executive functions and suggested that following an initial delay in response (behavioural inhibition) they consist of 4 further processes:

Separation of affect A delay between an incoming signal to the brain and a response allows the information from that signal to be separated from the emotion. Once separated, the information is perceived in a more objective

way. This is more likely to lead to a logical, reasoned response rather than an emotional one.

Prolongation Delaying a response allows the brain to construct a mental representation of the event. This is necessary because the individual needs to be able to manipulate the facts yet recall an accurate representation of the original event when necessary. From this process, an individual constructs a sense of past experiences, which can then be related to future events. These processes largely take place in the working memory.

Internalisation Bronowski (1977) suggested that a delay in response permits the internalisation of language. This internalised language becomes a tool for problem solving, reflection and investigation. It is not necessarily the same as formal spoken language but may be a feeling or a series of images. The resultant practical instructions form a basis for planning and executing a response. Theories which described rule governed behaviour (Hayes, 1989, Skinner, 1953) had many ideas in common with Bronowski.

Reconstitution Once the images and thoughts of internalised language have been manipulated and processed, the individual reconstructs them into a recognisable form which can be acted upon or communicated to others.

Each of the functions described above can inform and interact with the others. Executive functions continue to develop through childhood and adolescence. As a child grows, the four functions change from public observable actions to

private internalised behaviour. Young children can often be heard talking to themselves but as they mature this speech becomes silent and the power of words to control the motor system increases.

Attention, Executive Functions and ADHD

The British Psychological Society (1996) discussed the results of a number of studies which had investigated whether or not children with ADHD do have an actual attention deficit (Douglas, 1972, Van Der Meere, 1996, Sergeant and Scholten, 1985). Given that the concept of attention is complex and is dependent upon the motivation of an individual, the type of task, the length of time required to complete the task, to name just a few variables, they found that the results of studies sometimes seemed to contradict each other and the broad assumption that children with ADHD have an attention deficit should not be automatically assumed to be true. It seemed that in certain situations children with ADHD were capable of responding to stimuli (visual and auditory), processing the information they attended to, completing more than one task at a time and ignoring distractions. However, the length of time between stimuli did seem to be important. Long delays seemed to result in a decrease in attention and increased failure of the task in hand.

Barkley (1996) discussed studies that measured the number and type of errors made on continuous performance tests by children with and without ADHD. It was found that when children without ADHD made a mistake they then increased the focus of their attention and responded more slowly. Children with ADHD did not seem to follow this pattern of behaviour leading

researchers to consider ADHD as a disorder of response inhibition rather than attention deficit alone.

At the First European conference for Health and Education Professionals on Attention Deficit Hyperactivity Disorder (1997), Sonuga-Barke presented data of the performance of children with and without ADHD on a computerised version of a matching familiar figures test. He discussed whether their rapid response rate was due to them being averse to delay or whether it was because they were impulsive. In the first test there was no time delay between items. He predicted that the children with ADHD would respond more quickly than the control group and indeed found this to be true. In the next test he introduced a time delay of 45 seconds between each item. The response speed of the children with ADHD was slower. There was no benefit in them responding quickly because they still had to wait for 45 seconds to pass before they were presented with the next item. Their response time was the same as the control group. Initially it would appear that under these conditions, the children with ADHD behaved the same as the control group. However the ADHD group made more errors than the control group. It seemed that the ADHD group did not use the extra time to minimise errors. Once they realised they could not change the length of delay by responding early, they wasted the time on non-productive activities. In a further experiment, errors were linked to an increase in delay thus providing an incentive to minimise them. Sonuga-Barke thought that if the ADHD group were averse to delay, they would concentrate on the task to avoid making the errors that led to delay. Results showed that under these conditions the

ADHD group did respond more slowly thus supporting the hypothesis that they were averse to delay rather than impulsive. However the number of errors they made was still high. They were inefficient at using the extra time, leading Sonuga-Barke to suggest that children with ADHD have an aversion to delay which restricts the experience required for the development of information processing strategies, ultimately leading to learning difficulties. Therefore, creating a situation which forces children with ADHD to spend longer solving a problem is unproductive if they do not possess the necessary strategies for analysing and acting upon information. This supports the theory that individuals with ADHD have impaired executive functions. However, whether delay aversion in young children with ADHD results in limited opportunities to develop and practice executive function skills, or limited executive function skills, which result in delay aversion remains questionable. The data presented by Sonuga-Barke compared children with ADHD against a control group. The results of the children with ADHD were not categorised by sub-type of the disorder.

Response inhibition is a vital first step, which enables the executive functions to reach a considered response rather than an immediate reaction. Recently, Barkley (1997) proposed a theory, which linked behavioural inhibition, executive functions and ADHD. He gave three reasons why a new model of ADHD was needed. Firstly, he argued that research in the past has been mainly exploratory and descriptive. It has not led to the formulation of a satisfactory theory from which predictions can be made and tested. Secondly, the current description of the apparent symptoms (inattention and

impulsivity/hyperactivity) excluded other cognitive and behavioural deficits associated with ADHD. Thirdly, the three sub types described in the DSM-IV which represent the current model all include the symptom of inattention, but symptoms of impulsivity/hyperactivity need not be evident in the 'Predominantly Inattentive' type. A diagnosis of ADHD may be given to an individual who appears to have an attention deficit but shows no symptoms of imulsivity or hyperactivity. In the light of the research discussed above which demonstrates how in some circumstances children with ADHD do have the same attention as other children, (their attention being dependent upon various factors associated with the task and the environment), it is perhaps inaccurate to assume that the symptom of inattention seen in an individual of the Predominantly Inattentive type has the same root cause as the symptom of inattention seen in the Combined or Predominantly Impulsive/Hyperactive types. Hence, Barkley's third reason for the new model. He suggested that the attention deficit in individuals diagnosed as Predominantly Inattentive was due to their poor speed of information processing and problems with focussed and selective attention, whereas the attention deficit in the Combined type was due to a deficit in sustained attention and increased distractibility brought about by an impairment in behavioural inhibition. If this is correct, two different disorders are being classified as one and this should be investigated.

Barkley's theory followed on from the work of Bronowski (1977) and Fuster (1995). In brief, this model is a chain of events beginning with behavioural inhibition, which 'turns off' the motor system to enable the four executive functions to work towards producing a goal directed response.

The diagram below outlines this chain of events:

Behavioural Inhibition

Executive Functions *Self regulation of affect/Motivation/Arousal*

(Referred to earlier as Separation of affect)

Working memory

(Referred to earlier as Prolongation)

Internalisation of speech

Reconstitution

Goal Directed Response *Motor control/Fluency/Syntax*

In this model Barkley has refined the 'separation of affect' category described earlier and named it 'Self regulation of affect/motivation/arousal' which as its name implies now includes the actions of self regulation of motivation and arousal. Self regulation is a self directed action which functions to modify one's own behaviour. It is future directed. That is, it changes a later outcome.

The working memory allows an individual to evaluate the present situation in relation to past experiences and then to imagine the consequences of their

actions. It is sometimes referred to as sequential memory because it considers sequences of events. For example when planning a future event such as a conference, an individual will review their past experience (perhaps last year's conference) and then devise a plan which approximately outlines what actions need to be taken at what time in the future to meet the deadline of the conference day. The working memory enables an individual to understand the concept of time and manipulate their actions accordingly. It organises cross-temporal behaviour.

The motor system is referred to as motor control/fluency/syntax. The result of the reconstitution process is converted into an actual response at the motor control-fluency-syntax stage. This response may not necessarily be a movement. It could be for example, emotional, linguistic or perceptual.

Barkley suggested that individuals with ADHD experience a disruption in the initial mechanism of inhibition. If this mechanism is not activated, the executive functions and motor control/fluency/syntax output that follow it do not function. Therefore disrupting the initial mechanism has an indirect effect on the response.

He then reviewed past studies to support his theory of ADHD being an impairment of behavioural inhibition. He found evidence to support the theory, which pointed to impairments in behavioural inhibition, working memory, poor self-regulation and motivation, motor control and the sequencing of complex motor sequences. There was no evidence to suggest

that there were impairments in the internalised speech or reconstitution functions but this may be due to lack of research into these specific areas. Although Barkley did find evidence to support his theory, he acknowledged that many of the studies were based on small sample sizes, which had been selected using inconsistent criteria, and many did not take into account other factors such as comorbid disorders, making further research necessary. This would seem to be a particularly important point when considering that although many of the studies used to support his theory used inconsistent criteria to diagnose ADHD, he did not discuss the possible differences between individuals diagnosed using DSM versions III, III-R and IV. He has argued that the predominantly inattentive type of ADHD in DSM-IV might actually be a different disorder to the combined type and the predominantly impulsive/hyperactive type. He discussed how those individuals with the predominantly inattentive type of ADHD appear to be slow in processing information and have poor selective attention and argued that these individuals may have a different disorder if ADHD is the result of impaired behavioural inhibition. But, they will have been included as having ADHD in the very studies he used to support his theory.

Barkley (1997) suggested avenues of further research required to validate his model. These included the investigation of the strength of the relationship between behavioural inhibition and each of the executive functions, the extent to which the components of the model are appropriately ordered, the development and sequential staging of the executive functions and whether

the Predominantly Inattentive group should be a subtype of ADHD or whether it is in fact a different disorder.

Brown (1998) addressed some of the above issues. He believed that individuals diagnosed as Predominantly Inattentive have no trouble with behavioural inhibition but argued that they do have problems with working memory. He suggested that Barkley's model could be revised to take account of this. In the model, Barkley placed the action of behavioural inhibition first, arguing that this action was required to enable the four executive functions described above to work. Hence impaired behavioural inhibition results in impaired executive functions. Brown suggested that if behavioural inhibition is placed alongside the four executive functions rather than being a requirement for their action, the Predominantly Inattentive group would remain a subtype of ADHD. Individuals in this subtype do have impaired executive functions although this is not necessarily a result of impaired behavioural inhibition. The subtypes would be classified as follows: The Hyperactive/Impulsive group would have impaired behavioural inhibition, the Predominantly Inattentive group would have impaired executive functions although not necessarily impaired behavioural inhibition, and the Combined group would have a combination of impaired behavioural inhibition and impaired executive functions.

It is important to bear in mind that children can be inattentive, hyperactive and impulsive as a consequence of reasons other than having ADHD. Sabatino and Booney-Vance (1994) re-examined 75 children who had been initially

diagnosed with ADHD and found that nearly one third of the sample could be reclassified with other disorders. Inattention might be the result of hearing loss, visual impairment or other communication difficulty, such as a young child with English as an additional language in an English classroom with no interpreter (Shafer and Shafer, 1998). Hyperactivity has been linked to environmental factors (e.g. nutrition, exposure to toxins), social factors, learning difficulties and emotional factors (Carter, 1998, Goldstein, 1998, Searight and McLaren, 1998). As demonstrated later, (Chapter 10, Results 1 – Distribution of Scores from the End of Reception Behaviour Rating Scale) the behaviour of children also varies greatly between classes and schools due to factors other than the age and gender of the pupils and the geographical location of the school.

To summarise:

- Barkley (1996) suggested that the behavioural inhibition of individuals with ADHD was impaired, which resulted in a subsequent disruption of executive functions.
- Brown (1998) further developed Barkley's theory and suggested that the above mechanism might be different in individuals with the Predominantly Inattentive sub-type of ADHD. He argued that the behavioural inhibition of these individuals was not necessarily impaired, but that one of the four executive functions might be impaired.

I would suggest that further research is required to determine whether impaired behavioural inhibition alone is the cause of ADHD or whether the

executive functions are impaired as well. Brown has already suggested that individuals in the Predominantly Inattentive subtype do not necessarily have impaired behavioural inhibition but that other executive functions are impaired. It is conceivable that individuals with the Combined and Predominantly Hyperactive/Impulsive subtypes have impaired behavioural inhibition and that additionally all three sub-types have one or more impaired executive functions.

- Inattentive, hyperactive and impulsive behaviour can be a consequence of factors other than ADHD.

Chapter 5

The Assessment of ADHD

Introduction

This chapter will examine the issue of diagnosing ADHD. The merits and problems associated with both subjective and objective methods of assessment will be discussed.

The Subjective Assessment of ADHD

As discussed previously, the DSM-IV contains a list of conditions that should be met for an individual to be diagnosed as having ADHD. These are assessed by observation across different settings by parents, teachers, clinicians and possibly other professionals. Marketed observation schedules such as the Brown Attention Deficit Disorder Scales may help to make observations between parents and professionals more comparable. Du Paul (1992) and Atkins and Pelham (1991) have provided descriptions of a range of published rating scales. However detailed these may be, the scores derived from rating scales are subjective and as such may be inaccurate. They could be subject to bias (Songa-Barke *et al.* 1993) or they reflect the opinion of a frustrated parent or teacher rather than a child's actual behaviour (McMillan, Walters and Holder, 1993). The place in which the assessment is conducted may also have an effect on the behaviour of the individual being assessed for example Barkley (1990) found that children with ADHD often display appropriate levels of attention and behaviour when they are being assessed by a novel adult. In clinic situations, assessment tasks are generally novel and stimulating and the child is receiving individual attention. Zentall (1993) noted that a strong stimulus can captivate the

attention of children with ADHD. This was reiterated in the results of studies reviewed by Van Der Meere (1996) described in the report by the British Psychological Society, 1996.

When a child is observed across different settings by different adults they will behave differently in response to the demands of each situation and observer. Zentall (1993) discussed the relationship between the novelty of a task and the behaviour of children with ADHD. As the length of the task increases so the novelty decreases and a child with ADHD will often become increasingly active and impulsive. Attending a clinic and performing tasks is likely to be a novel situation, whereas the familiar classroom environment where a child knows the teacher and is required to attend to longer tasks is a lot less exciting. At home it is unlikely that a structured timetable will be imposed on a child. They have far more freedom to select and move between activities at will and by so doing, they increase the novelty of the situation. Many activities at home do not need to be completed in the same way as a piece of schoolwork does. The child may therefore not display the same kind or severity of symptoms at home or in a clinic as they do at school. Also different observers will have different expectations of 'acceptable' and 'normal' behaviour.

Therefore it is often suggested (and recommended by the American Psychological Society, 1994) that evidence from a wide range of settings and observers is analysed. Du Paul (1992) proposed a four-stage school based assessment of ADHD. The assessment would be initiated following a teacher

complaint of inattention, impulsivity and/or over-activity. Stage 1 is a teacher rating of the ADHD symptoms. Stage 2 is a detailed assessment, which includes teacher and parent ratings of ADHD symptoms and interviews, reviews of school records and academic performance data, observations of classroom behaviour and an assessment of the organisation of the child's desk. He noted that teachers frequently complained about children with ADHD having disorganised desks resulting in them losing pieces of work and equipment and not completing work or not submitting it on time. In a separate study, Zentall, Harper and Stormont-Spurgin (1993) also found that children with ADHD experience problems with the organisation of time and belongings. They developed scales to assess these problems and were able to confirm and quantify them. Interestingly, they found that those children with ADHD who were receiving medication still experienced problems with organisation.

Stage 3 of Du Paul's model involved the analysis and interpretation of all the data collected from different sources. Stage 4 was the development of a treatment plan.

The principle of examining data from a variety of different sources suggested by Du Paul (1992) also formed the basis of the argument presented by Scotti, Morris, McNeil and Hawkins (1996), who suggested that whilst the descriptive diagnostic criteria in the DSM-IV are an adequate starting point for the diagnosis of a disorder such as ADHD, any diagnosis should also utilise functional analysis.

Functional analysis considers the behavioural symptoms within the context of the individual, with the aim of implementing an effective treatment plan. In other words, if the factors that trigger particular behavioural problems are identified, then it follows that addressing these factors should help to resolve the problems. Clearly this involves identifying a direct explanation of behaviour and in practice solutions might not be clear-cut, particularly if there are a combination of environmental and internal factors (e.g. impaired executive functions).

Atkins and Pelham (1991) reviewed a range of school based assessment procedures. They argued that although assessing a child within the school setting is important and behaviour in that situation is probably more typical than patterns of behaviour observed in a clinic, teacher reports should be just one of many measures used in the diagnosis of ADHD. The purpose of the diagnosis should be to provide information, which can be interpreted and used to implement appropriate intervention strategies. They concluded that there was no single instrument currently available capable of diagnosing ADHD. Multiple measures should be used because the differing results from rating scales, interviews, peer ratings and direct observations reflect the wide range of symptoms associated with ADHD as well as differences in the perceptions of different assessors. Their recommendation of assessing ADHD using a variety of different strategies was consistent with Du Paul's four-stage model. It is interesting to note that they commented on ADHD being essentially a school-based disorder. Whilst many may disagree with this statement, by making it,

Atkins and Pelham have raised the issue that the type of behaviour expected and the demands of the tasks in the classroom may exacerbate the symptoms of ADHD.

The Objective Assessment of ADHD

Objective measures are clearly defined and minimize interference from the administrator although the development of a single reliable objective measure is often problematic. Du Paul (1992) stated that 'individual objective testing plays a minimal role in the evaluation of ADHD'. In comparison to the large number of subjective rating scales available and the widely used diagnostic criteria included in the DSM-IV, there has been less success in the development of objective assessments. Barkley (1991) held the opinion that no individual test or group of tests demonstrated a sufficiently high degree of validity to be useful in the diagnosis of ADHD. The results of studies that have attempted to determine the relationship between objective measures of children with and without ADHD have often contradicted each other. There are so many variables to take into account such as the age of the child, the time of day, the length of the test, the motivational and emotional state of the child and their intellectual ability.

In providing evidence to support his theory of ADHD, Barkley (1997) reviewed studies which have investigated the differences in many objective tests between children with and without ADHD. Children with ADHD do perform differently to non-disabled children on certain tests. As more information regarding the theory

and cause of ADHD becomes available, it may become easier to establish tests that diagnose the disorder and measure the resultant behaviours.

Many of the tests used in the past were intended to quantify attention. One widely used test was the Continuous Performance Test. There are several versions of this test available as pencil and paper or computerized tests. For example, on a computerized test a random sequence of individual letters will appear on the computer screen. When a particular character or sequence of characters appears on the screen, the subject should indicate this by pressing a key on the keyboard. The number of errors and the reaction time are the two products often measured. Individuals who are impulsive tend to react very quickly, frequently to the wrong characters or sequences. Individuals who are inattentive tend to lose interest in the assessment and fail to respond to the correct characters or sequences. When they do respond, the time taken to do so is generally longer than the population norm. However, as discussed earlier, many individuals with ADHD do possess the ability to attend to stimuli under certain circumstances. The measurement of behavioural inhibition (currently perceived as an important facet of ADHD) has not been the primary aim of many studies in the past; however impulsivity is now beginning to be considered when analysing the results of tests previously used for measuring attention. Sergeant (1996) discussed two products of tests – latency and errors. He suggested that there could be a 'speed – accuracy trade off'. The speed at which problems are posed to the subject (the event rate) also affects performance. The type of errors

made on a test such as a continuous performance test may be just as important as the number of errors. The work undertaken by Halperin, Wolf, Greenblatt and Young (1991) was discussed by Barkley (1996). They examined the types of errors made on continuous performance tests and found that reaction times associated with them differed significantly. Some of the error patterns reflected impulsivity leading them to suggest that this may be useful in the diagnosis of ADHD.

Barkley (1996) also discussed the work of Van Der Meere and Sergeant (1988) who studied the effect of errors on the subsequent performance of subjects. They found that individuals without ADHD acted upon this feedback and slowed down their response rate. Individuals with ADHD did not appear to follow this trend. The findings of Van Der Meere and Sergeant (1988) have been replicated in other studies. The work of Sonuga Barke (1997) described earlier investigated the ideas suggested in the findings of Van Der Meere and Sergeant (1988) in more detail.

The studies described above have tried to measure and explain the differences from CPT tests between the types of error and times taken to answer questions of samples of children with and without ADHD. Children with ADHD also appear to experience difficulty with other tests such as those requiring them to quickly stop an ongoing response and divert to a different course of action. This type of behaviour is required in the Wisconsin Card Sorting Test (Heaton, 1981). The

failure to adjust motor performance after being given feedback may be due to poor inhibition or it may be due to an inability to retain previous information in the working memory and manipulate it to apply to a new situation. The Wisconsin Card Sorting Test (WCST) is sensitive to frontal lobe functioning. The possible link between ADHD and executive functions that occur in the frontal lobe of the brain means that the WCST may be a useful objective assessment to be used alongside other measures when diagnosing ADHD. Research by Barkley, Grodinsky and Du Paul (1992) led to the establishment of an expanded WCST to include developmental norms for children (Heaton, Chelune, Talley, Kay and Curtiss, 1993) which increases its usefulness as a diagnostic measure.

In response to suggestions from Goldstein and Goldstein (1990) that assessment from a number of different perspectives is important, McMillan, Walters and Holder (1993) attempted to develop a multi-method approach to the diagnosis of the disorder, which included both subjective and objective methods. They aimed to develop an assessment model that could detect the level of functioning within Mirsky's four phases of attentive functioning; the coordinated action of focusing, sustaining, shifting and encoding (Mirsky, 1987). He had suggested that each of these elements could be assessed using a variety of procedures. The ability to focus attention could be assessed by tests such as the Digit Symbol Substitution Test from the Wechsler Adult Intelligence Scale – Revised (WAIS-R) (Wechsler, 1981) the Stroop Colour Word test (Stroop, 1935), the Trail Making Test (Parts A and B) from the Halstead-Reitan Scale (Reitan and Davidson, 1974) and the

Talland Letter Cancellation Test (Talland, 1965). These assessments measured the ability to identify and focus attention on the important task elements and then perform motor responses under conditions of distraction. The encode element could be assessed by tests such as the Digit Span and Arithmetic sub tests of the WAIS-R which measured sequential registration, recall and mental manipulation of numeric information. The ability to shift attention from one stimulus to another could be measured using the Wisconsin Card Sorting Test (Grant and Berg, 1948). The ability to sustain attention on a stimulus for a given time could be measured using a Continuous Performance Test (Rosvold, Mirsky, Sarason, Bransome and Beck, 1956), which incorporated the analysis of correct responses, correct non-responses and reaction times.

The research conducted by McMillan *et al.* (1993) built upon Mirsky's reasearch. They used a battery of tests that measured the four phases of attention to assess children with ADHD with the intention of providing an accurate description of the child that would eventually lead to a successful treatment plan. The study assessed 32 children aged between 6 and 12 years from several schools in southern Oklahoma and Northern Texas. The results of these tests were compared with the ratings of two teachers and the scores of a continuous performance test. A regression of the test scores against the hyperactivity scale derived from the teacher ratings indicated that the test battery accounted for 90% of the variance in teacher ratings. The authors advised that the results should be interpreted with caution because of the small sample size. The study should be

viewed as exploratory and additional studies on much larger samples are required. However, the high multiple regressions between the battery and the teacher ratings demonstrated that this battery may be useful for assessing ADHD in children. It could be a good global predictor of the presence of ADHD and far exceeds the usefulness of teacher rating scales alone by offering a much more detailed description of the child's ability. The authors recognized that it was too early to begin to use a regression formula to predict ADHD and recommended that the battery should be used in combination with teacher and parental ratings.

In another study, Bowers, Risser, Suchanec, Tinker, Ramer and Donoto (1992) investigated the accuracy of the Weschler Deterioration Index (WDI) in the diagnosis of ADHD. This index was originally intended to measure the decrease in the cognitive functioning of adults with brain damage. It compared performance in the Vocabulary, Information, Object Assembly and Picture Completion subtests of the Weschler Adult Intelligence Scale with Digit Span, Similarities, Coding and Block Design subtests. Bowers *et.al.* examined the WDI to see whether or not it could reliably distinguish children with ADHD from non-disabled children. They found that children with ADHD gained higher WDI scores than non-disabled children. Because the WDI was intended to measure deterioration in the cognitive functioning of brain damaged adults, it was suggested that as the cognitive functioning of children is still developing, the difference in scores between the two groups of children might be attributed to a slower rate of development in children with ADHD rather than deterioration.

Thus, the index may be more appropriately termed 'Wechsler's Developmental Index'. Although some differences were found between the WDI scores of children with ADHD and non-disabled children, they were not sufficiently reliable to lead to a definite diagnosis of ADHD. Instead, Bowers *et al.* suggested that high WDI scores could be useful in raising the possibility that the child may have ADHD rather than a firm diagnosis.

Lufi, Cohen and Parish-Plass (1990) compared the performance on the Stroop Colour Word Test of children with ADHD, children who were emotionally disturbed, and a control group of children with no history of behavioural or emotional problems. The performance of the control group was found to be superior to the other two groups. The study used small samples (approximately 20 children in each group) and therefore the results should be viewed with caution. Similar results were found between children with and without ADHD in a recent study by Houghton, Douglas, West, Whiting, Wall, Langsford and Powell (1998) who also used the Stroop Colour Word Test when they investigated the differential patterns of executive function in children with ADHD according to subtype. Thirty two children with the Predominantly Inattentive sub-type of ADHD, 62 children with the Combined sub-type and 28 control non-ADHD children took part in the study. They were all aged between aged 6 – 13 years. The children with ADHD children did not receive medication during the period of the study. All the participants were assessed using the verbal sub-tests and performance sub-tests (which measure vocabulary), from Weschler Intelligence

Scale for Children (III), the Hundred Pictures Naming Test (which measures expressive vocabulary), and the Peabody Picture Vocabulary Test (which measures receptive vocabulary). A Trail Making Test, the Matching Familiar Figures Test, the Tower of London Test, the Stroop Colour Word Test, and the Wisconsin Card Sorting Test (WCST) were also used in order to assess executive function. The results showed that there were no main or group effects for age or gender. However, differences between groups were found on some of the tests. On the Stroop Colour Word Test and the WCST there was a difference between the Combined group and the control group. There was no difference between the results of the control group and the Predominantly Inattentive group. The results from the Tower of London Test did not reveal differences between any of the groups. The authors thought this might be because the task was not difficult enough to differentiate between the groups.

These results support the opinions put forward by Barkley (1997) and Conners (1997), which suggested that the Combined type of ADHD and the Predominantly Inattentive type of ADHD may indeed be two separate disorders. Alternatively, the tests themselves may not be measuring different executive functions accurately. Whilst the tests used in the study were well established measures of executive function, (Booney-Vance, 1998), perhaps the level of executive function currently under investigation was too sophisticated for these measures. There may be a difference between the executive functions of the control group and the Predominantly Inattentive group and there may also be similarities in the impairments of the executive functions of the Combined and

Predominantly Inattentive ADHD groups. Once again, the need for further work is evident.

If ADHD is actually a global term for more that one disorder, as has been suggested by Barkley (1997) and Conners (1997), this may also partly explain the difficulties encountered in designing an accurate objective instrument for its diagnosis. Perhaps it is time that the dimensions of ADHD should be considered as separate disorders as Conners (1997) suggested, in order to make further progress in the true definition and reliable objective diagnoses.

To summarise:

The discussion of research throughout this chapter has revealed that the accurate diagnosis of ADHD presents many difficulties. Rating scales and observation are commonly used to assess children who are inattentive, hyperactive and/or impulsive. Swanson, Sergeant, Taylor, Sonuga-Barke, Jensen and Cantwell (1988) recommended that the diagnosis of ADHD should be based on clinical history however this method of diagnosis is subject to bias. It would be ideal if a diagnosis of ADHD that had been made on the basis of evidence presented by the individual themselves along with parents, teachers and others could be confirmed with the findings of an objective instrument, yielding a more reliable diagnosis. However, the discussion of the results of several studies has demonstrated that a suitable instrument has yet to be developed.

Chapter 6

ADHD from an Educational Perspective

Introduction

In previous chapters the symptoms of ADHD and the theories that attempt to explain the causes of them have been discussed. ADHD is a complex disorder and researchers are continually striving to understand and explain exactly how it is caused. In the meantime, what effect do the symptoms have on the lives of those individuals with the disorder? To what extent does their behaviour influence their self-esteem, education and long-term prospects?

This chapter will review previous studies (and relate these to the current theory of ADHD where appropriate) of children with ADHD in relation to ability, academic achievement, long-term outcomes and specific problems in reading and mathematics.

ADHD, Ability and Achievement

In a longitudinal study, Shoda, Mischel and Peake (1990) demonstrated how pre-school children who were able to delay immediate gratification developed into successful adolescents. In their study, the behaviour of preschool children was observed as they faced the choice of accepting an immediate reward or waiting for a short period (15 - 20 minutes) in order to receive a larger reward. The time that they were able to wait for the larger reward was also measured. 185 children from middle class families with a mean age of 4.4 years were observed. The children were divided into four treatment groups:

1) The reward was exposed and the children devised their own strategies to distract themselves whilst waiting for the period of delay to elapse.

2) The reward was obscured and the children devised their own strategies to distract themselves whilst waiting for the period of delay to elapse.

3) The reward was exposed but the experimenter suggested ways in which the child could distract themselves whilst waiting for the period of delay to elapse.

4) The reward was obscured but the experimenter suggested ways in which the child could distract themselves whilst waiting for the period of delay to elapse.

About ten years later, the parents of these subjects were asked to complete a questionnaire about the coping and cognitive competence of their children. This was repeated two years later when the children's Scholastic Aptitude Test (SAT) scores were also available.

The highest correlation was found between treatment 1 and later parent questionnaire and SAT scores although the authors advised caution in applying these results to a general population because of the limitations of the sample. These children were not diagnosed as having any problems or learning difficulties at the start of the experiment.

This study demonstrated the importance of being able to delay an initial reaction and generate a more considered response to improve the long-term outcome. As discussed in previous chapters, the mechanism of behavioural inhibition appears to be impaired in individuals with ADHD (Barkley, 1997) making them impulsive. Therefore if young children with ADHD exhibit similar

behaviour to the impulsive pre-school children included in the study by Shoda *et al.*, it is possible that they will follow similar trends as adolescents in terms of experiencing academic and social problems. Block (1995) also reported on the relationship between IQ, delinquency and impulsivity. He suggested that impulsivity is an important (but not exclusive) predictor of delinquency.

The behaviour and social problems of adolescents with ADHD were explored by Barkley, Fischer, Edelbrock and Smallish (1990) in an eight-year study, tracking children with and without ADHD into adolescence. A sample of 158 hyperactive children and 81 non-disabled children aged between 4 and 12 years of age were selected for the study. All the children were required to have a minimum IQ of 80 (measured using the Peabody Picture Vocabulary Test), not have any sensory or motor disabilities, and be living with their biological mother (or have been adopted at birth and still be living with their adoptive mother). Although the hyperactive children were not selected using the criteria in the DSM-III-R, the authors assumed that it was highly likely the subjects would have met the criteria had they been available at the time.

Eight years later, a large number of the original sample and their families were re-assessed. The adolescents completed self-report forms, interviews, psychological tests and a maths test. Their families were interviewed and their teachers completed behaviour checklists. During the eight year study period the hyperactive group received more medication, individual and group therapy and even though they were educated in mainstream classes, assistance from special educational services than the control group. In

general, the hyperactive adolescents were less successful than the control group in the areas of academic achievement, social and family relationships. The hyperactive group were three times more likely to have failed a grade or have been suspended. They suffered from more psychiatric problems and were often in trouble with the police. Sixty per cent of the hyperactive adolescents had either oppositional-defiant disorder or conduct disorder at the end of the eight-year period. The results of this study support the view that children with ADHD appear to be at risk of failure in many areas of later life, however it did not quantify the extent of the academic underachievement in detail.

In a later study, Barkley, Anastopoulos, Guevremont and Fletcher (1991) found that adolescents diagnosed as having ADHD displayed significantly more antisocial behaviour such as theft and vandalism than a control group and that they were less socially competent. Once again, it appeared that children with ADHD were less likely to be successful in life than their non-disabled peers.

Many studies (e.g. Barkley, Fischer, Edelbrock and Smallish, 1990) have documented how children with ADHD achieve lower grades in academic subjects than their peer group, although as noted earlier, the study by Barkley et. al. (1990) did not quantify this difference. A review of literature by Zentall (1993) concluded that children with ADHD experienced problems with maths and reading even when controlling for IQ. In other words the academic

achievement of many children with ADHD was lower than their peers given their IQ.

The DSM -IV has split ADHD into subtypes and there may be a difference in the academic performance of children according to their subtype. The results of a study by Karustis, Power, Eiraldi and Rescorla (1997) suggested that although there were differences between the behaviour of children diagnosed as the Combined or Predominantly Hyperactive/Impulsive sub-types of ADHD, the difference in the academic functioning of children in both these subtypes was negligible. Elbert (1993) also found that although children in the Combined sub-type showed significantly poorer word attack skills, the subtypes did not significantly differ from each other on other reading/written language measures including single word recognition, vocabulary, contextual comprehension, spelling, and writing.

Lahey *et al.* (1994), in contrast to the studies described above, reported that teacher ratings of children's academic impairment differed significantly between individuals diagnosed as the Combined or Predominantly Inattentive sub-types and individuals who did not have ADHD or were diagnosed as the Predominantly Hyperactive/Impulsive sub-type. Those individuals diagnosed as the Combined or Predominantly Inattentive sub-types had significantly greater impairment than the other two groups. These teacher ratings were from the sample of children selected to take part in the field trials for the validation of the DSM-IV and the individuals were all clinic referrals. Therefore, even though significant differences were seen between sub-types,

there was no comparison against a true control group. The closest group to a control group was those children who had been referred to a clinic but did not have ADHD and who may well have had other problems. These results did not indicate whether or not the academic achievement of children diagnosed as the Predominantly Hyperactive/Impulsive sub-type differed significantly from the rest of the population neither did they quantify the differences. Willcutt, Chhabildas and Pennington (2001) reported similar differences in academic achievement between sub-types. They administered the Peabody Individual Achievement Test to four groups of children (diagnosed with one of the three ADHD sub-types in DSM-IV or not diagnosed with ADHD). The Predominantly Inattentive and Combined sub-types scored significantly lower on measures of reading and mathematics achievement than both the Predominantly Hyperactive/Impulsive group and the non-ADHD group. The difference in standardized scores was generally about 10 points (around 0.6 SD). Neither the Predominantly Inattentive and Combined sub-types, nor the Predominantly Hyperactive/Impulsive sub-type and non-ADHD group were significantly different from one another.

Gaub and Carlson (1997) assessed the 'behavioural, social and academic functioning' of a school-based population of children. Class teachers assessed their pupils by completing rating scales and checklists related to the three areas of functioning. Whilst the authors reported that the study had limitations regarding the composition of the sample and the diagnosis of ADHD being restricted to the opinion of one person in the classroom

environment only, their results (which are summarised in Table 2 below) supported the findings of Lahey *et al.* (1994):

Table 2 Percentage of children in ADHD sub-types classified as impaired

Impairment Variable	Combined sub-type	Predominantly Inattentive sub-type	Predominantly Hyperactive/Impulsive sub-type
Social (Peer like or dislike)	82	59	53
Behavioural (Appropriate behaviour)	90	58	80
Academic (Learning)	82	76	23
Not impaired in any of the 3 domains	2	11	4

(From Gaub and Carlson, 1997).

Like Lahey *et al.* (1994), Gaub and Carlson (1997) found that a high proportion of individuals met the required number of criteria in the DSM-IV for the Combined sub-type or the Predominantly Inattentive sub-type were academically impaired compared to those individuals who met the required number of criteria for the Predominantly Hyperactive/Impulsive sub-type. Although these results may provide an indication of differences in academic impairment between the three subtypes, they should be viewed with caution. The children in the sample meeting a high number of ADHD criteria were not matched to children in the control group by IQ. The academic performance of each child was assessed subjectively be their class teachers. No objective measures of ability or attainment appeared to have been collected or reported.

Baumgaertel, Wolraich and Dietrich (1995) found similar patterns of academic functioning and behavioural impairment according to DSM-IV subtype, to those described above.

Marshall, Hynd, Handwerk and Hall (1997) investigated the relationship between ADHD sub-types and academic achievement. They assessed children between 6 and 12 years of age diagnosed as having ADHD or Attention Deficit Disorder without hyperactivity (ADD/no hyperactivity) on five measures of academic achievement. The academic measures were the Reading and Mathematics subsets of the Basic Achievement Skills Individual Screener (BASIS, Psychological Corporation, 1983), the Arithmetic subtest of the Wide Range Achievement Test – Revised (WRAT-R, Jastak and Jastak, 1987), the Passage comprehension subtest and the Reading Comprehension Cluster of the Woodcock Reading Mastery Test-Revised (Woodcock, 1987). The children were diagnosed as having ADHD or ADD/no hyperactivity on the basis of information gathered from several sources and situations, and diagnostic decisions were based on the criteria in DSM-III and DSM-III-R. There was no significant difference between the Full-scale IQ or the verbal IQ scores of the two groups. A control group of children matched by IQ were not included, however the academic measures were standardized on normal populations. Since the diagnoses were based on the criteria from DSM versions III and III-R, the study did not appear to differentiate between children with the Combined and the Predominantly Hyperactive/Impulsive sub-types of ADHD as defined in the DSM-IV. The results of this study showed the mathematics achievement (BASIS Math) of children with ADD/no hyperactivity to be significantly lower than the ADHD group. No significant differences between the two groups were found for the other academic measures. One possible reason for no significant differences being found on the other four academic measures was that the ADHD group might have

contained children of both the current Combined and Predominantly Hyperactive/Impulsive sub-types and there could be differences in the achievement of these groups. Furthermore, a simple examination of the mean scores obtained by pupils with ADHD and pupils with ADD/no hyperactivity showed them to be below average on all of the measures except for the scores of the ADHD group on the BASIS Math assessment, so although there was only one significant difference between groups, there may have been more significant differences if comparisons with the general population had been made. As means and standard deviations were reported, it is possible to compute Effect Sizes from the data (for a further explanation of Effect Sizes, see Chapter 12 - Results 3, Achievement and Progress in Reading and Mathematics). Table 3 shows the differences between the two groups and the normal population expressed as Effect Sizes.

Table 3 The difference in achievement between a non-disabled sample and pupils with ADHD and ADD/no ADHD (from Marshall *et.al.*, 1997)

	Effect Size	
Assessment	**ADHD Group**	**ADD/no hyperactivity group**
BASIS Reading	-0.06	-0.11
BASIS Math	+0.13	-0.57
WRAT-R Arithmetic	-0.54	-0.85
WRMT-R Passage comprehension	-0.32	-0.49
WRMT-R Reading comprehension	-0.09	-0.12

The largest differences between the ADHD groups and the normal population were found on the WRAT-R Arithmetic and the WRMT-R Passage comprehension. A large difference was noted between the ADD/no hyperactivity group and the normal population on the BASIS Math, but in fact

the ADHD group appeared to be better than the normal population on this measure. The authors commented that the WRAT-R was a good assessment for comparing the achievement of clinical and non-disabled samples but may not possess sufficient sensitivity to discriminate between two clinical populations. The WRAT-R Arithmetic assessment did discriminate between the ADHD groups and the normal population, the largest difference being between the ADD/no hyperactivity group and the normal population. If the authors had computed Effect Sizes, they would have also noticed a modest difference between the two groups on this measure.

To summarise, Marshall *et al.* (1997) found differences on five academic measures between the normal population and children with either ADHD or ADD/no hyperactivity. With the exception of the results of the BASIS Math assessment of the ADHD group, the largest of these differences were on the assessments that measured mathematics achievement. The only significant difference between the ADHD and ADD/no hyperactivity groups was found on the BASIS Math assessment ($p=0.03$). Perhaps larger differences would have been found if the children in the ADHD group had been re-classified as the DSM (IV) Combined or Predominantly Hyperactive/Impulsive ADHD sub-types. In later research, Marshall, Schafer, O'Donnell, Elliott and Handwerk (1999) again found that children with ADD/hyperactivity and children with ADD/no hyperactivity experienced problems on a variety of mathematics assessments. The two groups experienced problems with different elements of the assessments, leading the authors to suggest that children with the Predominantly Inattentive sub-type of ADHD might be at increased risk of

arithmetic calculation deficits, caused by deficits in selective attention, whereas children with the Predominantly Hyperactive/Impulsive sub-type of ADHD might experience difficulties on tasks associated with sustained attention.

In spite of the limitations of the studies described above, the results they reported would suggest that differences in academic performance between the subtypes of ADHD appear to exist. It is important for future studies of the academic achievement of children with ADHD to include a breakdown of results by sub-type.

There are many possible reasons for this difference in achievement between children with and without ADHD. The research on the connection between ADHD, behavioural inhibition and executive functions discussed earlier seems likely to be one of the key factors. Impairment of these mechanisms will affect a child's capacity to find solutions to problems. The primary function of the working memory (an important executive function) is to organise cross-temporal behaviour. Therefore activities that rely on this skill will be problematic for children with ADHD. For example, mental arithmetic is a test of working memory. The brain has to hold and manipulate information to produce an answer. Zentall, Harper and Stormont-Spurgin (1993) suggested that the problems with mathematical computations experienced by children with ADHD were related to their poor organisation of temporal and spatial events.

Zentall, Smith, Lee and Wieczorek (1994) found that whilst the solution of some mathematical problems was dependable on reading and vocabulary, when this variable was held constant, boys with ADHD aged between 7.4 and 14.5 years experienced difficulties solving mathematical problems. They appeared to have difficulty manipulating mathematical concepts, which supports the theory that these children have impaired executive functions. They have difficulty relating problems to existing knowledge and holding the information in their minds whilst they consider possible solutions.

Barkley, Anastopoulos, Guevremont and Fletcher (1991) attributed problems with mathematics to a combination of slower computational speed, slower visual motor speed, and off-task behaviour. The slower computational and visual motor speed may be the result of off-task behaviour.

Nussbaum, Grant, Roman, Poole and Bigler (1990) assessed the effect of age on the achievement and behaviour of children with ADHD. The results indicated that there was a negative relationship between age and arithmetic skill. As children with ADHD get older, they fall behind their peers in maths achievement. It was suggested that this could be due to a deficit in attention of these children. If they fail to concentrate fully and miss one small step in the process of completing a maths problem, the answer will be wrong whereas this level of attention is not as critical in reading and other subjects. Since this paper was published, the emphasis of the cause of ADHD has shifted from being a deficit in attention towards impaired behavioural inhibition. Nevertheless the authors' point about the level of precision

required in solving mathematical problems may contribute to the difference in maths performance between children with and without ADHD. In a commentary about this work, Solanto (1990) suggested that as children with ADHD become older, the frustration of repeated failure in the subject might affect their attitude and willingness to persist at tough maths problems. Nussbaum *et al.* recognised that the data generated in their study was of limited use because it was cross sectional rather than longitudinal. The sample of children included only boys referred to a neurological clinic. It was therefore suggested that future longitudinal studies of a wider sample of children are required to confirm these results.

Children with ADHD also appear to have problems associated with reading, writing, speaking and listening. Zentall (1993) reported that reading difficulties are more common in children with ADHD than those without. She noted that even when controlling for IQ, some researchers still found that children with ADHD performed worse than control groups in reading (August and Garfinkel, 1989). Nussbaum (1990) suggested that pupils with AD/HD were less likely to fall behind their peers in vocabulary than reading comprehension and suggested that this was because vocabulary does not appear to require the high level of sustained attention demanded by the processing of a long passage of text. Barkley (1997) suggested that the poor reading comprehension skills often observed in children with ADHD were caused by impaired executive functions. He proposed that the processes of internalising speech and relating the event to the past and then to the future occur when a child is reading and particularly when performing a reading comprehension

test. He discussed the results of two studies, which measured the reading comprehension skills of children with ADHD. The first by Cherkes-Julkowski and Stolzenberg (1991) found that children with ADHD performed worse on a reading comprehension test than a control group and that the performance of the ADHD group declined as the length of text increased. This would be expected because the working memory would be less efficient as the amount of information it was expected to process increased and also as the children became distracted from the task. The second study by Brock and Knapp (1996) compared ADHD severity with reading comprehension skill. After controlling for the effects of other variables such as word attack skills, vocabulary, word identification, speed of reading and background knowledge, the results of the ADHD group were still lower than the control group. Brock and Knapp also found that standard of reading comprehension declined as the severity of the ADHD symptoms increased.

Pennington, Grossier and Welsh (1993) investigated the phonological processing skills and executive functions of children with ADHD-only, children with reading difficulties-only, children with ADHD and comorbid reading difficulties and a control group. A total of 70 children aged between 7 and 10 years were assessed. Children who usually received medication had their treatment withheld for 24 hours prior to the assessment time. The design of this study was intended to show whether children with ADHD experienced problems with phonological processing which is considered to be an important element in reading development (Bryant, Maclean, Bradley and Crossland, 1990) and the extent to which executive functions were impaired in the four

groups. The results showed that the executive functions of the ADHD-only group were significantly impaired compared with the reading difficulties-only and control groups. The ADHD-only group did not experience problems with phonological processing. Their phonological processing scores did not differ significantly from those of the control group. The results support the theory proposed by Barkley (1997) that the poor working memory of children with ADHD could be why they find reading comprehension difficult. These results also add to existing knowledge by discounting the possibility that poor phonological processing is the reason why children with ADHD are often poorer at reading than their non-disabled peers.

Purvis and Tannock (1997) also argued that many studies of the language abilities of children with ADHD have not distinguished between children with ADHD alone and those with comorbid disabilities, making it difficult to determine whether the language impairments are specific to ADHD. They examined the language abilities of children with ADHD and the impact of concurrent reading disability. The subjects of this study comprised four groups of boys aged between 7 and 11 years. The first group were diagnosed as having ADHD alone, the second group ADHD and reading disability, the third group reading disability alone and the fourth group were normal controls. All children had an IQ greater than 80. Three measures of language were used in the study. A 'Story Re-telling' task in which the subject listened to a story and was then required to re-tell it assessed comprehension and reproduction (the total amount of the story recalled, organisation of the story events and self monitoring of the output). A 'Word' test measured

expressive vocabulary and semantic abilities. The third measure was a 'Language Processing' test.

The authors found that all children with ADHD (regardless of whether or not they also had a reading disability) experienced problems with organising and monitoring their responses in the 'Story Re-telling' task whereas the children with reading disability (regardless of whether or not they also had ADHD) experienced problems in the semantic aspects of language. The 'Story Re-telling' task made demands on a child's executive functions. It required the individual to pause in order to organise events and plan a response. The ADHD-only group performed as well as the control group in the 'Word' test, which did not require lengthy responses and did not depend on executive functions. The authors suggested that the language deficits of children with ADHD are related to the use of language rather than the comprehension of the subsystems of language (e.g. phonology, syntax). Once again, these results support the theory of the nature of ADHD proposed by Barkley (1997) and the findings of the earlier study by Pennington, Grossier and Welsh, (1993).

Many of the studies discussed earlier in this chapter have focussed on the academic achievement of children with ADHD. Kaplan, Crawford, Dewey and Fisher (2000) compared the range of IQ scores of children with ADHD against children with ADHD and comorbid reading difficulties. This separation of groups enabled the authors to determine whether or not in the presence and absence of reading difficulties, the IQ scores of a sample of children with

ADHD were normally distributed. The study sample comprised 63 children (56 boys, 7 girls) with ADHD and 68 children (52 boys, 16 girls) with a combination of ADHD and reading difficulties. The participants either attended special schools, clinical/tutorial settings or were hospital/clinic referrals. From the selection procedure, the children classified as having ADHD met the criteria for ADHD in the DSM Version III-R (American Psychiatric Association, 1997). Children were classified as having reading difficulties if they scored at or below the 24th percentile on the word attack subtest of the Woodcock Johnson Psycho-Educational Battery-Revised (Woodcock and Johnson, 1989), *and* scored at or below the 16th percentile on the spelling subtest of the Wide Range Achievement Test-Revised (Jastak and Wilkinson, 1984), *and* less than 17 on the Auditory Analysis Test (Rosner and Simon, 1971). Children were also classified as having reading difficulties if they scored at or below the 16th percentile on the basic reading or the reading comprehension of the Woodcock Johnson Psycho-Educational Battery-Revised. The measure of IQ (FSIQ) was obtained using the short form (vocabulary and block design) of the Wechsler Intelligence Scale for Children-Third Edition (WISC – III, Wechsler, 1991) and standardised scores were then estimated using the norms from the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974). Three children with IQ scores of 75 or lower were excluded from the analysis. The mean age of the group of children with ADHD was 12.42 years with a standard deviation of 2.43 years. The mean age of the group of children with ADHD and comorbid reading difficulties was 11.61 years with a standard deviation of 2.42 years.

The distributions of FSIQ for each group were not found to be significantly different from a normal distribution. In addition to considering the shape of the distribution of FSIQ scores, the authors also looked at the proportion of children falling into each IQ range - above average (scores greater than 110) average (scores between 90 and 110) and below average (scores lower than 90). Once again no significant differences were found. The distributions of the IQ scores for both groups were found to be normal.

The results of the study by Kaplan *et al.* suggested that the IQs of children represented the full spectrum from gifted children to children with special educational needs. Additionally, the distribution of IQ scores of children with ADHD and comorbid reading difficulties followed a similar profile. The authors noted that this finding was inconsistent with earlier research e.g. Dykman and Ackerman (1994). They could not offer an explanation for the difference, but suggested that the different methods employed to identify children with ADHD and reading difficulties could have been contributing factors.

A possible weakness in experimental design acknowledged by the authors was the use of the WISC – III and subsequent estimation of full scale IQ using the norms of the WISC – R. They considered this approach to be valid, and argued that if inaccuracies occurred, they would have not affected one group more than the other. Power analysis confirmed that the sample size was large enough to compare the FSIQ of each group to the normal distribution. Although the paper was published several years after the introduction of the DSM-IV (American Psychiatric Association, 1994), the authors identified the

children with ADHD as meeting criteria from DSM Version-III-R. A limitation not acknowledged by the authors was that there was no comparison of the distribution of FSIQ scores by the sub-types of ADHD described in the DSM-IV. This would have made a useful contribution to the existing evidence about the ability and achievement of children within these sub-types, although the sample sizes of each group would then have been small.

Warner-Rodgers, Taylor, Taylor and Sandberg (2000) also investigated the full scale IQ of children with behavioural problems of inattention, hyperactivity and impulsivity. Their sample comprised a school-based population of 7-year old boys who were divided into four groups: children who were purely inattentive, children who were purely overactive, children who exhibited a combination of both types of behavioural problems and a control group who did not exhibit any behavioural problems. These groups were similar to the ADHD sub-types listed in the DSM-IV, however the boys in the purely inattentive group did not show any symptoms of overactivity, and the boys in the overactive group did not show any symptoms of inattention. They were more extreme than the DSM-IV sub-types in which children may be inattentive, but still meet a small number of criteria relating to hyperactivity/impulsivity although insufficient to qualify for the Combined sub-type of ADHD. The boys were assessed using the WISC – R (1974), which included the vocabulary and block design units used by Kaplan *et al.* Warner-Rodgers *et al.* found that boys who were purely inattentive had a significantly lower mean full-scale IQ than the control group and closer examination of the results revealed that the language-based skills of the inattentive children were

weaker than the non-verbal skills. The full scale IQ of the children in the purely overactive and combined groups did not differ significantly from the control group (mean scores and standard deviations of 101.7, 13.8 and 98.8, 17.6 respectively). These results indicated that there appeared to be a relationship between full scale IQ and inattention.

To summarise:

A review of literature by Zentall (1993) concluded that children with ADHD experienced problems with maths and reading even when controlling for IQ. In other words the academic achievement of many children with ADHD was lower than their peers given their IQ. However, even though the true definition and characteristics behind the disorder of ADHD continue to evolve, this chapter has discussed the results from recent studies which have started to pin point specific areas of difficulty and the tentative explanations by put forward by authors for these. A common theme beginning to emerge is that many of the difficulties encountered by children with ADHD are related to impaired executive functions, and may be to some extent independent of IQ.

Chapter 7

The Treatment

Of Attention Deficit Hyperactivity Disorder

Introduction

The previous chapters have described the impact that the behavioural problems associated with Attention Deficit Hyperactivity Disorder have on the social and academic outcomes of children diagnosed with the condition. Naturally, treatment for the symptoms, and the disorder itself, is frequently sought. Although there is no recognised cure for ADHD, there are several methods of treatment for the symptoms, the most common being stimulant medication and psychosocial interventions. The National Institute for Clinical Excellence suggested that children with ADHD should receive "a comprehensive treatment programme involving advice and support to parents and teachers, and could, but does not need to, include specific psychological treatment (such as behavioural therapy)". Several studies have investigated the effects of various kinds of treatment. The results from some of these studies, reviews and meta-analyses are discussed in this chapter.

Stimulant Medication

Stimulant medication such as methylphenidate (commonly known as 'Ritalin') is very commonly used and has been found to improve the sustained attention, impulse control, social behaviour and academic productivity of 70 – 80% of children with ADHD (Du Paul and Eckert, 1997). Baldwin and Anderson (2000) reported that around 114,000 prescriptions for methylphenidate were made to children and teenagers in the UK between January and September 1999. These data were obtained from the Department of Health and were unlikely to reflect the additional number of

individuals with ADHD treated by private psychiatric services so therefore the total number of prescriptions may have exceeded this figure.

Methylphenidate is believed to work by inducing an increase in the level of dopamine in the brain. Dopamine is a chemical whose presence is necessary for the transmission of signals between nerve cells to take place. It could be imagined that increasing the activity of the brain cells of an already hyperactive and impulsive child would amplify this behaviour. To speculate why methylphenidate has a beneficial effect on children with ADHD, consider the theory that behavioural inhibition is a positive reaction that needs to occur to allow the executive functions to process information (see Chapter 4, 'Understanding ADHD from a Biological and Psychological Perspective'). It is possible that insufficient dopamine means that the transmission of the signal from the external stimulus to the area of the brain that triggers the initial behavioural inhibition is inefficient. If so, artificially stimulating an increase in the level of dopamine would enhance behavioural inhibition and enable the subsequent executive functions to take place. Kempton *et al.* (1999) found that methylphenidate could enhance the performance of adults and children with ADHD on an assessment which was sensitive to executive functions. Mehta *et al.* (2000) also found that methylphenidate improved the functioning of the spatial working memory of individuals with ADHD and concluded that stimulant medication was associated with enhanced executive functions in individuals with ADHD.

Kavale (1982) conducted a meta-analysis of the effect of stimulant medication on individuals with ADHD. The meta-analysis included 135 between-subject studies, in which non-intervention control groups were compared to experimental groups. The effectiveness of stimulant medication varied according to the outcome variables being measured. An average effect size of 0.80, in favour of medication treatment, was found for behavioural outcomes, and a lower average effect size of 0.49, in favour of medication treatment for cognitive outcomes. Studies investigating the effectiveness of stimulant medication versus placebo on reducing ADHD symptoms, have generally demonstrated effect sizes in the region of 1.0 in favour of stimulant medication (e.g. meta-analysis by Jensen and Payne, 1998).

Stimulant medication appears to be very effective at reducing ADHD symptoms and improving the behaviour of individuals with ADHD, however it is not the answer to the problems of all individuals with ADHD. Du Paul and Eckert (1997) reported that about 20 – 30% of children do not respond positively to this type of medication, (for some of these individuals there is little evidence of enhanced functioning, others experience negative side effects of insomnia and appetite reduction). Du Paul, Eckert and McGoey (1999) have also suggested that whilst 50% of children treated with methylphenidate show positive changes in academic achievement, the remainder show either no improvement or deterioration. Many individuals with ADHD, parents of children with ADHD and professionals treating the disorder find the prescription of stimulant medication undesirable, largely

because of worries about the unknown long-term side effects (Baldwin and Anderson, 2000).

Although many studies have demonstrated the efficacy of stimulant medication for the treatment of ADHD symptoms, in their Consensus Development Conference Statement on the Diagnosis and Treatment of Attention Deficit Hyperactivity Disorder (1998), the National Institutes of Health (NIH) discussed the outcomes and limitations of much of the research to date. It was noted that these studies had focused on the use of stimulant medication to treat individuals who met criteria for inattention and hyperactivity/impulsivity, implying an absence of research into their effect on individuals meeting only criteria for inattention. Also, whilst stimulant medication was generally found to be an effective treatment for ADHD, most randomised clinical studies had been short term (less than 5 months duration). The NIH did not find any information about the long – term outcome of individuals with ADHD treated with medication in relation to social and academic achievements. The Multimodal Treatment of ADHD study (The MTA Cooperative Group, 1999) monitored the treatment of individuals with ADHD for 14 months. The results of this study will be discussed later in the chapter when combined therapies are considered.

Behavioural and Classroom Interventions

Behavioural and classroom interventions have been found to be effective in reducing ADHD symptoms and improving academic performance (Abramowitz and O'Leary, 1991, Fiore, Becker and Nero, 1993, Houlihan and Van Houten, 1989, Pfiffner and O'Leary, 1993) though they do not appear to be as effective as stimulant medication.

Possible classroom interventions are many and varied. For example, Cooper and Ideus (1996) published practical advice about effective classroom teaching for children with ADHD including techniques such as seating the child in a place which is relatively free from distraction e.g. doors and windows, in a position where the teacher can easily intervene if the child is not attending, having a designated quiet area for a child to work in, providing stimulating activities, giving concise, clear instructions, following a defined, regular timetable, avoiding repetitive tasks, breaking down tasks into a series of small steps, giving frequent positive feedback, working in a pair rather than a group, isolating the child from the class for a short time when they are misbehaving, giving points or tokens as rewards to be exchanged at a later time for a favourite activity or treat, among many other ideas.

Fiore *et al.* (1993) discussed the positive outcomes of many classroom-based interventions in their review of educational interventions for attention deficit disorder. For example, positive reinforcement was found to be effective in reducing activity level, increasing time on task and improving academic performance. Hyperactive children appeared to be unusually sensitive to

rewards, but partial rewards were less effective than continuous ones. Some of the studies examined the effect of punishment. Mild corrections proved effective in decreasing off-task behaviour, and to some extent increasing academic productivity. This was partly contradicted by Worland (1976) who compared positive feedback, negative feedback and no feedback, and found that hyperactive children were on task significantly more under negative conditions, but this type of feedback significantly increased their errors on a spelling task. Reprimands were found to result in significantly lower off task rates, and the length of reprimand was important. Short reprimands were more effective than long reprimands. It was suggested that long reprimands involve more adult interaction and may actually serve as positive reinforcement. Response-cost programmes (a combination of positive reinforcement and punishment) were found to be effective. Reward and response-cost programs have both been shown to produce gains in the on-task behaviour of hyperactive children, although the response-cost treatment had a more lasting effect after the programs had been phased out. Response-cost has been shown to be more effective than positive reinforcement alone in improving on task behaviour and completion of academic assignments. Although informative, this review was not a meta-analysis and did not report effect sizes for each type of intervention.

Abikoff (1991) reviewed 28 studies that had investigated the effect of cognitive training (the development of self controlled skills and reflective problem solving strategies) in promoting appropriate behaviour regulation and academic functioning. None of the results from these studies suggested that

cognitive training was as effective as stimulants or that it enhanced their beneficial effects. However, in a more recent study, Semrud – Clikeman, Nielsen, Clinton, Sylvester, Parle and Connor (1999) did find that an intensive training course improved the attention and problem – solving skills of children with ADHD. The participants of their study comprised 33 children identified as having ADHD but no other learning or behavioural problems, and a control group of 21 children who did not have any behavioural or learning problems. The age range of the participants was 8 to 12 years. Of the 33 children with ADHD, 21 participated in the intervention, the remaining 12 forming an ADHD control group. Eight of the children in the ADHD intervention group were identified with the Combined subtype of ADHD and 13 with the Predominantly Inattentive subtype. None of the children had the Predominantly Hyperactive/Impulsive subtype. No differences were found between groups for vocabulary or block design sub-tests of the Wechsler Intelligence Scale for Children – Third edition (WISC – III, Wechsler, 1991). Each participant completed pre and post – tests of visual and auditory attention. The intervention, implemented outside school hours, consisted of an 18 – week period of attention and problem solving training. Children attended two hour – long sessions per week at which they practiced visual and auditory attention tasks. Regular feedback on performance was given. The children then talked to the researcher about the strategy they had used and evaluated its effectiveness. The results of the pre – test showed the visual and auditory attention of the ADHD groups to be significantly lower than the control group. Means and standard deviations were reported, so it was possible to calculate the differences in terms of effect size. The differences between the ADHD

groups and the control group for visual attention were 0.8 (ADHD control) and 0.8 (ADHD intervention) and for auditory attention were 1.00 (ADHD control) and 0.8 (ADHD intervention). The results showed an increase in scores between the pre and post – tests for all groups. The differences for the control group and the ADHD control groups were small (effect sizes of 0.5 and 0.3 respectively for the visual attention test, and effect sizes of 0.2 and 0.3 respectively for the auditory attention test). The differences for the ADHD intervention group were much larger (effect size = 1.2 for the visual test and 1.4 for the auditory test). This improvement meant that the post – test scores of the ADHD intervention group were almost as high as the control group. No differences were found between the performance and improvement of children with the Combined subtype of ADHD and children with the Predominantly Inattentive subtype. This could have been due to the small sample sizes. So few children were on stimulant medication that it was not possible to assess whether or not they performed differently to the others. The intervention programme had taken place outside school hours, although the authors were optimistic that the strategies could successfully be implemented in the classroom. The children in the study were not re-tested at a later time to assess the long-term effects of the strategy. Another interesting outcome would be to measure the impact of the strategy on classroom behaviour and academic achievement.

Jadad *et al.* (1999) published a critical appraisal of systematic reviews and meta-analyses of the treatment of ADHD. They considered that many of these reviews were flawed due to the poor description of the methods used by the authors to identify, collect, analyse and synthesise the information. Of the 13 reviews appraised, a review by Du Paul and Eckert (1997) was one of only two highlighted as having 'minor to minimal flaws' (the other review had investigated the effect of medication). So, even with the limitations recognised by the authors, it might be regarded as one of the best available sources of information about the effectiveness of school based interventions for children with ADHD. The meta-analysis conducted by Du Paul and Eckert examined 63 studies of the effects of school-based interventions for children and adolescents with attention deficit hyperactivity disorder. They analysed studies of:

a) *academic interventions*, which focused on changing teaching strategies, such as introducing peer tutoring, or adapting support material to increase academic performance
b) *contingency management interventions*, in which teachers used positive reinforcement or punishment to reduce negative behaviour
c) *cognitive behavioural interventions*, which develop self control skills and reflective problem solving strategies to encourage individuals to regulate their own behaviour.

The experimental designs included:

a) *between subjects*, which consisted of one or more intervention groups and a control group. The effect of the intervention was assessed by

comparing the outcome of experimental groups with the control group.

b) *within subjects*, in which each participant was subjected to an intervention. The effect of the intervention was assessed by measuring the progress made between a pre-test administered before the intervention and a post-test administered afterwards.

c) *single subject*, which recorded the changes in behaviour of a single participant.

They found that school-based interventions for children with ADHD resulted in a significant improvement in their behaviour across all experimental designs ('between subjects' = 0.45, 'within subjects' = 0.64 and 'single subjects' = 1.16). The effect of the interventions on academic performance was more variable and smaller than those for improvement in behaviour ('between subjects = 0, 'within subjects' = 0.31 and 'single subjects' = 0.82). Contingency management and academic interventions were found to be more effective than cognitive-behavioural interventions for improving behaviour. But, cognitive-behavioural interventions were more effective in improving academic performance than the other two interventions. This may appear to contradict the findings of Abikoff (1991) discussed earlier, however, Abikoff was comparing the effectiveness of cognitive-behavioural interventions to stimulant medication, whereas the experimental designs included in the meta-analysis by Du Paul and Eckert compared the effect of interventions against previous performance in the case of 'within subject' and 'single subject' designs, or against controls in the case of 'between subject' designs.

Du Paul and Eckert recognised that their findings were limited because most of the studies in the review were either 'within subject' or 'single subject' designs with only a small number of participants in each. Nevertheless, they do provide an estimate of the effect of school-based interventions for children with ADHD, and as such add to the findings of previous qualitative reviews.

Combined Treatments

The Multimodal Treatment of ADHD (MTA Group, 1999) study sponsored by the National Institutes of Mental Health was a large-scale study intended to systematically investigate the effects of different treatments over a considerably longer time span than previous research.

A total of 579 children between the ages of 7 and 9.9 years of age, with ADHD (Combined type) were randomly assigned to one of four treatments:

1) medication alone,
2) behavioural therapy,
3) combination of medication and behavioural therapy,
4) community care in which individuals received treatment generally provided in their local community.

Treatments were carefully implemented, and a wide range of outcome measures was collected.

The combined treatment and medication alone treatment were found to be statistically and clinically superior to the behavioural therapy or the community

care treatments in reducing ADHD symptoms. The combined treatment outcomes were achieved with significantly lower medication doses than those used in the medication alone treatment. Few differences were found between treatments for other areas of functioning (oppositional/aggressive behaviour, internalising symptoms, social skills, parent/child relations and academic achievement). When differences occurred they were generally smaller than the reduction in ADHD symptoms. One noteworthy difference was found between the reading scores, measured by the Wechsler Individual Achievement Test, of the children assigned to the combined treatment and the children assigned to the behavioural therapy treatment in which the combined treatment had the greatest effect.

It should be remembered that the findings of the MTA study applied to children with the Combined sub-type of ADHD and different results might be found if children with the Predominantly Inattentive and Predominantly Hyperactive/Impulsive sub-types were studied.

In addition to the MTA study, recent reviews have aimed to provide more information about the effectiveness of combined interventions (medication and psychosocial) compared with medication and psychosocial interventions alone. In 1997, the Agency for Health Care Policy and Research in America commissioned the Evidence-Based Practice Centre at McMaster University to conduct a systematic review of the literature on the treatment of ADHD. Two general questions formed the focus of the report:

'What is the evidence from comparative studies on the effectiveness and safety, both long term and short term of pharmacological and psychosocial interventions for ADHD in children and adults?'

'Are combined interventions more effective than individual interventions?'

The limitations of the methodology of the studies reviewed were recognised, e.g. small sample size, failure to report the number of withdrawals or cases that dropped out and reasons for reduction in sample sizes, which all increased the likelihood of biased results. The comparison of data across studies was limited due to the poor quality of reporting and by the wide variety of outcome measures. The results of the review did indicate that stimulant medication alone was more effective than psychosocial interventions alone, and that combined treatment offered modest additional benefits over single treatments for non-ADHD areas of functioning.

Jensen and Payne (1998) also conducted a review with the aim of comparing the effect of stimulant medication alone and in combination with psychosocial approaches. After rejecting some of the studies included in the McMaster review on the grounds of them not focusing on change in ADHD symptoms as a primary outcome or for failing to provide sufficient methodological detail of the treatments, and identifying more recently published work, they reviewed a total of 15 studies. Fourteen of these employed complete random assignment to treatments. Jensen and Payne discussed a number of limitations of the studies published to date. With the exception of the MTA study described earlier, sample sizes were modest, ranging from 18 to 103 subjects. When

subjects were assigned to different treatment groups, the small sample size of each treatment group within each study meant that the results of 14 studies had insufficient statistical power to detect the presence of benefits of combination treatments over single treatments, except for moderate to large effects. Secondly, with the exception of the MTA study and the Multimodal Treatment Study, (Hechtman and Abikoff, 1995), the periods of treatment were short term, usually no more than three months. This time period is too short to detect changes in many outcomes of interest other than ADHD symptoms, for example the onset and impact of comorbidities, long-term improvement in self esteem and academic achievement. Thirdly, Jensen and Payne suggested that in comparative studies to date, the psychosocial treatments have not been sufficiently intensive. Fourthly, most studies have not optimally adjusted the treatment to the child's specific requirements, a process that would usually be the outcome of functional assessment (Scotti *et al.* 1996, Ervin *et al.* 1998). The MTA study did alter the dose of medication prescribed to each participant for optimum effect.

In spite of the limitations of individual studies, the findings of the review by Jensen and Payne provided evidence on various treatments. They discussed the results from two of the largest and most rigorous short-term studies (Klein and Abikoff, 1991, Horn, Ialongo, Pascoe, Greenberg, Packard, Lopez *et al.*, 1991) which suggested that under some conditions, combined treatments offer advantages over medication-only treatments for some outcomes of interest. The results from these studies also suggested that medication treatments alone were superior to psychosocial treatments alone with respect

to a range of short-term outcomes. For example, in the study by Klein and Abikoff, the combined group, who were treated with behaviour therapy plus medication, showed significantly more improvement than the medication-only group on teacher ratings of cooperation, impulse control and attention seeking behaviour. Horn *et al.* followed up the participants 9 months after the treatment period. The group who had received a combination of medication, parent behavioural training and child self-control training showed a continued increase of parent reported benefits compared with the medication-only group who showed no further gains.

Evidence from the short-term studies supported the theory that combined treatments enabled a reduction in the dose of stimulant medication required for optimal behaviour.

A longer-term study conducted by Hechtman and Abikoff (1995) was also discussed. One group of children received a combination of medication, parent training/counselling, social skills training, academic skills training and individual psychotherapy for a 12 month period, followed by monthly booster sessions for 12 months. The combined treatment was not found to be superior to the medication-only treatment at the 12, 18 or 24 month assessment points. This may have been due to insufficient statistical power, a consequence of the small sample sizes.

The findings of the review by Jensen and Payne supported the findings of the McMaster review. Namely, medication management alone appeared to be

superior to psychosocial treatments alone in the reduction of ADHD symptoms. Combined treatment offered advantages on some outcomes over medication-alone. They recommended that further follow-up studies are required to determine the long-term benefits of combined and psychosocial-only treatments compared with medication-only treatment on a wide range of outcomes.

Another theme of future research should also be the effect of interventions by subtype of ADHD. There is far more information available about the effect of classroom-based interventions on children with the Combined subtype than children with the Predominantly Inattentive subtype. After completing large-scale research studies on the effectiveness of interventions on each ADHD subtype perhaps it would then be more appropriate to focus research on individual needs. Previous studies have demonstrated the effectiveness of a variety of interventions on groups of children who have been diagnosed globally as having ADHD, but because ADHD is a term describing a diverse set of behaviours, it may be inappropriate to try and find interventions that are effective with all children diagnosed with the disorder. Instead, the focus should be on the effect of interventions tailored to each child's individual requirements, following a functional assessment. This would mean returning to 'single-subject' experimental design but 'fine tuning' the findings of large-scale research to optimise outcomes for individuals.

Reasons For The Effectiveness of Behavioural and Classroom Interventions

Barkley (1997) has discussed possible reasons for the effectiveness of different interventions on the outcomes of children with ADHD in relation to his theory of the nature of ADHD (see Chapter 4 - Understanding ADHD From a Biological and Psychological Perspective). Since he proposed that ADHD is the result of impaired behavioural inhibition and subsequent executive functions, treatments that improve behavioural inhibition should lead to an improvement in executive functions. It has also been shown that stimulant medication enables the executive functions to proceed efficiently (Kempton *et al.*, 1999, Mehta *et al.*, 2000); however stimulant medication only achieves this aim for as long as the active chemicals remain within the brain.

Barkley also suggested other forms of treatment aimed at addressing deficits in four further executive functions; working memory, internalised speech, self regulated motivation and reconstitution. He suggested that these alternative treatments do not alter internal underlying deficits, but instead they alter the environment to enhance the performance of an individual within a particular setting. The effects of such treatments are not generally successfully transferred to different environments where the treatment is not in place and the conditions are different. Working memory, internalised speech and self-regulated motivation are all internalised behaviours. They all take place in the time between the brain receiving a stimulus and producing a goal directed response. If these actions are impaired, Barkley argued that externalising them would help the individual. So, distracting stimuli should be replaced with

information to prompt and assist the internalised behaviours. For example, if when a child is being asked to complete an assignment, it is presented as short tasks to be completed in a given time that can be monitored by a clock on the wall and other prompts, it will be easier for them to complete than if it is presented in its entirety with a completion date sometime in the future. Physical prompts such as worksheets breaking the tasks down into small sections also externalise the required actions. Self – regulated motivation must also be externalised. Children with ADHD cannot motivate themselves in the same way as other children. They can't think ahead to the intrinsic satisfaction of completing a task, this motivation has to come from another person, and for this reason they respond positively to artificial sources of motivation such as frequent praise and rewards. In fact, token reinforcement and response – cost strategies have been found to be successful with children as young as 3 years diagnosed with ADHD (McGoey and DuPaul, 2000). Reconstitution is a more difficult process to externalise, but Barkley suggested providing apparatus to assist with this process. If an adult has a problem to solve, they might talk to themselves out loud, or make notes or diagrams, which they rearrange as they struggle to find a solution. Children can also be encouraged to use these techniques. They can talk about an answer to a problem with a peer or teacher, using prompts such as a worksheet to help them structure their response. Peer tutoring would also enable children with ADHD to discuss solutions to problems, particularly if they are the tutor. DuPaul, Ervin, Hook and McGoey (1998) found this technique was found to be successful in reducing off-task behaviour and

raising the math and spelling achievement of some children with ADHD, although their results were variable.

Although Barkley's theory of the nature of ADHD and discussion into the implications for treatment were written before the MTA study took place, the results of the MTA study supported his ideas. Medication was found to be a very effective treatment alone regardless of environment, and also when it was combined with behavioural therapy. Behavioural therapy alone was less effective, which is in agreement with Barkley's suggestion that altering the environment of an individual may reduce their symptoms, but no benefit would be seen if the individual moved to an environment where these conditions were not in place. Although the behavioural therapy treatment in the MTA study was an intensive programme, which involved both teachers and parents, the extent and the way in which this programme was implemented would naturally vary between families and schools.

It is natural to anticipate that a reduction in ADHD symptoms brought about by an intervention will automatically lead to an improvement in long-term outcomes such as academic achievement and self esteem. The studies described above have indicated that this is not necessarily true. The MTA study reported that a combination of medication and behavioural therapy led to an improvement in reading scores on the Weschler Individual Achievement Test. Fiore *et al.* found that positive reinforcement improved academic performance although the size of this effect was not reported. Response cost programmes were found to improve on-task behaviour and completion of

academic assignments, although again, the size of the effect was not reported and although academic assignments were more likely to be completed, the quality of the work was not discussed. In their meta-analysis, Du Paul and Eckert found that the effect of classroom interventions on academic achievement varied with experimental design (Effect Size varied from 0 to 0.82).

Future Research

Further research into the effectiveness of classroom interventions to improve not only the behaviour but also the academic achievement of children with ADHD is required. The way in which results from such studies are reported is important. If smaller studies are to be directly compared and synthesised in meta-analyses, then effect sizes (or statistics from which these can be calculated) must be stated. The MTA study included a large sample of children with the Combined sub-type of ADHD and now children with the Predominantly Inattentive and Predominantly Hyperactive/Impulsive sub-types of ADHD also need to be studied. Interventions tailored to children's individual needs following functional assessment are likely to be important as the term ADHD is increasingly thought to be a multi-faceted disorder. The extent to which the findings from behavioural and classroom interventions also apply to children with similar behaviour but who have not been formally diagnosed as having ADHD should be investigated. It is possible that the long-term outlook of these children could also be improved by applying the same types of intervention.

Chapter 8

Method

Introduction

The aims of the present study were to investigate the prevalence, ability, attainment and progress of young children who were severely inattentive and/or hyperactive/impulsive in the classroom. To be able to investigate rates of prevalence and the relationship between behaviour and attainment, three separate cohorts of children were assessed at regular intervals during their first three years at school.

The chapter begins by describing the established research project through which much of the data for the present study were collected. Details of the participants and the timing and content of the assessments to measure reading, mathematics, developed ability and behaviour are given.

In addition to measuring the above variables, some of the teachers of participating schools were surveyed about their perceptions of ADHD and the effectiveness of a range of teaching and classroom management strategies with individual children. The content and timing of the survey is discussed.

The postcodes of children in one cohort were matched to indicators of socio-economic status (SES) derived from the 1991 census in order to investigate the possible link between SES and the prevalence of children who were severely inattentive and/or hyperactive/impulsive. The variables included in the SES indicators are described at the last section of the chapter.

Source of the data

Data for this study were gathered from schools that took part in the Performance Indicators in Primary Schools (PIPS) project run by the Curriculum Evaluation and Management (CEM) Centre, University of Durham.

The CEM Centre currently (August 2001) offers a comprehensive monitoring system for pupils from the start of the Foundation Stage through to A Level (or GNVQ). It runs projects which track pupils' attainment and attitude/self-esteem, and provides value-added measures in relation to both prior achievement and ability. It was established by Professor Carol Taylor Fitz-Gibbon in the early 1980's, initially to investigate the performance of students studying for A Levels (Fitz-Gibbon, 1996). This first project was known as ALIS (A Level Information System). Gradually, the scope of the CEM Centre information systems has broadened to include younger students in secondary education and primary schools. Data from statutory assessments, public examinations and assessments produced by the CEM Centre are analysed to provide participating institutions detailed feedback on each of their pupils.

The PIPS project monitors the progress of children as they move through primary school (see for example Tymms, Merrell and Henderson, 1999 and Tymms, 1999). Each participating school (or Local Education Authority) pays an annual fee, which enables the CEM Centre to develop and provide assessment material, data entry and detailed pupil level feedback for them.

The PIPS project started in 1992 and included six primary schools from one local education authority. By 1994, approximately 150 schools had volunteered to participate in the project. These schools were from three Local Education Authorities which supported the project, and six clusters (of approximately six schools per cluster) which were sponsored by the National Association of Head Teachers. Children were assessed on entry to full time education in the reception class, at the end of the reception year, at the end of key stage 1 (year 2) and the end of key stage 2 (year 6). It was anticipated that after their first assessment, the progress made by children would be monitored. In other words, the children who completed the baseline assessment at the start of reception would be re-assessed again at the end of the reception year, year 2 and year 6. The progress of children who were initially assessed in year 2 could be monitored to year 6. The children who were in year 6 during the early years of the project were also assessed because although the information about these pupils was limited, it was nevertheless still considered to be valuable.

The number of schools joining the PIPS project increased rapidly during the following years, as did the number of assessments offered. In September 1999, almost 4000 schools had registered to take part in the project and assessments were offered at several time points. Table 4 (Details of PIPS Assessments) provides more information about the range of PIPS assessments and the first year they were used.

Table 4 Details of PIPS assessments

Assessment	Time of administration	Date when assessment was first available
Baseline	Within the first seven weeks of the child starting the reception class	September 1994
End of Reception	End of the reception year	June 1995
Assessment 2	Spring term of year 2 (or September of year 3 as a baseline for junior schools)	January 1993
End of Year 3	End of summer term of year 3	June 1999
Assessment 4	End of summer term of year 4 (or September of year 5 as a baseline for middle schools)	June 1996
End of Year 5	End of summer term of year 5	June 1999
Assessment 6	Spring term of year 6	January 1992
Assessment 8	End of year 8 (middle schools only)	June 1996

Schools may take part in as many assessments as they choose.

Participants of this study

The participants of this study attended schools in the PIPS project from a wide area of England (predominantly in the north and midlands) and the Isle of Man. A small number of schools in Wales, Scotland and Northern Ireland were also included.

Three separate cohorts of children (Group C, Group D and Group E) were monitored. As the PIPS project has become increasingly popular over time, so each cohort is larger than the previous one. Table 5 provides details about each cohort. It shows the year in which the pupils started school in reception, the number of pupils and proportion of boys and girls at each point in time for which assessment data were available.

The content and timing of the assessments will be described in more detail later in this chapter. However, the rationale for selecting the three particular cohorts included in the present study was that Group C was the first cohort of pupils whose behaviour was assessed at the end of reception with a rating scale based on the criteria for the diagnosis of ADHD from DSM-IV. Pervious cohorts were assessed with a rating scale based on criteria from DSM-III-R and so were excluded. The behaviour of children in Groups D and E was assessed using the same rating scale as Group C. The analysis of data from three cohorts provides a larger sample and also enables trends over time to be monitored, particularly the distribution of scores from the behaviour rating scale. If teachers in schools

common to all cohorts are rating the behaviour of children consistently, the distribution of scores should remain stable. There is a chance that the reported behaviour of children in a particular cohort might differ significantly, but this should be minimal given the sample sizes *unless* it is influenced by external factors such as teachers' increasing awareness of ADHD.

Table 5 Details of the participating cohorts

	Group C	Group D	Group E
Date of Baseline Assessment at start of reception	September 1996	September 1997	September 1998
Date of end of reception assessment	June 1997	June 1998	June 1999
Date of Year 2 assessment	February 1999	February 2000	Not included in analysis
Number of pupils in reception (%boys/girls)	22,044 (51.9% / 48.1%)	47,479 (51.1%/48.9%)	63,966 (50.5%/49.5%)
Number of pupils monitored from start of reception to Year 2 (%boys/girls)	5,569 (52.3% / 47.7%)	12,722 (51.4%/48.6%)	Not included in analysis

Measures

The attainment, attitude, home background and behaviour of the participants were assessed using the measures described below.

The Behaviour Rating Scale

Class teachers used a rating scale to assess their pupils at the end of the reception year. It included the 18 criteria for the diagnosis of ADHD in DSM-IV (American Psychiatric Association, 1994). Some of the criteria were slightly modified. (See Appendix 1 for a full list of the criteria in the DSM-IV, a copy of the behaviour rating scale and a description of the differences between them.)

The behaviour rating scale was completed at the end of reception to allow the children to settle into the classroom environment, and to give teachers sufficient opportunity to work with and observe the children. Any rating scale based upon observation has a degree of subjectivity associated with it. In an attempt to reduce the subjectivity of the behaviour rating scale used in this study, teachers were advised to consider a criterion met if the behaviour had persisted for at least six months and was considerably more frequent than that of children of the same gender and developmental level.

A small proportion of children started school at the start of the summer term. These pupils were included in the assessment even though teachers had not been able to observe them for the recommended six months. If any of these

children met a high number of criteria over a period of three months rather than six, it is still important for teachers to be aware of this to enable them to monitor the situation. However, because one of the conditions laid down by DSM-IV for the diagnosis of ADHD is that the behaviour has persisted for at least six months, two separate analyses were conducted; excluding and including the children who had spent less than six months in the reception class. This meant that the scores derived from the behaviour rating scale in this study for children who started school in September or January could be compared with previous studies of the prevalence of individuals with ADHD, although they were still not strictly comparable because the behaviour was only observed in one situation rather than the recommended two.

One mark was awarded for each criterion met on the behaviour rating scale and the score for each of the three sections; B1 (criteria relating to inattention), B2 (criteria relating to hyperactivity) and B3 (criteria relating to impulsivity) were recorded. These section scores were used to calculate the total score and scores for each of the sub-types of ADHD described.

The attainment and ability measures

Attainment and ability measures have been developed by a team of researchers (including the author of this study) for the exclusive use of the PIPS project with one exception; the non-verbal ability 'Problems of Position' test, which was

developed by David Moseley (an educational psychologist at Newcastle University).

New assessments for the PIPS project were developed because those available from existing publishing companies and other sources when the PIPS project started in 1992 were not considered suitable. For pupils in Years 2 and 6, the end of Key Stage assessments (SATs) introduced by the government appeared to be problematic (Shorrocks-Taylor, 1994) and many schools actually refused to administer them for some years. However, the reliability and validity of SATs assessments have improved and since 1998 they have been analysed in addition to (or instead of) PIPS reading, mathematics and reading assessments if schools request this service. Baseline assessments for assessing children when they started school in reception were intended for many different uses such as the identification of children with special educational needs (Blatchford and Cline, 1992, Blatchford and Cline, 1994) rather than for value-added purposes. In order to be able to be able to monitor progress, it is important that the items in a baseline assessment must provide reliable information about children of all abilities and have a high correlation with later achievement. Research has found that skills such as the ability of four year-old children to recognise letters are strongly related to reading at age 7 years (Blatchford, Burke, Farquhar, Plewis and Tizard, 1987). Phonological awareness and an awareness of the concepts of print are also strong predictors of later achievement (Bryant, MacLean, Bradley and Crossland, 1990). Unlike previous baseline assessments, the baseline assessment developed for use at the start of reception by the PIPS

project was based upon research findings such as these in order for it to correlate with later achievement and therefore be used as a baseline from which progress could be monitored. (Tymms, 1999a.)

The PIPS assessments have been regularly updated. The overall sections have remained the same, although new questions were sometimes included and some questions were altered or omitted in order to improve the reliability and validity.

The Baseline Assessment

This assessment was administered at the start of reception and measured early language and mathematics skills. It was administered on an individual basis either by the class teacher, head teacher or classroom auxiliary, and took approximately 15 minutes per child. In order to standardise the administration procedure, all the assessment tasks and instructions were contained in a manual, which the administrator worked through with the child. The assessment could be tailored to the ability of the child; the questions were ordered in difficulty so that when the child got a certain number wrong in a particular section, they would move immediately to the next section.

The following activities were included:

Writing - The child was asked to write his/her full name. They were not allowed to copy from a name card. The quality of the writing was rated against examples in the manual.

Vocabulary - The child was shown a series of scenes and asked to identify certain objects.

Ideas about Reading - The child was shown pictures and asked a series of questions relating to concepts about print such as 'Look at this picture. Can you point to a word? If I wanted to read this story, where would I start?'

Rhymes - This section was a measure of phonological awareness. The child listened to a target word and was then asked to select a word which rhymed with it from a choice of three options.

Letter recognition - The child was asked to give the letter sound or name of a mixture of upper and lower case letters. The first letter they were asked to identify was always the upper case first letter of their first name.

Word recognition - The assessment used with Group C included a list of words which the child was asked to read. The word recognition section used with Groups D and E asked children to identify certain words from a choice of four. (e.g. 'Point to the word car from a printed choice of cat, door, far, car.')

Ideas about Mathematics - This section measured understanding of mathematical concepts and vocabulary such as big, small, most, least using a set of pictures.

Counting - The child was asked to count a certain number of objects printed in the manual. The children in Group C were asked to count groups of objects up to a maximum of 25. The children in Groups D and E were presented with a picture of 4 balls. After correctly counting them, the picture was covered and the

child was asked to remember how many balls they counted. This procedure was repeated with a picture of seven dogs to give a maximum of four marks.

Sums – The processes of subtraction and addition were assessed by showing the child a picture of a certain number of objects and asking him/her to subtract or add-on further objects e.g. the administrator said "Here are three balls, if we took one away how many would be left? Here are two rabbits, if we put one more rabbit in the picture how many would there be?"

Digit identification - The child was asked to identify a series of single and two-digit numbers.

Table 6 (Details of the baseline assessment) shows the sections and number of items in the baseline assessment used with each cohort.

Table 6 Details of the baseline assessment

	NUMBER OF ITEMS		
SECTION	Group C	Group D	Group E
Writing	5	5	5
Vocabulary	27	25	22
Ideas about Reading	12	12	12
Rhymes	9	9	9
Letter Recognition	27	27	27
Word Recognition	9	N/A	N/A
Word recognition (multiple choice)	N/A	8	14
Ideas about Maths	7	7	7
Counting (up to 25)	25	N/A	N/A
Counting (up to 7)	N/A	4	4
Sums	8	8	8
Digit Identification	15	15	19
Reading total	89	85	89
Maths total	55	34	38
Total score	144	119	127

The End of Reception Assessment

An extended version of the baseline assessment was repeated at the end of the reception year. This included exactly the same items as the assessment conducted at the start of reception and also more difficult words and stories to read, more difficult math problems (including number sequencing in the Group C assessment), an assessment of short-term memory (Group C assessment only) and a measure of attitude to school. The words included in the reading section were words common to the reading schemes most widely used in schools. Again, this assessment was administered on an individual basis.

Table 7 shows the number of items in the reading, mathematics and attitude sections of the end of reception assessment for each cohort.

Table 7 Details of the end of reception assessment

	NUMBER OF ITEMS		
SECTION	Group C	Group D	Group E
Reading	181	186	171
Maths	74	64	55
Short term memory	5	N/A	N/A
Total score	260	250	226
Attitude (3 point scale)	8 (24 marks)	8 (24 marks)	8 (24 marks)

The Year 2 Assessment

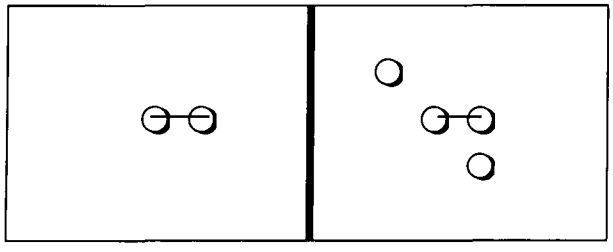
The Year 2 assessment was administered to pupils at the beginning of the Spring term of year 2. This was a group assessment made up of three sections (reading, mathematics and context), each taking half an hour to complete. The questions had multiple-choice answers (with the exception of some of the questions in the mathematics section where the child had to write their answer).

The context section included measures of vocabulary, non-verbal ability, home background and attitude to reading, mathematics and school in general.

The vocabulary assessment used pictures rather than relying upon the reading skills of the children. The teacher read out a word, and the child had to tick the picture that demonstrated the meaning of the word from a choice of 5 pictures.

The non-verbal ability assessment (Problems of Position, originally devised by David Moseley, Reader in Educational Psychology, University of Newcastle Upon Tyne, (Moseley, 1976)) was a timed, culture-fair test that determined the degree to which children were successful in recognising shapes and patterns. The idea was that pupils joined up the dots on the left hand side and then found and joined up the same pattern of dots on the right hand side.

For example:



The attitude scales were based upon research by Marsh, Byrne and Shavelson (1988), Epstein and McPartland (1976) and on the research findings of the CEM Centre, Fitz-Gibbon, C.T., (1996). Children were presented with 5 statements related to mathematics, (for example 'I enjoy doing sums') 5 statements related

to reading, (for example 'I like reading stories') and 5 statements related to being at school (for example 'I look forward to school', 'I like the lessons'). Responses were recorded on a three-point scale ranging from negative to positive by ticking either a sad face (representing a negative attitude), a neutral face (representing a neutral attitude) or a happy face (representing a positive attitude).

The home background questions were intended to measure the extent of the educational support in the home from the child's perspective and included items such as 'When you are not at school, how often do you visit the local library?' with a choice of the following answers; never, sometimes, often. These items build upon research by Kelly, Whyte and Smail (1984) and Bordieu and Passeron (1977) who suggested the measurement of home background from the child's perspective be termed 'Cultural Capital'. The 'Cultural Capital' scale did not include measures of economic deprivation such as entitlement to free school meals.

The reading and mathematics sections were based upon the programmes of study in the National Curriculum Document (DfEE, 1995).

The weighted combination of the picture vocabulary and the non-verbal ability scores from the context section provided a measure of the developed ability for each child from which reading and mathematics attainment could be predicted. There is an extensive literature on the relationship between non-verbal ability and

educational outcomes (see for example Cronbach, 1970, Haertel and Walberg, 1980, Naglieri and Ronning, 2000, Raven, Raven and Court, 1998). This added a further dimension to the assessments. As well as being able to monitor the progress of children relative to their prior achievement (as assessed using the baseline assessment at the start of reception and the end of reception assessment), it was also possible to monitor the achievement and progress of each child in relation to their developed ability.

Table 8 (Details of the Year 2 assessment) shows the number of items in each section of the Year 2 assessment for each cohort.

Table 8 Details of the Year 2 assessment

	Number of items		
SECTION	Group C	Group D	Group E
Reading	116	116	N/A
Maths	38	38	N/A
Picture vocabulary	32	32	N/A
Non-verbal Ability	25	25	N/A
Attitude	16	16	N/A
Home Background	7	7	N/A

Survey 1 - Teachers' awareness of ADHD and their teaching strategies

A sample of class teachers completed a questionnaire about their teaching strategies in relation to particular children. In addition to medication, other treatments have been found to be effective in the management of the behaviour of children with ADHD (see chapter 6 'The Treatment of ADHD'). Strategies such as contingency management, social skills training and other forms of behavioural therapy can be readily applied in the classroom to all children and

may be of particular value for those who are inattentive, hyperactive and/or impulsive.

A questionnaire was distributed to a sample of teachers asking about the kinds of teaching strategies they used, and their perceived effectiveness on different children: some who had met a high number of criteria on the behaviour rating scale at the end of reception (6 or more criteria on the inattentive sub-scale and 6 or more criteria on the hyperactive sub-scale for the combined sub-type, 6 or more criteria on the inattentive sub-scale for the predominantly inattentive sub-type or 6 or more criteria on the hyperactive/impulsive sub-scale for the predominantly hyperactive/impulsive sub-type) and on children who had not met any of the criteria on the behaviour rating scale at the end of reception (zero scores). The strategies were based upon published advice to teachers (Cooper and Ideus, 1996), reviews of studies about effective classroom strategies (Fiore *et al.*, 1993, Du Paul and Eckert, 1997), a 14-month Randomized Clinical Trial of Treatment Strategies for Attention Deficit/Hyperactivity Disorder (MTA Cooperative Group, 1999). One of the strategies (Did the child have the opportunity to work in a group with at least 3 other children?) contradicted published advice and research about effective teaching methods. It was not expected to be particularly effective, and was included to check that this in fact corresponded to teachers' perceptions.

Teachers were also asked whether or not they were familiar with ADHD and Hyperkinetic disorder, and if they had attended any courses about ADHD. This

might provide an insight into whether they were implementing strategies intuitively or because they had heard that they were effective with children who were inattentive, hyperactive and/or impulsive.

Before Survey 1 was conducted, schools in the PIPS project routinely received pupil level feedback on each part of the assessments that they participated in, with the exception of the behaviour rating scale conducted at the end of reception. In 1995 only, raw scores obtained on the behaviour rating scale were printed on the pupil feedback returned to schools. One educational psychologist expressed concern about the possible damaging effects of this action in the future of those pupils labeled with high scores and so no feedback about the behaviour rating scale was conveyed to schools in subsequent years. Consequently, the results from Survey 1 reflected the kinds of strategies used by teachers to manage the behaviour of certain pupils in the absence of feedback from the PIPS project highlighting children with high scores on the behaviour rating scale, or information provided by the project about the association between the behaviour rating scale and ADHD.
(See Appendix 2 for a copy of the questionnaire used in Survey 1.)

This questionnaire was sent to the teachers of a sample of 432 pupils from Group C. These pupils were selected on the basis of their scores from the behaviour rating scale administered at the end of reception. The sample represented children with high scores or zero scores on the behaviour rating

scale. The pupils were in the second term of year 1 at the time of the survey, so the questionnaire was completed by their Year 1 teachers.

The data were analysed in terms of the teachers' opinions of the effectiveness of various teaching strategies on children with and without behavioural problems.

Indicators of Socioeconomic Status

The prevalence of children with severe inattentive, hyperactive and impulsive behaviour was examined in relation to socioeconomic status (SES). Several deprivation indexes have been calculated from the 1991 Census data. Scores are available for each electoral ward. The home postcode of each child participating in the PIPS project was matched to its electoral ward in order to obtain a measure of SES from published deprivation indexes.

Deprivation indexes are composite scores of a range of variables that were related to the ward within the 1991 Census data. Some of the indexes weight the variables. Table 9 summarises the variables included in the Townsend Material Deprivation Index (Townsend, P. Phillimore, P. Beattie, A., 1988) the Jarman Index (Jarman, 1984), the Department of Environment Index (Department of the Environment, 1995) and the Carstairs index (Carstairs, 1989) and their weightings.

Table 9 Summary of variables included in deprivation indices with weightings

Variable derived from 1991 Census	**Townsend Index**	**Jarman Index**	**Dept. of Environment Index**	**Carstairs Index**
Unemployment	1	3.34	2	1
Overcrowding*	1	2.88	1	1
Non car ownership	1			1
Non home ownership	1			
Lone pensioners		6.62	2	
Single parents		3.01	2	
Residents born in the New Commonwealth		2.5	1	
Children under 5 years of age		4.64		
Low social class		3.74		1
One year migrants**		2.68		
Households lacking basic amenities			1	

* households with more than 1 person per room

** residents with a different address one year before the census

Chapter 9

Reliability and Validity of the Measures

The test-retest reliability is a measure of the consistency of an assessment over a short time span. It is the correlation between the scores of an assessment administered on two separate occasions and provides an indication of the extent to which the answers given were true scores (an accurate reflection of the construct being assessed) or random observations. If the time between assessments is longer (say two years) then the correlation is a measure of predictive validity.

Inter-rater reliability measures the stability of an assessment made by different individuals. A high correlation between scores obtained from independent sources gives some indication that the results from an assessment were not subject to bias. For example if a teacher administers an assessment to pupils who are well known to them, prior knowledge may influence the teacher's judgment. If those pupils were also to be assessed by someone with no knowledge of their abilities and their scores were the same as the scores derived from the teacher's assessment, the inter-rater reliability of that assessment would be considered to be high. It should be remembered when considering inter-rater reliability that if both raters are biased, the correlation between their scores will be high yet their interpretation of a situation will nevertheless be inaccurate. Inter-rater reliability is a particularly important measure when an activity is being assessed using a subjective method such as the application of the behaviour rating scale employed in this study.

The internal reliability provides an indication of how closely the items in a scale are related and is often measured using the Cronbach's alpha statistic. For example, it would be expected that all the items in a mathematics assessment were measuring the mathematical ability of an individual. If this is indeed the case, the internal reliability (measured by Cronbach's alpha) will be high (greater than 0.8). If the scale is poor and the items are unrelated, alpha would be close to zero.

An instrument can be reliable at yielding the same information about an individual on different occasions and when applied by different assessors but it is also important to assess its validity. That is, the extent to which it gives an accurate indication of the concept being investigated. This can be done using two or more independent techniques to assess a single concept. If the results of these are strongly related, a degree of confidence about the validity of the assessments can be assumed (concurrent validity). For example if a high correlation is found between the results of an objective measure and a subjective measure of a type of behaviour, then confidence that a valid assessment of the behaviour has been made is increased.

The Baseline Assessment

The test-retest reliability of the baseline assessment was measured each year. A random sample of children were reassessed by the author approximately 4-5 weeks after the baseline assessment had first been administered by school staff. This was also a measure of inter-rater reliability.

The test-retest reliability of the baseline assessment used by each cohort is shown in Table 10 (Test-retest reliability of the Baseline Assessment)

Table 10 Test-retest reliability of the Baseline Assessment

	Reliability		
	Reading	Maths	Total
Group C (n=17)	0.94**	0.96**	0.96**
Group D (n=32)	0.94**	0.94**	0.96**
Group E	not measured	not measured	not measured

** Correlations significant (p<0.01)

The End of Reception Assessment

The test - retest reliability for the end of reception was measured for one cohort only. The first assessment was done in June before the pupils left the reception class. A sample of pupils was re-assessed by the author approximately 10 weeks later (after the six weeks summer holiday) when they were in year 1. The results are shown in Table 11 (Test-retest reliability of the End of Reception Assessment)

Table 11 Test-retest reliability of the End of Reception Assessment

	Reliability		
	Reading	Maths	Total
Group D (n=29)	0.93**	0.89**	0.94**

** correlations significant (p<0.01)

Validity of the baseline and end of reception assessments

The high correlation (approximately 0.7 for Groups C and D) between both the baseline and end of reception assessments and reading and mathematics attainment assessed using the PIPS year 2 assessment was an indicator of their validity.

The Year 2 Assessment

The internal reliability (Cronbach's alpha) of the sections of the year 2 assessment for cohorts C and D are shown in Table 12 (Internal reliability (alpha) of the Year 2 assessment). Exactly the same assessment was used for both cohorts.

Table 12 Internal reliability (alpha) of the Year 2 assessment

	Reliability (α)				
	Reading	Maths	Vocabulary	Non-Verbal ability	Cultural Capital
Groups C and D	0.98	0.90	0.86	0.92	0.35

The Behaviour Rating Scale

Many researchers have measured the reliability and validity of the diagnostic criteria in the DSM-IV (Gomez *et al.* 1999, Lahey *et al*, 1994, Morgan *et al.*, 1996, Willcut, Chhabildas and Pennington, 2001). This work has been discussed in an earlier chapter (The Definition and History of Attention Deficit Hyperactivity Disorder). Since the criteria in the behaviour rating scale used in this study were those recommended for the diagnosis of ADHD in the DSM-IV, a certain degree of confidence in the reliability and validity of the behaviour rating scale could be assumed. However, the DSM-IV criteria were intended for use by trained clinicians rather than classroom teachers and therefore it was necessary to measure the reliability and validity of the criteria of the behaviour rating scale within the context of this study.

The reliability and validity of the behaviour rating scale used in this study were measured in a number of different ways. The results were analysed using

simple linear correlation (Pearson 'r'), which determines the extent to which two variables are linearly related. Visual examination of the scatterplots indicated a linear relationship.

Firstly, a small number of randomly selected children (n=113) were re-assessed using the behaviour rating scale in year two (aged seven years) by their current teachers. This second assessment took place approximately 20 months after the first. The sample included children who had spent at least six months in the reception class and had total scores on the behaviour rating scale ranging between 0 and 18 at the end of reception. The correlation of the total scores between the two time points was 0.64($p<0.01$). The correlation for the inattentive sub-scale was 0.58 ($p<0.01$) and 0.63 ($p<0.01$) for the hyperactive/impulsive sub-scale.

The correlations of the present study are lower than those from the study described by Willcutt, Chhabildas and Pennington, 2001, in Chapter 1 'The Definition and History of ADHD'. That study had followed up the initial DSM-IV ADHD parent ratings of 357 children (9 with ADHD) with a second assessment by parents 18 months later. The test/re-test correlations were 0.87 for the inattention symptoms and 0.78 for the hyperactive/impulsive symptoms. Willcutt *et al.* concluded that the results provided support for the reliability of the DSM-IV sub-types when rated by a single adult. Although the time difference between the initial and follow-up assessments was similar, the teachers assessing the pupils at the end of reception were a different group to the teachers who assessed the pupils in year 2. This could explain the lower

correlation, particularly considering that other researchers (e.g. Gomez *et al.* 1999) found poorer inter-rater reliability (e.g. teachers and parents assessing pupils in independent settings).

The moderately high correlations of this study indicated that teacher rating scales based on the diagnostic criteria for ADHD (DSM-IV) could be useful tools for the identification of children who display severe behavioural problems associated with ADHD, which in many cases are fairly stable over time.

The behaviour of children inevitably changes and varies across situations and as they become older and settle into school. An assessment of behaviour recorded at a single time point is naturally of limited use. However, the results presented above have quantified the variation in some aspects of behaviour over time and situations.

The stability of inattention, hyperactivity and impulsivity over time in relation to additional factors such as age and language is discussed in more detail in Chapter 11, 'Results: 2 The Stability Of Inattention, Hyperactivity and Impulsivity Over Time'.

To assess the validity of the behaviour rating scale, 17 children (who had spent a full year in the reception class) were re-assessed in year two with the behaviour rating scale by their current class teachers and with the Conners' Continuous Performance Test (CPT) (Conners, 1995) by the author of this study. The Conners' CPT is a computerised instrument which assesses

attention and impulsiveness. Although there is no evidence to suggest that CPT scores alone are a reliable indicator of ADHD, they are objective and are valuable when used alongside other assessments in the evaluation of individuals with ADHD. Researchers have found that certain trends in measurements derived from CPTs are associated with individuals who have ADHD. For example, from the close examination and classification of error patterns, Halperin, Wolf, Greenblatt and Young (1991) found that only some error patterns reflected impulsivity whereas others did not. Van der Meere and Sergeant (1988a, 1988b, 1988c) used the CPT to study the influence of errors made by a subject on their responses in subsequent trials, and demonstrated that typical subjects note their errors and increase their focus of attention whereas subjects with ADHD do not seem to do so.

The format of the Conner's CPT is considered to be particularly effective in distinguishing between children with and without ADHD. The Conner's CPT presents the individual with a sequence of letters, each one appearing on the computer screen for a brief time. As soon as the examinee sees a letter, they must respond unless it is the letter 'x'. The length of time between each letter also varies as the test progresses. This format (where the subject responds to many stimuli and is then required to inhibit their response) is thought to increase the sensitivity of the measure to the impulsiveness of individuals (Barkley in Reid Lyon and Krasnegor, 1996).

The Conners CPT records many variables including reaction time and the number of correct and incorrect responses. These variables are described

more fully in a later chapter (Case Studies). The program also calculates an overall index and advises that if this score is between 0 and 7 the examinee has performed well on the CPT and is unlikely to have problems with attention or impulsiveness. Scores between 8 and 11 are borderline, and scores greater than 11 almost certainly indicate problems.

The correlation between the total number of criteria met on the behaviour rating scale administered at the end of reception and the Conner's CPT index for the 17 children assessed in year two was 0.7 ($p<0.01$). The correlation between the scores from the behaviour rating scale administered in year 2 and the Conner's CPT index was also 0.7 ($p<0.01$) suggesting that the behaviour rating scale was a valid and useful instrument for identifying children with behavioural problems associated with ADHD in the classroom. In contrast to the research described above which indicates that certain variables on the CPT identify particular sub-types of ADHD, the correlation between the total number of criteria met on the behaviour rating scale and the Conner's CPT index was higher than the correlation between criteria relating to each of the ADHD sub-types and other variables recorded from the CPT, although the sample size was small and interpretation should be viewed with caution.

The results from the sample of children who were assessed using the Conner's CPT and were also reassessed by their year 2 class teachers using the behaviour rating scale are discussed in more detail in Chapter 13 'Results 4 - Case Studies'.

Chapter 10

Results 1

Distribution of Scores from the End of Reception Behaviour Rating Scale

Introduction

In this chapter the distribution of scores from the behaviour rating scale at the end of reception is reported and then compared to the estimated rates of prevalence of ADHD from previous published research.

The shapes of the distributions are of interest. Levy, Hay and McStephen, (1997) recommended that ADHD should be viewed as the extreme of a behaviour, which changes genetically throughout the whole population rather than as a disorder that an individual either does or doesn't have. In other words, everyone is inattentive, hyperactive and impulsive. The degree of this behaviour varies between individuals and those with the most extreme behaviour of this type are considered to have ADHD. This could mean that although inattentive, hyperactive and impulsive behaviour is demonstrated by all individuals sometimes, it is not considered to be sufficiently severe to qualify as meeting any criteria, resulting in a large proportion of children meeting no criteria and then a very small proportion of children meeting one or more criteria. Alternatively, as the executive functions of young children are not fully developed, certain aspects of their behaviour might be considered severe enough for them to meet one or more of the criteria, resulting in many children meeting no criteria and then a gradual decline in the proportion of children meeting increasingly more criteria. If both these theories apply, a high proportion of children meeting no criteria will be found. Far fewer children will meet one or more criteria, and the distribution of children meeting one or more criteria will decline gradually.

The proportion of children meeting a high number of criteria is also of interest. If the same cut-off points that are used in DSM-IV for the diagnosis of ADHD are applied to the data from the present study, a tentative comparison of estimated rates of prevalence of ADHD can be made. The results from the present study will not represent the true prevalence of ADHD amongst four year-old children in England because their behaviour has only been assessed by one person (the reception teacher) in one setting (the school) but it will be interesting to see how teachers perceive the behaviour of young children in the classroom and whether or not the proportion of children identified with severe problems is comparable to the proportion of older children diagnosed with ADHD.

The proportion of children with scores above the cut-off point suggested in the DSM-IV will be compared with other studies based on similar teacher ratings of behaviour. This will help to validate the behaviour rating scale used in the present study.

The results are presented in the following order:

- Total behaviour rating scale scores for all pupils in each cohort and then split by sex.

- The distributions of scores from the sub-scales (inattention and hyperactivity/impulsivity) of the behaviour rating scale.

- The proportions of children with scores on the behaviour rating scale above the cut-off point suggested in DSM-IV are reported for each ADHD sub-type.

- The overall results from each cohort are compared.

- One advantage of collecting data from three cohorts of children is that it enables trends over time to be monitored. If teachers in schools common to all cohorts are rating the behaviour of children consistently, the distribution of scores should remain stable. There is a chance that the reported behaviour of children in a particular cohort might differ significantly, but this should be minimal given the sample sizes *unless* it is influenced by external factors such as teachers' increasing awareness of ADHD. The data from schools common to all cohorts were extracted and compared. This was intended to reduce the possibility of fluctuation between cohorts due to the inclusion of schools from geographical areas. Although it is not possible to be certain that the population of reception teachers in schools common to all cohorts was completely stable over the three-year period of the data collection, there is a chance that some teachers will have rated children in all three cohorts. ADHD has been found to be related to age (see Chapter 3 - The Prevalence of Attention Deficit Hyperactivity Disorder). The ages of the children in each cohort were compared to ensure that they were not significantly different.

Having selected a sample of schools that were common to each cohort, the prevalence of ADHD (based on teacher ratings only) was

estimated. Children included in this analysis had spent at least six months in the reception class. A further sub-sample was drawn from the schools common to all cohorts. This sample was nationally representative. The prevalence of ADHD, estimated from teacher ratings, for this sub-sample were compared to the findings of other studies. The results were reported for the whole of the nationally representative sample and then separate analyses by gender and first language.

- The relationship between age and behaviour is reported.

The distribution of scores from the Behaviour Rating Scale conducted at the End of Reception

The distribution of scores from the behaviour rating scale administered at the End of Reception are reported for each cohort (Groups C, D and E) in the graphs and tables that follow.

Group C

The distribution of scores from the behaviour rating scale for the all the pupils in Group C are reported below:

Table 13 Frequencies of subjects

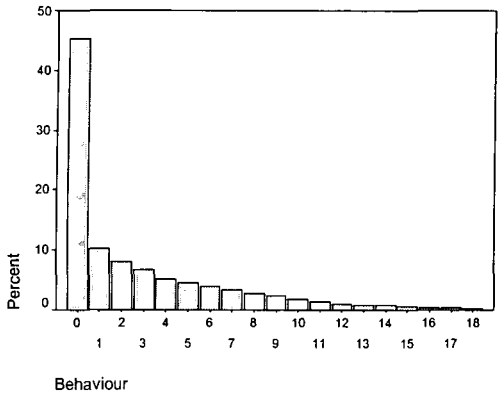
Group C	Count	Percent
Boys	11449	51.9
Girls	10595	48.1
Total	22044	100

Table 14 Group C frequencies of behaviour rating scale (Total scores and by Sex)

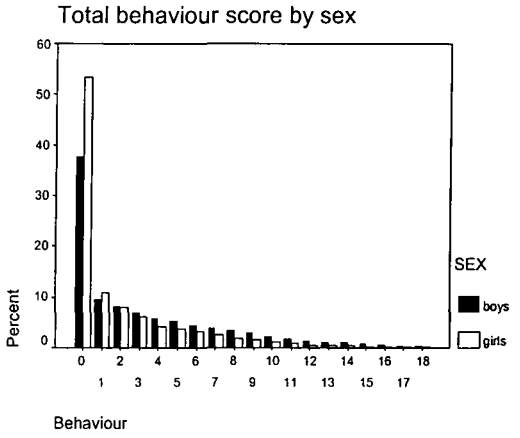
Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	4329	37.8	5649	53.3	9978	45.3
1	1116	9.7	1158	10.9	2274	10.3
2	938	8.2	852	8.0	1790	8.1
3	809	7.1	660	6.2	1469	6.7
4	686	6.0	452	4.3	1138	5.2
5	612	5.3	391	3.7	1003	4.5
6	519	4.5	352	3.3	871	4.0
7	465	4.0	271	2.6	736	3.3
8	403	3.5	199	1.9	602	2.7
9	346	3	174	1.6	520	2.4
10	275	2.4	115	1.1	390	1.8
11	226	2.0	96	0.9	322	1.5
12	175	1.5	53	0.5	228	1.0
13	130	1.1	55	0.5	185	0.8
14	130	1.1	43	0.4	173	0.8
15	114	1.0	26	0.2	140	0.6
16	81	0.7	18	0.2	99	0.4
17	50	0.4	17	0.2	67	0.3
18	45	0.4	14	0.1	59	0.3

The data in Table 14 are summarised in Graphs 1 and 2 below:

Graph 1 Distribution of behaviour scale total scores of Group C



Graph 2 Distribution of behaviour rating rating scale total scores of Group C by sex



The total scores of the Group C pupils presented in Table 14, and Graphs 1 and 2 are interesting but of limited value as they do not provide any information about the proportion of children who met criteria relating to inattention and/or hyperactivity/impulsivity. Children with a total score of 6 may have met criteria relating only to inattention, criteria relating only to hyperactivity/impulsivity or a mixture of both. The distribution of scores derived from the inattentive and hyperactive/impulsive sub-scales are reported in Tables 15 and 16, Graphs 3, 4, 5 and 6

Group C Distribution of scores from the behaviour rating scale of the criteria relating to inattention.

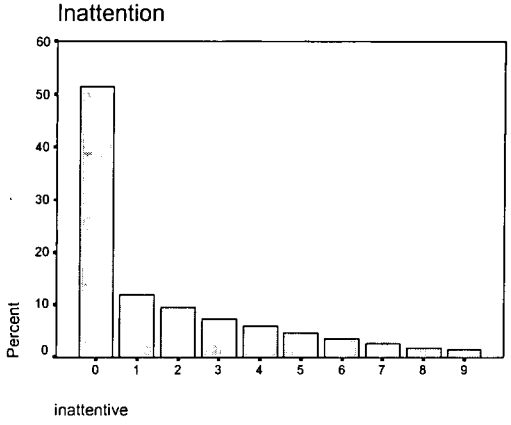
Table 15 Group C Frequencies of the distribution of scores of criteria relating to inattention (Total scores and by Sex)

Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	5033	44.0	6299	59.5	11332	51.4
1	1402	12.2	1243	11.7	2645	12.0
2	1187	10.4	909	8.6	2096	9.5
3	945	8.3	672	6.3	1617	7.3
4	839	7.3	477	4.5	1316	6.0
5	651	5.7	357	3.4	1008	4.6
6	487	4.3	267	2.5	754	3.4
7	390	3.4	185	1.7	575	2.6
8	267	2.3	103	1.0	370	1.7
9	248	2.2	83	0.8	331	1.5

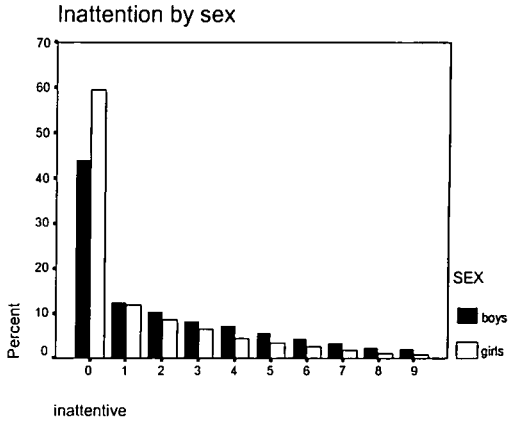
The proportion of pupils in Group C meeting six or more criteria relating to inattention was 9.2% (a ratio of 2.03 : 1, boys : girls).

The distribution of scores from the behaviour rating scale of the criteria relating to inattention can be seen more clearly in Graphs 3 and 4 below:

Graph 3 Distribution of behaviour rating scale scores (Criteria relating to Inattention)



Graph 4 Distribution of behaviour rating scale scores (Criteria relating to Inattention) by sex



Group C Distribution of scores from the behaviour rating scale of the criteria relating to Hyperactivity and Impulsivity.

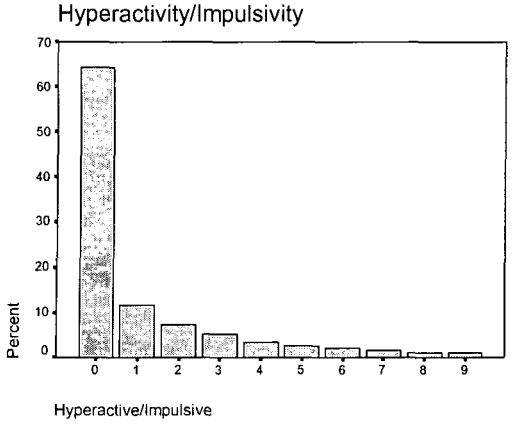
Table 16 Group C Frequencies from the behaviour rating scale of scores of criteria relating to hyperactivity/Impulsivity (Total scores and by Sex)

Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	6574	57.4	7600	71.7	14174	64.3
1	1380	12.1	1160	10.9	2540	11.5
2	929	8.1	675	6.4	1604	7.3
3	712	6.2	417	3.9	1129	5.1
4	508	4.4	237	2.2	745	3.4
5	409	3.6	173	1.6	582	2.6
6	342	3.0	130	1.2	472	2.1
7	232	2.0	110	1.0	342	1.6
8	193	1.7	53	0.5	246	1.1
9	170	1.5	40	0.4	210	1.0

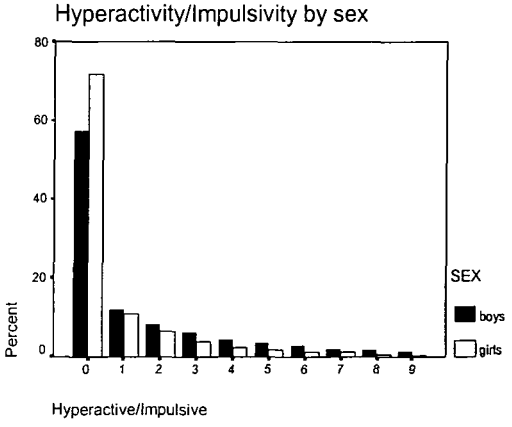
The proportion of pupils in Group C meeting six or more criteria relating to hyperactivity/impulsivity was 5.8% (a ratio of 2.7 : 1, boys : girls).

The distribution of scores from the behaviour rating scale of the criteria relating to hyperactivity/impulsivity can be seen more clearly in Graphs 5 and 6 below:

Graph 5 Distribution of scores (Criteria relating to Hyperactivity/Impulsivity)



Graph 6 Distribution of scores by sex (Criteria relating to Hyperactivity/ Impulsivity) by sex



Group C Distribution of scores from the behaviour rating scale of the criteria relating to Combined sub-type of ADHD.

As mentioned earlier, in order to qualify for a diagnosis of ADHD (Combined sub-type) an individual should meet at least six criteria relating to inattention and at least six criteria relating to hyperactivity/impulsivity. Table 17 shows the number and proportion of pupils in Group C meeting these criteria in the classroom setting only.

Table 17 Frequency of pupils meeting the number of criteria from the behaviour rating scale relating to the Combined sub-type

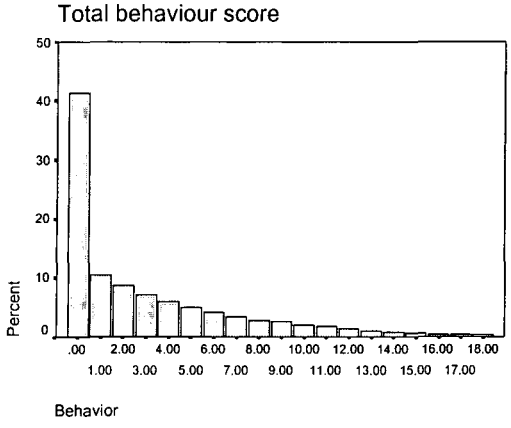
	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
Pupils who did not meet sufficient criteria for Combined sub-type	10969	95.8%	10445	98.6%	21,414	97.1%
Pupils who met sufficient criteria for Combined sub-type	480	4.2%	150	1.4%	630	2.9%

The proportion of pupils in Group C meeting six or more criteria relating to inattention and six or more criteria relating to hyperactivity/impulsivity and thus meeting sufficient criteria for the Combined sub-type of ADHD, in the classroom setting only, was 2.9%, (a ratio of 3 : 1, boys : girls).

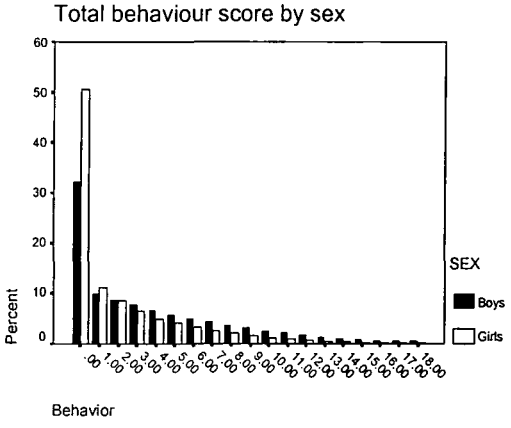
Group D

The distribution of scores from the behaviour rating scale was similar to those of Group C. The tables of scores can be viewed in Appendix 3. The data are summarised in Graphs 7 to 12 below:

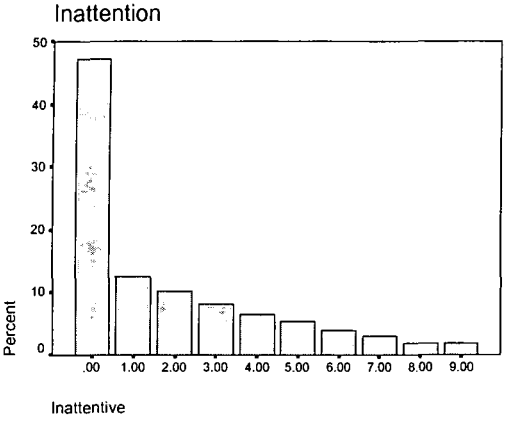
Graph 7 Distribution of behaviour rating scale total scores of Group D



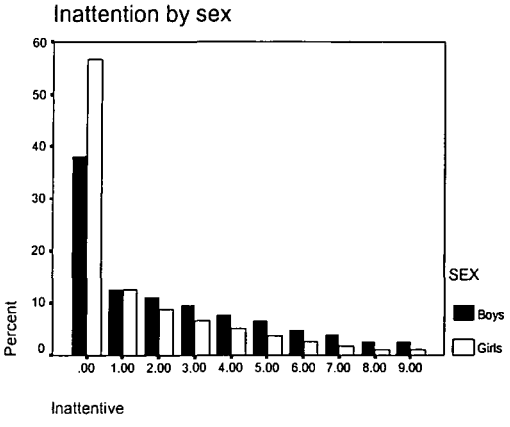
Graph 8 Distribution of behaviour rating scale total scores of Group D by sex



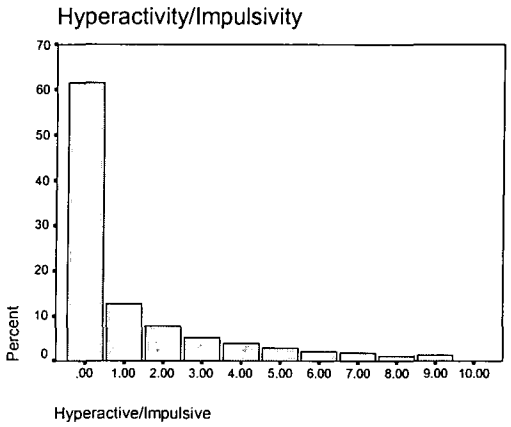
Graph 9 Distribution of behaviour rating scale scores (Criteria relating to Inattention) of Group D



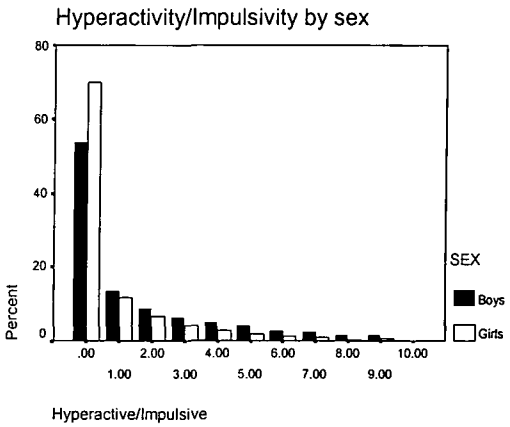
Graph 10 Distribution of behaviour rating scale scores (Criteria relating to Inattention) by sex of Group D



Graph 11 Distribution of scores (Criteria relating to Hyperactivity/Impulsivity) of Group D



Graph 12 Distribution of scores by sex (Criteria relating to Hyperactivity/ Impulsivity) by sex of Group D



The proportion of pupils in Group D meeting six or more criteria relating to inattention was 10.4% (a ratio of 2.1 : 1 boys : girls).

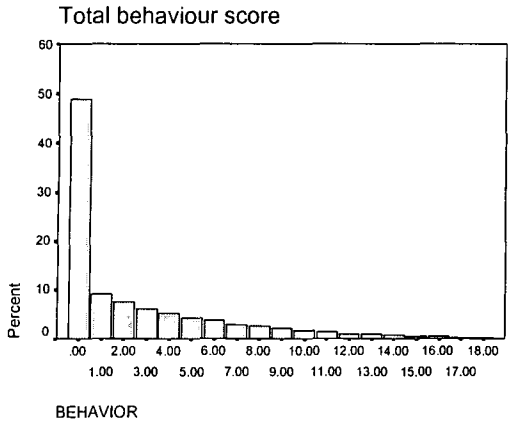
The proportion of pupils in Group D meeting six or more criteria relating to hyperactivity/impulsivity was 6.1% (a ratio of 2.5 : 1 boys : girls).

The proportion of pupils in Group D meeting six or more criteria relating to inattention and six or more criteria relating to hyperactivity/impulsivity, thus meeting sufficient criteria for the Combined sub-type of ADHD, in the classroom setting only, was 3.3% (a ratio of 2.8 : 1, boys : girls).

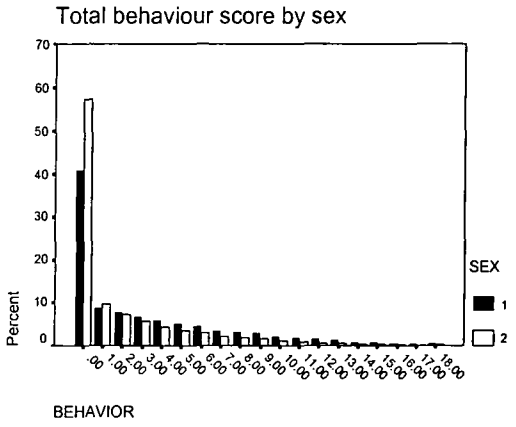
Group E

Again, the distribution of scores from the behaviour rating scale for the pupils in Group E was similar to Groups C and D. The tables of scores can be viewed in Appendix 3. The data are summarised in Graphs 13 to 18 below:

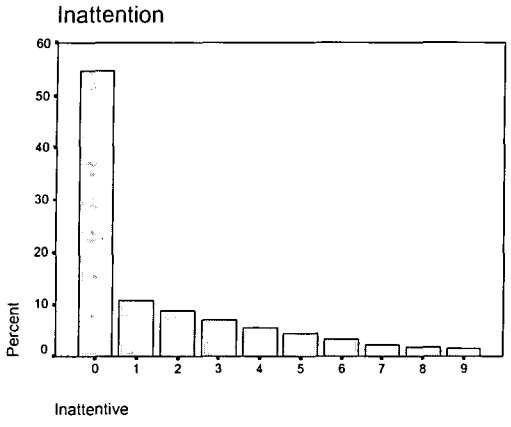
Graph 13 Distribution of behaviour rating scale total scores of Group E



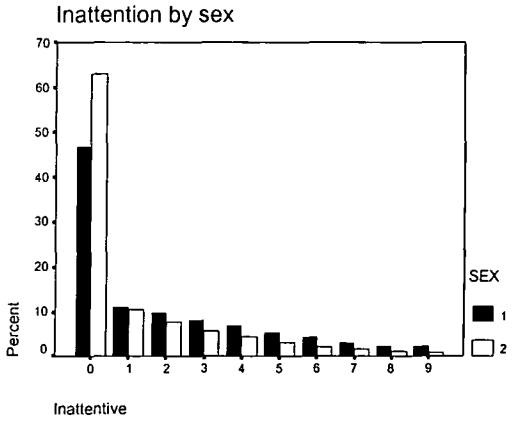
Graph 14 Distribution of behaviour rating scale total scores of Group E by sex



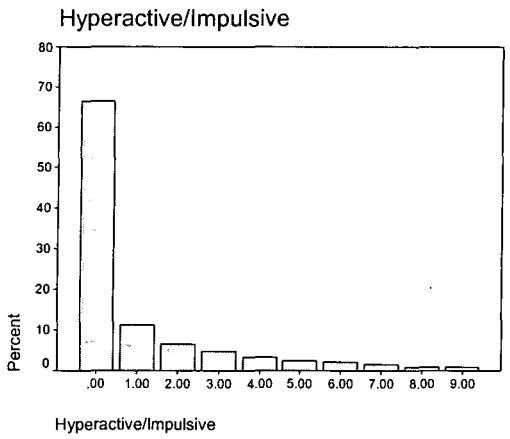
Graph 15 Distribution of behaviour rating scale scores (Criteria relating Inattention)



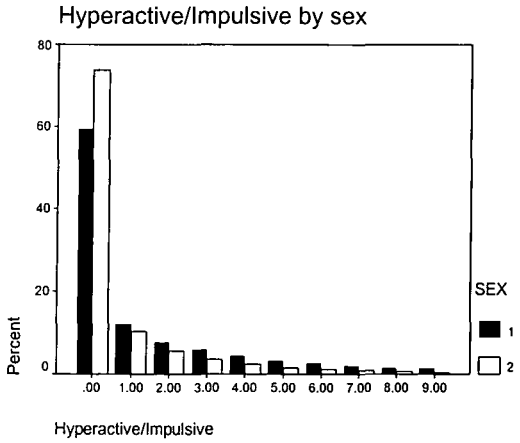
Graph 16 Distribution of behaviour rating scale scores (Criteria relating to to Inattention) by sex



Graph 17 Distribution of scores (Criteria relating to Hyperactivity/Impulsivity) across the whole of Group E



Graph18 Distribution of scores by sex (Criteria relating to Hyperactivity/ Impulsivity) by sex



The proportion of pupils in Group E meeting six or more criteria relating to inattention was 8.8% (a ratio of 2.1 : 1 boys : girls).

The proportion of pupils in Group E meeting six or more criteria relating to hyperactivity/impulsivity was 7.5% (a ratio of 2.5 : 1 boys : girls).

The proportion of pupils in Group E meeting six or more criteria relating to inattention and six or more criteria relating to hyperactivity/impulsivity and thus meeting sufficient criteria for the Combined sub-type of ADHD, in the classroom setting only, was 2.7% (a ratio of 2.9 : 1, boys : girls).

Summary of proportions of pupils in each cohort with sub-scale scores higher than DSM-IV cut-off points for ADHD in the classroom setting only

The total proportions of pupils and the ratio of boys:girls for each cohort are shown in Table 28

Table 28 Proportion of pupils in Groups C, D and E with sub-scale scores higher than the DSM-IV cut-off points in the classroom setting

	Combined sub-scale	Inattentive sub-scale	Hyperactive/Impulsive sub-scale
Group C	2.9% 3:1	9.2% 2:1	5.8% 2.7:1
Group D	3.3% 2.8:1	10.4% 2.1:1	6.1% 2.5:1
Group E	2.7% 2.9:1	8.8% 2.1:1	7.5% 2.5:1

Comparison Between Cohorts of the Distribution of Scores from the Behaviour Rating Scale

Upon initial inspection, the distribution of the scores from the behaviour rating scale appeared to be similar for each cohort. Graphs 1, 7 and 13 showed comparable distributions with a large proportion of children (between 41% and 49%) not meeting any criteria and a much smaller proportion (between 0.3% and 0.4%) meeting all 18 criteria. However, each cohort contained a large number of cases, and a small difference in percentage could have concealed a much larger difference in terms of raw scores. The Chi-Square test did in fact show that there were significant differences ($p<0.0005$) between the distributions of scores on the behaviour rating scale of all three cohorts.

N.B. In order to simplify the Chi-Square test, the number of groups was reduced to 7 by combining the number of criteria met by each child in the following way:

Table 29 Groups used for Chi-Square test to compare the distributions of scores from the behaviour rating scale of Groups C, D and E

Group	Number of criteria met
1	0
2	1, 2 or 3
3	4, 6 or 6
4	7, 8 or 9
5	10, 11 or12
6	13, 14 or 15
7	16, 17 or 18

The figures in Tables 14, 19 and 24 convey the impression of consistent patterns across cohorts of the proportion of children meeting 6 or more criteria relating to inattention (9.2%, 10.4% and 8.8% for Groups C, D and E

respectively). However, once again the Chi-Square test revealed significant differences between cohorts. The differences between Groups C and D, and between Groups D and E were significant (p=0.000). There was no significant difference between Groups C and E of the proportion of children meeting 6 or more criteria relating to inattention. It should be remembered when interpreting the results that a very small difference in such a large sample would generally be statistically significant.

When the proportions of children meeting 6 or more criteria relating to hyperactivity/impulsivity in each group were compared using the Chi Square test, a significant difference (p=0.000) was found between cohorts. Whilst a significant difference (p=0.000) was found between Groups D and E, and between Groups C and E (p=0.005), there was no significant difference between Groups C and D.

When the number of children meeting six or more criteria relating to inattention and 6 or more criteria relating to hyperactivity/impulsivity in each group were compared, a significant difference between cohorts was found. The difference between Groups C and D was significant, (p=0.002) the difference between Groups D and E was significant, (p=0.000) although the difference between Groups C and E was not significant.

These findings are summarized in Table 30.

Table 30 Summary of differences between Groups C, D and E of the distribution of scores from the behaviour rating scale

	Children meeting 6 or more criteria relating to inattention	Children meeting 6 or more criteria relating to hyperactivity/ impulsivity	Children meeting 6 or more criteria relating to inattention and 6 or more criteria relating to hyperactivity/ impulsivity
Groups C, D and E	Yes	Yes	Yes
Groups C and D	Yes	No	Yes
Groups D and E	Yes	Yes	Yes
Groups C and E	No	Yes	No

Yes = significant difference ($p<0.01$) No = no significant difference

The distribution of total scores from the behaviour rating scale were consistently different between Groups D and E with a significantly higher proportion of children meeting a high number of criteria in Group D than in Group E. A similar proportion of children in Groups C and E met a high number of criteria relating to inattention and also a high number of criteria relating to both inattention and hyperactivity/impulsivity. A similar proportion of children in Groups C and D met a high number of criteria relating to hyperactivity/impulsivity. When the proportions of children meeting a high number of criteria in each group were compared, no single group was significantly different to the others on all three measures although the differences noted above were investigated further.

The number of schools participating in the PIPS project (from which the data for this study were derived) increased over time, resulting in Group C being the smallest cohort and Group E the largest. This increase in sample size may have resulted in the characteristics of the population in each group being different. For example, a significant increase in schools which contained high

proportions of pupils for whom English was an additional language, or schools whose local education and medical services worked in partnership to treat conditions such as ADHD with medication and classroom strategies, the distribution of scores from the teacher rating scale would differ which may partly explain some of the reported significant differences between cohorts. Therefore, if the distribution of scores from the behaviour rating scale were reported only using data from schools who were included in all three cohorts, no significant difference between cohorts would be expected, providing the behaviour rating scale was reliable. Tables 31, 32 and 33 below show the distribution of scores from the behaviour rating scale when only schools present in all three Groups were included (385 schools). Also, in order to be consistent with the DSM (IV) advice that symptoms should have persisted for at least six months, children who had attended the reception class for less than six months were excluded from the next analysis.

Table 31 Frequencies of behaviour rating scale total scores from schools present in all Groups

Behaviour Score	Group C		Group D		Group E	
	Count	Percent	Count	Percent	Count	Percent
0	5838	44.9	5477	41.7	6017	46.3
1	1347	10.4	1366	10.4	1260	9.7
2	1054	8.1	1188	9.1	1081	8.3
3	854	6.6	920	7.0	837	6.4
4	666	5.1	772	5.9	695	5.3
5	591	4.5	669	5.1	551	4.2
6	534	4.1	487	3.7	490	3.8
7	426	3.3	443	3.4	418	3.2
8	370	2.8	351	2.7	320	2.5
9	318	2.4	310	2.4	312	2.4
10	235	1.8	237	1.8	222	1.7
11	195	1.5	227	1.7	207	1.6
12	138	1.1	177	1.3	144	1.1
13	107	0.8	140	1.1	130	1.0
14	106	0.8	103	0.8	101	0.8
15	90	0.7	57	0.4	77	0.6
16	62	0.5	54	0.4	47	0.4
17	40	0.3	64	0.5	34	0.3
18	32	0.2	79	0.6	66	0.5

Table 32 Frequencies of behaviour rating scale scores of criteria relating to inattention from schools present in all groups

Behaviour Score	Group C		Group D		Group E	
	Count	Percent	Count	Percent	Count	Percent
0	6668	51.3	6281	47.9	6814	52.4
1	1532	11.8	1684	12.8	1468	11.3
2	1199	9.2	1315	10.0	1224	9.4
3	944	7.3	1085	8.3	926	7.1
4	797	6.1	782	6.0	757	5.8
5	636	4.9	645	4.9	555	4.3
6	440	3.4	478	3.6	430	3.3
7	354	2.7	354	2.7	338	2.6
8	224	1.7	237	1.8	226	1.7
9	209	1.6	260	2.0	271	2.1

Table 33 Frequencies of behaviour rating scale scores of criteria relating to hyperactivity/impulsivity from schools present in all groups

Behaviour Score	Group C		Group D		Group E	
	Count	Percent	Count	Percent	Count	Percent
0	8288	63.7	8104	61.8	8381	64.4
1	1529	11.8	1611	12.3	1546	11.9
2	961	7.4	1017	7.8	920	7.1
3	690	5.3	698	5.3	620	4.8
4	445	3.4	504	3.8	481	3.7
5	342	2.6	384	2.9	352	2.7
6	283	2.2	273	2.1	262	2.0
7	206	1.6	223	1.7	190	1.5
8	136	1.0	113	0.9	131	1.0
9	123	0.9	194	1.5	126	1.0

Initial inspection indicated that when only schools common to all cohorts were included in the sample, the distribution of total scores on the behaviour rating scale changed very slightly for Group C. The largest difference (which was only 0.4%) was between the proportions of children not meeting any criteria. The total sample of children in Group C contained a slightly higher proportion of children with zero scores than the sample containing only schools common to all cohorts. A similar trend was observed for Group D. A greater difference was observed between the distributions of total scores for the two samples derived from Group E. 49% of children in the whole sample did not meet any criteria compared to 46.3% of children in the group containing only schools

common to all cohorts. However, the proportion of children meeting 1 or 2 criteria in Group E in the sample containing only schools common to all cohorts was higher than the total sample.

The Chi-Square test showed that significant differences still existed between the distributions of total scores of the three Groups when only schools common to all cohorts were included in the sample. (Once again, for the purposes of the Chi-Square test, behaviour rating scale total scores were condensed into seven groups in the same way as described in Table 29, *Groups used for Chi-Square test to compare the distributions of scores from the behaviour rating scale of Groups C, D and E*). The distribution of scores in Groups C and D, and Groups D and E were found to be significantly different ($p=0.000$) but the distribution of scores of Groups C and E were not ($p=0.317$) which was different to the distributions of scores of the complete cohorts where the distribution of total scores of the three Groups differed significantly.

A further variable that may have led to differences in the distribution of scores between Groups was the age of the children. Young children generally appear to be more boisterous and inattentive than older children (see the 'Age and ADHD section in Chapter 3 - The Prevalence of Attention Deficit Hyperactivity Disorder). The age at which children are admitted to reception classes in England is influenced by government policy and other local arrangements. For example, some schools admit children as young as four years whereas others wait until the term in which the child is five years old. Changes in local arrangements may have resulted in different age profiles

between groups, in turn influencing the distribution of scores on the behaviour rating scale. The pupil age profiles of the three samples containing schools common to all Groups (incorporating children who had attended the reception class for at least six months - the same conditions as used previously) were compared. Table 34 summarises the months of birth of the pupils in each Group.

Table 34 Months of birth of pupils included schools common to all Groups who had attended the reception class for a minimum period of six months

Months of Birth	Group C	Group D	Group E
Missing	315	183	77
September, October, November	3229	3295	3275
December, January February	3154	3148	3144
March, April, May	3243	3256	3292
June, July, August	3062	3239	3220

A Chi-Square test showed no significant difference between Groups. Overall, the age profile of the pupils being admitted to the reception class during the first half of the academic year had not changed over time, although there may have been changes at school level, particularly in small schools.

An important issue was whether or not teachers were able to consistently identify children who met sufficient criteria in the classroom to qualify for a diagnosis of ADHD. Further analyses were conducted on the samples containing schools common to all Groups to investigate whether there were any significant differences between cohorts of the proportion of children meeting sufficiently high numbers of criteria to be diagnosed as having ADHD

(in the classroom setting), or whether the differences were associated with those children who met no or very few criteria. The Chi-Square test showed that there was no significant difference between cohorts of the proportion of children meeting 6 or more criteria relating to inattention. Neither was there a significant difference between cohorts of the proportion of children meeting 6 or more criteria relating to hyperactivity/impulsivity nor between cohorts of the proportion of children meeting six or more criteria relating to inattention and 6 or more criteria relating to hyperactivity/impulsivity. When the sample of schools was held constant across the cohorts reflecting a common geographical area and stable local policies and attitudes, the teachers' application of the behaviour rating scale was reasonably consistent.

Longitudinally, teachers appeared to be assessing children with severe problems relating to inattention, hyperactivity and impulsivity consistently. They did not distinguish as well between children who had milder problems and met just a few criteria. This reflected the subjective nature of a rating scale. Also, teachers may slightly change their standards of exactly what level of behaviour must be present in order to meet a criterion. Their opinion may be altered by the individual personalities of children making up a class. Some classes may contain several children who may meet one or two criteria and in this case it is possible that teachers become used to this standard of behaviour and perceive it as being within the bounds of 'normal'. Other classes may contain a large number of quiet children who do not meet any criteria. In this case the behaviour of a child who met one or two criteria

would be more apparent within the classroom environment and perhaps merit a higher score on the behaviour rating scale than they would have done in a class of more disruptive children. The average age of the class may also affect the teachers' perceptions of 'normal' behaviour. A class of younger, more immature children may be more inattentive, hyperactive and impulsive than a class of older children and again the teacher of the younger class may accept a higher level of behavioural problems as being the norm.

Comparison of behaviour rating scale scores with estimated rates of prevalence of ADHD

The results discussed above were simple distributions of scores based upon the numbers of criteria met relating to the sub-scales of inattention and hyperactivity/impulsivity, and the total number of criteria met. They could not be directly compared to the rates of prevalence of ADHD reported in previous studies because the data must be adjusted to exclude those children meeting the criteria suggested in the DSM-IV to qualify for the Combined sub-type of ADHD from the Predominantly Inattentive and Predominantly Hyperactive/Impulsive sub-scales. When this was done, the proportion of children meeting a high number of criteria on the behaviour rating scale could then be compared to other published estimates of the prevalence of ADHD.

A further condition for the diagnosis of ADHD stipulated in the DSM (IV) was that the behaviour must have been present for at least six months prior to the

assessment. This condition was applied when the samples containing schools common to all cohorts were analysed in order to make the results of this study yet more closely comparable to published ADHD prevalence figures. Children who started school later than January, or for whom no start date was available were excluded from the analysis. After applying these conditions, the proportion of children meeting the number of criteria (in the classroom setting only) higher than the cut-off point recommended in the DSM-IV for a diagnosis of ADHD are shown in Tables 35, 36 and 37. These samples included all children meeting the above conditions, NOT just the children from schools common to all cohorts. This enables the extent of variation that may have been caused by geographical and cultural differences to be included.

Table 35 Percentage of pupils meeting the number of criteria (in the classroom setting only) higher than the cut-off point recommended in the DSM-IV for a diagnosis of ADHD in Group C

	Boys	Girls	Total
Combined	4.3%	1.9%	2.9%
Predominantly inattentive	8.2%	4.9%	6.6%
Predominantly hyperactive/impulsive	4.1%	1.8%	3.0%

n=17011

Total percentage of children (classroom setting only) meeting the number of criteria to higher than the recommended cut-off point recommended in the DSM-IV for the diagnosis of ADHD (any subtype) = 12.5%

Ratio of Boys : Girls = 1.9 : 1 (total)
2.3 : 1 (Combined)
1.7 : 1 (Predominantly inattentive)
2.3 : 1 (Predominantly hyperactive/impulsive)

Ratio of Subtypes = 2.3 : 1 : 1
(Predominantly Inattentive : Combined : Predominantly hyperactive/Impulsive)

Table 36 Percentage of pupils meeting the number of criteria (in the classroom setting only) higher than the cut-off point recommended in the DSM-IV for a diagnosis of ADHD in Group D

	Boys	Girls	Total
Combined	4.8%	1.7%	3.3%
Predominantly inattentive	9.2%	4.9%	7.1%
Predominantly hyperactive/impulsive	3.9%	1.6%	2.8%

n=46430

Total percentage of children with scores above the cut-off point in DSM-IV recommended for a diagnosis of ADHD (any subtype) = 13.2%

Ratio of Boys : Girls = 2.2 : 1 (total)
2.8 : 1 (Combined)
1.9 : 1 (Predominantly inattentive)
2.4 : 1 (Predominantly hyperactive/impulsive)

Ratio of Subtypes = 2.5 : 1.2 : 1
(Predominantly Inattentive : Combined : Predominantly hyperactive/Impulsive)

Table 37 Percentage of pupils meeting the number of criteria (in the classroom setting only) higher than the cut-off point recommended in the DSM-IV for a diagnosis of ADHD in Group E

	Boys	Girls	Total
Combined	4.0%	1.4%	2.7%
Predominantly inattentive	7.9%	4.2%	6.1%
Predominantly hyperactive/impulsive	3.6%	1.6%	2.6%

n=62069

Total percentage of children with scores above the cut-off point in DSM-IV recommended for a diagnosis of ADHD (any subtype) = 11.4%

Ratio of Boys : Girls = 2.2 : 1 (total)
2.9 : 1 (Combined)
1.9 : 1 (Predominantly inattentive)
2.3 : 1 (Predominantly hyperactive/impulsive)

Ratio of Subtypes = 2.4 : 1 : 1
(Predominantly Inattentive : Combined : Predominantly hyperactive/Impulsive)

So far, the estimated rate of prevalence of ADHD has been based upon the results obtained from pupils who had spent at least six months in the reception class of ALL the schools included in each Group. If the schools in each cohort were not representative of those in England, the resulting estimate of the prevalence of ADHD would be biased. Therefore, in addition to the condition of pupils having spent at least six months in the reception class, a nationally representative sample of schools was drawn from Group C. The schools were nationally representative in relation to school type, End of Key Stage 2 statutory assessment results, PIPS assessment results and percentage of children not from the United Kingdom. (The end of Key Stage 2 statutory assessments were externally marked and thus considered to provide a more robust indicator of school performance than the Key Stage 1 statutory assessments.)

The same schools were drawn from Groups D and E. The numbers and proportions of children meeting the number of criteria (in the classroom setting only) higher than the cut-off point recommended in the DSM-IV for a diagnosis of ADHD are reported in Tables 38, 39 and 40.

Table 38 Proportion of children meeting the number of criteria (in the classroom setting only) higher than the cut-off point recommended in the DSM-IV for a diagnosis of ADHD in the nationally representative sample of schools from Group C

	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
Combined	83	3.8%	20	1.0%	103	2.5%
Predominantly inattentive	158	7.3%	83	4.2%	241	5.8%
Predominantly hyperactive/impulsive	85	3.9%	37	1.9%	122	2.9%

N=4148 (Girls = 1980, Boys = 2168)

Total percentage of children with scores above the cut-off point in DSM-IV recommended for a diagnosis of ADHD (any subtype) = 11.2%

Ratio of Boys : Girls = 2.3 : 1 (total)
4.2 : 1 (Combined)
1.9 : 1 (Predominantly inattentive)
2.3 : 1 (Predominantly hyperactive/impulsive)

Ratio of Subtypes = 2.3 : 1 : 1.2
(Predominantly inattentive : Combined : Predominantly hyperactive/Impulsive)

Table 39 Proportion of children meeting the number of criteria (in the classroom setting only) higher than the cut-off point recommended in the DSM-IV for a diagnosis of ADHD in the nationally representative sample of schools from Group D

	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
Combined	108	4.1%	51	2.1%	159	3.2%
Predominantly inattentive	235	9.0%	89	3.7%	324	6.4%
Predominantly hyperactive/impulsive	89	3.4%	41	1.7%	130	2.6%

N=5047 (Girls = 2435, Boys = 2612)

Total percentage of children with scores above the cut-off point in DSM-IV recommended for a diagnosis of ADHD (any subtype) = 12.2%

Ratio of Boys : Girls = 2.4 : 1 (total)
2.1 : 1 (Combined)
2.6 : 1 (Predominantly inattentive)
2.2 : 1 (Predominantly hyperactive/impulsive)

Ratio of Subtypes = 2.5 : 1.2 : 1
(Predominantly Inattentive : Combined : Predominantly hyperactive/Impulsive)

Table 40 Proportion of children meeting the number of criteria (in the classroom setting only) higher than the cut-off point recommended in the DSM-IV for a diagnosis of ADHD in the nationally representative sample of schools from Group E

	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
Combined	102	4.0%	37	1.5%	139	2.8%
Predominantly inattentive	207	8.1%	117	4.8%	324	6.5%
Predominantly hyperactive/impulsive	98	3.9%	39	1.6%	137	2.8%

N=4978 (Girls = 2436, Boys = 2542)

Total percentage of children with scores above the cut-off point in DSM-IV recommended for a diagnosis of ADHD (any subtype) = 12.1%

Ratio of Boys : Girls = 2.1 : 1 (total)
2.8 : 1 (Combined)
1.8 : 1 (Predominantly inattentive)
2.5 : 1 (Predominantly hyperactive/impulsive)

Ratio of Subtypes = 2.4 : 1 : 1
(Predominantly Inattentive : Combined : Predominantly hyperactive/Impulsive)

A Chi-Square test showed that there was no significant difference between the total numbers of pupils meeting a number of criteria above the recommended cut-off points (in the classroom setting) for one of the subtypes of ADHD in the nationally representative samples drawn from Groups C, D and E.

The figures in Tables 38, 39 and 40 offered the most accurate estimate of the rate of prevalence of ADHD that could be extracted from the data in this study. Of course, two important factors are missing from the data that would usually be considered when making a formal diagnosis – the history of the

child and the behaviour of the child in different settings. It is vital to remember that the assessment of pupils' behaviour is based on teacher ratings alone when interpreting the results. So although the results of this study are unusual in that they are based upon a large nationally representative sample of children, it is important to be aware of the limitations of the data.

Based on the figures reported above, the estimated rate of prevalence of ADHD based on ratings derived from the classroom setting only of ALL schools in each Group ranged from 11.4% to 13.2% (mean = 12.4%). The estimated rate of prevalence of ADHD derived from the classroom setting only of the nationally representative sample of schools in each Group was slightly lower and ranged from 11.2% to 12.2%. These results were similar to figures reported in previous studies and discussed in an earlier chapter (The Prevalence of Attention Deficit Hyperactivity Disorder). The results of this study were higher than previous studies that used the ICD-10 classification system or DSM-III such as Costello (1989), Szatmari, Offord and Boyle (1989) and Taylor *et al.* (1991). In their review of studies that estimated the prevalence of ADHD, Swanson *et al.* (1998) found that those which used diagnoses based upon a single rating or unconfirmed interview from one point in time estimated rates of prevalence between 10% and 20% across populations. In a sense, this study is similar because behaviour is assessed by one individual (the teacher) although their opinion was based upon observation over at least six months and also the reliability of their judgements has been examined. The results of this study were within the range reported by Swanson *et al.* (1998).

Baumgaertel *et.al.* (1995) published teacher-reported prevalence rates for disruptive disorders (ADHD and Oppositional Defiant Disorder) using DSM-III, DSM-III-R and DSM-IV criteria in German elementary schools. The study had several points in common with this study. Firstly, it used teachers' ratings of a normal population (not a clinic-referred population) using a scale based upon the diagnostic criteria for ADHD from the DSM-IV. Forty-four participating schools provided an even mix of children with varied socio-economic status. The children were between 5 and 12 years old which was slightly different to this study where all the children were assessed with the behaviour rating scale when they were 5 years old. The authors noted the highest rates of prevalence of ADHD when the DSM-IV criteria were applied. Their finding partly explains why the results of this present study were higher than previous studies that had based their diagnoses on DSM-III, DSM-III-R or ICD-10 criteria. The estimated overall rate of prevalence reported by Baumgaertel *et al.* was 17%, much higher than the estimates for any of the cohorts reported in this study. Perhaps this higher figure was a reflection of the geographical area from which the data were gathered. Perhaps German teachers have different expectations to teachers in England. The estimated rate of prevalence of ADHD has varied between previously published research to the extent that the NIH Consensus Development Conference on Diagnosis and Treatment of Attention Deficit Hyperactivity Disorder (1998) called for improved studies of ADHD in different populations.

More recently, Warner-Rodgers, Taylor, Taylor and Sandberg (2000) estimated the prevalence from a school based population of three separate categories of 7 year old boys: those who were purely inattentive with no overactive behaviour whatsoever, those who were overactive with no inattentive behaviour whatsoever, and those who exhibited a mixture of the two behaviours. The found that 1.3% of the children in the sample were purely inattentive, 2% were purely overactive and 1.7% had a mixture of inattention and overactivity. From the nationally representative cohorts derived from data in the present study, it was possible to calculate the prevalence of children who exhibited purely inattentive behaviour by removing from the Predominantly Inattentive groups those pupils who met any criteria relating to hyperactivity or impulsiveness. Similarly, it was possible to calculate the proportion of children who exhibited purely hyperactive/impulsive behaviour by removing from the Predominantly Hyperactive/Impulsive groups those children who met any criteria relating to inattention. This resulted in the following rates of prevalence:

Table 41 Rate of prevalence of pure inattentive and pure hyperactive/impulsive behaviour in the nationally representative samples from Groups C, D and E.

	Pure Inattentive behaviour	Pure Hyperactive/Impulsive behaviour	Combined behaviour
Group C	1.4%	0.07%	2.5%
Group D	1.9%	0.2%	3.2%
Group E	1.5%	0.2%	2.8%

The proportions of children with purely inattentive behaviour were similar to the figure reported by Warner-Rodgers *et al.*, which supports the reliability of the teacher rating scale used in the present study. The rates of prevalence reported in the present study were slightly higher, probably because the

ratings were based on teachers alone. There was a larger difference between the rates of prevalence for children who were purely overactive and children who displayed a mixture of the behaviours (the Combined group). The figures reported in Table 41 for the Combined group were higher than the figure reported by Warner-Rodgers *et al.*, and the figures for purely overactive behaviour were much lower. If the figures reported by Warner-Rodgers *et al.* for the purely overactive group and the group in which children showed a mixture of behaviour were combined, and the Combined and Hyperactive/Impulsive results from the present study were combined, the two sets of figures are similar. Perhaps the younger age of the children in the present study contributed to the differences seen between the hyperactive/Impulsive and the Combined groups. As will be seen later, age and behaviour do appear to be linked.

The results of this study were within the range of estimated rates of prevalence of ADHD reported by previous researchers who used diagnostic criteria based on DSM-IV. This is an important finding because it indicates that teachers in this study were identifying the same proportion of children in the population with severe ADHD symptoms as the estimated rate of ADHD prevalence from other sources. When the academic achievement and progress of children with high scores on the behaviour rating scale are examined later, any links between this study and previous research that discussed children with ADHD can be pursued with a greater degree of confidence.

The ratio of subtypes of ADHD reported in previous studies (Wolraich *et al.* (in press), Baumgaertel *et al.* (1995), Gaub and Carlson, (1997) was fairly constant and in the region of 2.5 : 1.2 : 1 (Predominantly Inattentive : Combined : Predominantly Hyperactive/Impulsive). (See Chapter 3 – The Prevalence of Attention Deficit Hyperactivity Disorder.) The results of this study were very similar (approximately 2.4 : 1.1 : 1). Once again this strengthens the reliability of the behaviour rating scale used in this study. However, studies that used clinic-referred subjects have reported different ratios between subtypes of ADHD. Lahey *et al.* (1994) and McBurnett *et al.* (1995) found the Combined subtype to be much more prevalent than both the Predominantly Inattentive and Predominantly Hyperactive/Impulsive subtypes. The studies based on whole schools rather than clinic referrals may be a more accurate estimate of the rate of prevalence of different subtypes of ADHD because they reflect the whole of society rather than an extreme group. Children are likely to have been referred to a clinic for treatment because their behaviour was disruptive and thus a constant problem to both teachers and other pupils. Children who meet sufficient criteria in the classroom to be diagnosed as having the Predominantly Inattentive subtype of ADHD are unlikely to be disruptive in the classroom environment and as such may be overlooked rather than referred for specialist help. A degree of purely impulsive and active behaviour may also be tolerated in the classroom particularly in a reception class of very young children, if it is perceived as a sign of immaturity and difficulty in adapting to the classroom environment rather than a symptom of a disorder. Indeed, in support of this argument, Baumgaertel *et al.* (1995) found that children diagnosed with the Combined or

Predominantly Hyperactive/Impulsive subtypes of ADHD displayed behavioural and peer relationship problems and the children diagnosed with the Predominantly Inattentive or Combined subtypes commonly experienced academic problems.

Differences in the estimated rate of prevalence of ADHD between genders

The DSM-IV (1994) reported a gender difference in the incidence of ADHD which ranged between a ratio of 3 : 1 and 9 : 1 (male : female) depending on the setting. Taylor *et al.* (1991) noted that boys attended ADHD clinics more frequently than girls by a ratio of 2.5 : 1. More recently, Swanson, Sergeant, Taylor, Sonuga-Barke, Jensen and Cantwell (1998) reported male : female ratios for the overall prevalence of ADHD ranging between 3 : 1 and 9 : 1. They suggested that the ratio may change with different age groups, and a further reason for the variation may be a result of referral bias related to symptoms of disruptive behaviour, since boys have more hyperactive/impulsive, conduct and oppositional symptoms than girls. This is in agreement with the findings of Baumgaertel *et al.* (1997) who noted that children diagnosed with the Combined or Predominantly Hyperactive/Impulsive subtypes of ADHD displayed more externalising behavioural problems than the children diagnosed with the Predominantly Inattentive subtype. The ratio of boys : girls meeting the number of criteria on the behaviour rating scale above the cut-off point recommended for a diagnosis of ADHD (in the classroom) in this study was on average closer to 2 : 1 (boys : girls). I would suggest that this lower ratio could be a result of the participating children being assessed at a younger age than the subjects of other studies.

Differences in the estimated rate of prevalence of ADHD between cultures

A further factor that may have contributed to variations in the reported estimated rates of prevalence of ADHD is the bias of the clinicians and teachers who are making the diagnoses. This may be a result of diagnosing people from different cultures differently even when they display the same symptoms to the same degree of severity (Townsend, 1979). Sonuga-Barke *et al.* (1993) assessed bias in teacher ratings of pupil behaviour against an objective measure of behaviour and found that teachers overestimated the levels of activity and inattention in Asian children compared with English children.

This study gathered information on the PIPS Baseline Assessment conducted at the start of reception about the first language spoken by the children. Teachers were asked to state whether or not English was an additional language for each child.

Tables 42, 43 and 44 (*Group C - Frequency of subtypes of ADHD symptoms by language, Group D - Frequency of subtypes of ADHD symptoms by language, and Group E - Frequency of subtypes of ADHD symptoms by language*) show the frequency of children with English as their first language and English as an additional language in each cohort meeting the number of criteria above the cut-off point recommended for a diagnosis of ADHD (in the classroom) in the classroom. (Note that these tables are based on children who have spent at least six months in the reception class.)

Table 42 Group C - Frequency of subtypes of ADHD symptoms by language

First language	Combined		Inattentive		Hyperactive/Impulsive	
	Count	Percent	Count	Percent	Count	Percent
English	437	2.9	960	6.4	464	3.1
Other	64	3.4	165	8.7	46	2.4
Total	501	2.9	1125	6.6	510	3.0

n=17011(number of children with English as an additional language = 1903)

A Chi-square test showed that there was no significant difference between the scores on the Combined and Predominantly Hyperactive/Impulsive sub-scales of the behaviour rating scale for children with English as their first language and children with English as an additional language. There was a significant difference between children with English as their first language and children with English as an additional language for the Predominantly Inattentive sub-scale scores, resulting in a higher percentage of children with English as an additional language meeting sufficient criteria to qualify for a diagnosis of this subtype in the classroom setting.

Table 43 Group D Frequency of subtypes of ADHD symptoms by language

First lang-Uage	Combined		Inattentive		Hyperactive/ Impulsive	
	Count	Percent	Count	Percent	Count	Percent
English	1398	3.3	2933	6.9	1158	2.7
Other	115	2.8	369	8.9	126	3.0
Total	1513	3.3	3302	7.1	1284	2.8

(Number of children = 46431 with 4161 children having English as an additional language).

Teacher ratings for children for whom English was an additional language and children with English as their first language did not differ significantly for the Predominantly Hyperactive-Impulsive sub-type. There were significant differences for the Combined sub-type and once again for the Inattentive sub-type.

Table 44 Group E Frequency of subtypes of ADHD symptoms by language

First language	Combined		Inattentive		Hyperactive/ Impulsive	
	Count	Percent	Count	Percent	Count	Percent
English	1561	2.7	3469	6.1	1502	2.6
Other	137	2.9	305	6.4	93	1.9
Total	1698	2.7	3774	6.1	1595	2.6

(Number of children = 62069 with 4800 children having English as an additional language).

Teacher ratings of children for whom English was an additional language and children with English as their first language did differ significantly for the Predominantly Hyperactive/Impulsive subtype. It is interesting to note that significantly more children whose first language was English were considered to be extremely hyperactive/impulsive than children with English as an additional language. There were no significant differences for the Combined sub-type and the Inattentive sub-type.

Whilst some statistically significant differences were found between the teacher ratings for children for whom English was an additional language and children with English as their first language, there were no consistent differences. The largest differences occurred for the Predominantly Inattentive subtype. Teacher ratings of Group C showed a significant difference for the Predominantly Inattentive subtype, between children whose first language was English and children for whom English was an additional language. A similar trend was found for the Predominantly Inattentive subtype of Group D. The results from Group E also showed that a higher proportion of children for whom English was an additional language met the number of criteria above the cut-off point recommended for a diagnosis of the Predominantly Inattentive subtype of ADHD (in the classroom) although the difference was not large enough to be statistically significant. It is not

surprising that young children who start school unable to understand the spoken language frequently appear to be inattentive. If this hypothesis were constant, an inverse relationship between the acquisition of the English language and behaviour rating scale score would be expected. Of the sample of children reassessed with behaviour rating scale in year 2 (see Chapter 9 - Reliability and Validity of the Measures for more details of the reassessment) only five children used English as an additional language. Of these five children, only two met the number of criteria recommended for a diagnosis of ADHD (in the classroom) at the end of the reception year. Both met sufficient criteria for the Combined subtype. By year 2, both children met only four criteria each, one relating to inattention and three relating to hyperactivity/impulsivity. These results complemented the issue discussed; however two children do not provide sufficient data to draw any meaningful conclusions and had resources permitted, a more detailed larger scale test/retest reliability assessment of the behaviour rating scale would have been useful.

Whilst some of the differences for the Combined and Predominantly Hyperactive/Impulsive subtypes between children with English as an additional language and English as their first language were significant, the size of the differences were all less than one percent which was a very small proportion of the whole sample.

These results have practical implications for the teachers of young children who use English as an additional language. The inattentive behaviour of these children should be observed carefully in an effort to determine whether

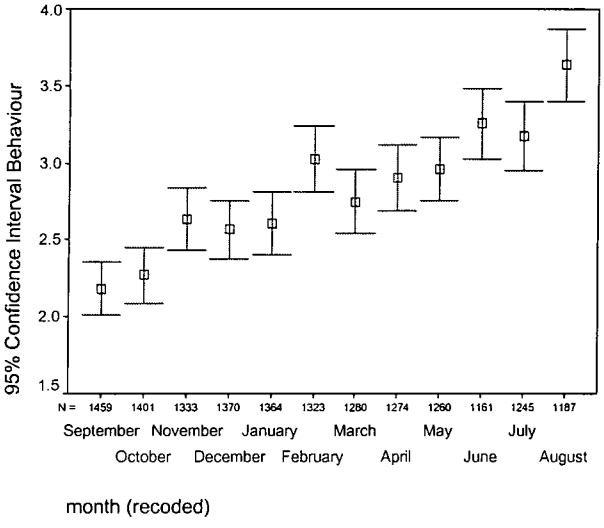
their symptoms originate from ADHD or whether they are a reflection of communication problems.

Age and Behaviour

Analysis of data from Group C

Graph 19 shows the mean behaviour scores and 95% confidence intervals by month of birth of children from Group C who had spent a full academic year in the reception class.

Graph 19 Group C Behaviour scores by month of birth



Graph 19 shows that there was an inverse relationship between the score from the behaviour rating scale and age, indicating that on average, younger children tended to be more inattentive, hyperactive and impulsive than older ones. A one-way analysis of variance showed significant differences between the behaviour of the younger children (born in June, July and August) and the oldest children (born in September, October and November). The mean behaviour score of the children born in February was unexpectedly high.

Further analysis of the other two cohorts would confirm whether or not this finding was stable.

The figures below are the results from the One-Way Analysis Of Variance test between the scores from the behaviour rating scale and month of birth.

```
Source      DF         SS         MS         F         P
Month       11     2476.9      225.2    15.66     0.000
Error    15645   224949.5       14.4
Total    15656   227426.4

                                        Individual 95% CIs For Mean
                                        Based on Pooled StDev
Level        N       Mean      StDev  -------+---------+---------+------
---
 Sept     1459      2.182      3.344  (--*---)
 Oct      1401      2.268      3.477   (---*--)
 Nov      1333      2.631      3.811         (---*--)
 Dec      1370      2.565      3.652        (---*--)
 Jan      1364      2.606      3.786         (--*---)
 Feb      1323      3.026      3.910                (--*---)
 Mar      1280      2.749      3.842           (---*--)
 Apr      1274      2.904      3.861              (--*---)
 May      1260      2.958      3.758               (--*---)
 June     1161      3.252      4.012                    (--*---)
 July     1245      3.176      3.994                  (---*--)
 Aug      1187      3.635      4.129                           (---*--)
                                       -------+---------+---------+------
---
Pooled StDev =     3.792                2.40      3.00      3.60
```

Although the difference between the mean behaviour scores of the children born in August and those born in September was significantly different, the size of this difference was actually quite small at just 1.45 points on the 18 point behaviour rating scale (Effect Size = 0.38).

Having considered the distribution of behaviour rating scale scores by month of birth, the next issue to investigate was whether proportionally more of the youngest children were considered to meet the number of criteria on the behaviour rating scale recommended for a diagnosis of ADHD (in the classroom setting). The Chi-Square test showed significant differences

between months of birth for the Combined and Predominantly Inattentive subtypes (p= 0.003 and p=0.000 respectively) but not for the Predominantly Hyperactive/Impulsive subtype (p=0.06). Details of the observed and expected number of children meeting a high number of criteria on the behaviour rating scale by month of birth are shown in Table 45.

Table 45 Observed and expected counts of children meeting a high number of criteria on the behaviour rating scale by month of birth

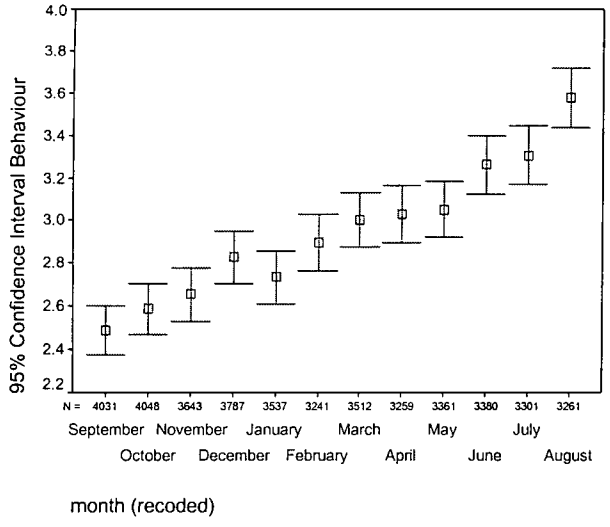
Month of birth	Combined		Predominantly Inattentive		Predominantly Hyperactive/Impulsive		Total number of children
	Count	%	Count	%	Count	%	Count
September							1459
Observed	23	1.6	61	4.2	45	3.1	
Expected	42.6	2.9	95.2	6.5	44.5	3.1	
October							1401
Observed	28	2.0	66	4.7	39	2.8	
Expected	40.9	2.9	91.4	6.5	42.8	3.1	
November							1333
Observed	39	2.9	59	4.4	54	4.1	
Expected	38.9	2.9	87	6.5	40.7	3.1	
December							1370
Observed	33	2.4	73	5.3	46	3.4	
Expected	40	2.9	89.4	6.5	41.8	3.1	
January							1364
Observed	40	2.9	62	4.5	44	3.2	
Expected	39.9	2.9	89.0	6.5	41.6	3.1	
February							1323
Observed	39	2.9	98	7.4	53	4.0	
Expected	38.6	2.9	86.4	6.5	40.4	3.1	
March							1280
Observed	43	3.4	75	5.9	39	3.0	
Expected	37.4	2.9	83.6	6.5	39.1	3.1	
April							1274
Observed	41	3.2	88	6.9	37	2.9	
Expected	37.2	2.9	83.2	6.5	38.9	3.1	
May							1260
Observed	32	2.5	100	7.9	33	2.6	
Expected	36.8	2.9	82.2	6.5	38.5	3.1	
June							1161
Observed	47	4.0	92	7.9	26	2.2	
Expected	33.9	2.9	75.8	6.5	35.4	3.1	
July							1245
Observed	48	3.9	109	8.8	23	1.8	
Expected	36.3	2.9	81.3	6.5	38	3.1	
August							1187
Observed	44	3.7	139	11.7	39	3.3	
Expected	34.6	2.9	77.5	6.5	36.2	3.1	

The largest difference was between the observed and expected counts for the children born in August meeting a high number of criteria on the Predominantly Inattentive subscale. The observed count was almost twice as high as the expected count. Whilst Graph 19 and the one-way analysis of variance showed that the children born in February met a higher number of criteria on the behaviour rating scale than might have been predicted, in actual fact the results in Table 45 demonstrated that when only the high behaviour scores were considered, the differences between the observed and expected counts were not large. The difference was in the number of February born children meeting a small number of criteria (1 – 5 on each subscale) compared with children born in other months.

Analysis of data from Group D

Graph 20 shows the mean behaviour scores and 95% confidence intervals by month of birth of children from Group D who had spent a full academic year in the reception class.

Graph 20 Group D Behaviour scores by month of birth



Graph 20 shows a similar inverse relationship between age and behaviour to the data from Group C. The behaviour scores of the children who were born in February were as expected, which increases the likelihood that the data from the children born in February in Group C were not typical. Group D contained more than twice as many children as Group C (42,361 and 15657 pupils respectively) and thus would be expected to yield results more typical of the general population.

A One-Way Analysis Of Variance test showed a significant difference between the behaviour scores and month of birth. This data can be viewed in Appendix 3.

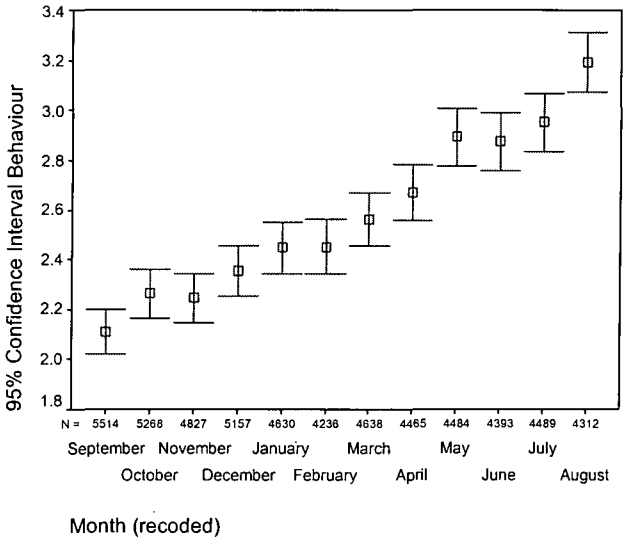
The difference between the mean behaviour score of the children born in September and those born in August was just 1.09 points on the 18 point behaviour rating scale (Effect Size = 0.28). This was slightly smaller than the difference found between the children born in September and August in Group C.

When the proportion of children meeting the number of criteria recommended to qualify for a subtype of ADHD (in the classroom) by month of birth was considered, a Chi-Square test showed significant differences between the observed and expected counts for the Combined and Predominantly Inattentive subtypes ($p = 0.001$ and $p = 0.000$ respectively) but not for the Predominantly Hyperactive/Impulsive subtype ($p = 0.07$).

Analysis of data from Group E

Graph 21 shows the mean behaviour scores and 95% confidence intervals by month of birth of children from Group E who had spent a full academic year in the reception class.

Graph 21 Group E Behaviour scores by month of birth



Graph 21 confirms the inverse relationship between age and behaviour found with Groups C and D.

The results from a One-Way Analysis of Variance test showed significant differences between behaviour for month of birth. The ANOVA table can be viewed in Appendix 3.

Once again, the difference between the mean behaviour score of the children born in September and those born in August was small (just 1.08 points on the 18 point behaviour rating scale, Effect Size = 0.29). This difference was similar to that found between children born in September and August in Group D and slightly smaller than the difference found in Group C. The sample of

pupils in Group C was smaller than Groups D and E, which may account for the differences between cohorts noted above.

When the proportion of children meeting sufficient criteria to qualify for a subtype of ADHD in the classroom by month of birth was considered, a Chi-Square test showed significant differences between the observed and expected counts for the Combined and Predominantly Inattentive subtypes ($p = 0.000$ for both) but not for the Predominantly Hyperactive/Impulsive subtype ($p = 0.12$). These results were similar to those of groups C and D.

In general, the inverse relationship between age and score on the behaviour rating scale was similar across the three cohorts. Whilst the difference in the behaviour scores of the oldest and youngest children was statistically significant, it was small when expressed as an Effect Size (Cohen,1977). Significantly more August born children than September born children met a high number of criteria on the Combined and Predominantly Inattentive sub-scales, but the difference on the Predominantly Hyperactive/Impulsive sub-scale was not significant.

The inverse relationship between age and behaviour rating scale score supported the findings of the studies reviewed by Hill and Schoener (1996), which showed a decline in the prevalence of ADHD with increasing age. The studies included in their review monitored individuals over long periods of time, but nevertheless, a similar trend was found. Although the behaviour of many children in this study has been demonstrated to be stable over time (see chapter 'Reliability and Validity of the Measures), the small but statistically significant trend of decreasing inattentive, hyperactive and

impulsive behaviour with increasing age found in this study might be partly attributed to the age of the children. It has been found that the executive functions that control these behavioural traits are not fully developed in many young children. Their behaviour can be a symptom of immaturity, and not the product of a psychological disorder. It is important to consider the proposed theory of the nature of ADHD (Barkley, 1997) alongside the normal patterns of development of behaviour (Vaughn *et al.*,1984, Zelazo, Kearsley and Stack, 1995). If the judgements of behaviour made by teachers in this study were reliable, it may be assumed that children with high scores on the behaviour rating scale experienced problems with behavioural inhibition. Some of these individuals may be developing at a slower rate than their peers and are not yet able to control their responses. Their behaviour will change without special interventions as their executive functions develop assisted by everyday social interactions and education. Other children may have ADHD. Their inability to inhibit a response would not be due to immaturity and their inattentive, hyperactive and impulsive behaviour could persist throughout childhood.

Socio-economic status (SES) and Behaviour

In order to examine the relationship between behaviour and SES, the home postcodes of pupils were used to match their behaviour scores to deprivation indexes, calculated from the 1991 census data. Many of the cases did not match due to missing data where no postcode had been supplied for a child, mis-entered data and changes in postcodes since 1991, the consequence of the recent creation of new unitary authorities. The scores from pupils in Group C were analysed. The total number of pupils for whom matched data were available was 6,211.

The correlations between the total score from the behaviour rating scale and the deprivation index scores (described in Chapter 8 – Method) are shown in Table 46.

Table 46 Correlations between total behaviour score and SES

Deprivation Index	Behaviour rating scale score
Townsend	0.07** (0.07** boys, 0.07** girls)
Department of the Environment	0.08** (0.08**boys, 0.08** girls)
Carstairs	0.08** (0.08** boys, 0.08** girls)
Jarman	0.09** (0.09** boys, 0.10** girls)

** $p \leq 0.01$

Weak, but significant, correlations were found between SES and total behaviour score. The correlations were virtually the same when boys and girls were analysed separately. Although the correlations were very similar, the highest correlation was found with the Jarman deprivation index. The Jarman index was a weighted, composite score, derived from unemployment, overcrowding in the home, lone pensioners, single parents, residents born in

the New Commonwealth, children under 5 years of age, low social class and residents who had lived in the area fro less than 1 year. It was based on more variables than the other indexes, and these variables were weighted, which perhaps provided the most accurate measure of deprivation. An Effect Size of 0.18 was calculated from the correlation between total behaviour score and Jarman deprivation index score. This was a low effect size and indicated a positive yet weak relationship between behaviour and SES. When the behaviour rating scale was divided into Inattentive and Hyperactive/Impulsive sub-scales, the correlations between behaviour and SES remained low, as shown in Table 47.

Table 47 Correlations between the Inattentive and Hyperactive/Impulsive sub-scales of the behaviour rating scale and SES

Deprivation Index	Inattentive sub-scale	Hyperactive/Impulsive sub-scale
Townsend	0.06**	0.07**
Department of the Environment	0.07**	0.07**
Carstairs	0.07**	0.07**
Jarman	0.09**	0.08**

** $p \leq 0.01$

A stronger relationship between inattentive, hyperactive and impulsive behaviour, and SES might have been expected. Pineda *et al.* (1999) reported a higher incidence of ADHD symptoms in 6 to 11 year-old, low SES boys than other boys of the same age living in less deprived areas. Although the results from Group C replicated their finding, the relationship between the two variables was weak, and there was virtually no difference between boys and girls.

Schools in deprived areas are often assumed to be difficult situations to work in, not only because of the low level of attainment of pupils, but also because of the perceived behavioural problems. The correlations reported in Table 46 and Table 47 demonstrated that children in deprived areas tended to be slightly more inattentive, hyperactive and impulsive than children in more affluent areas, but the relationship was very weak.

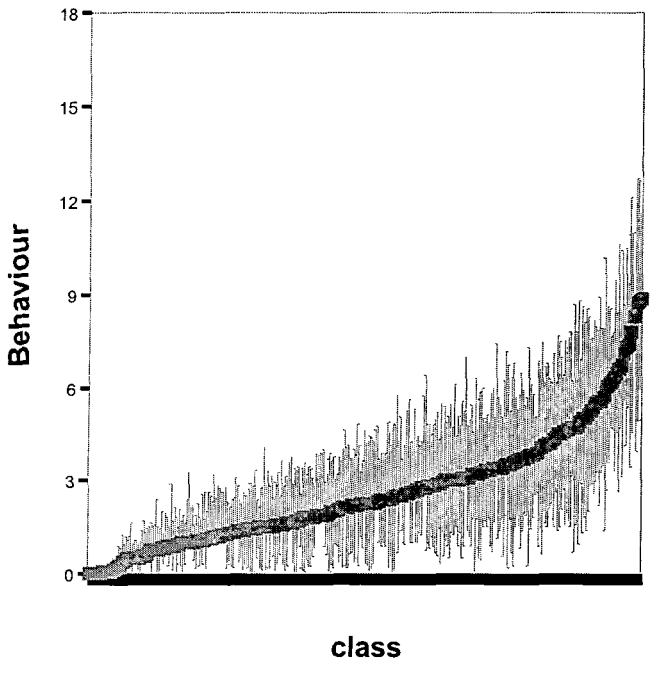
Teachers and Behaviour

The behaviour of children might possibly vary according to which teacher they are with. This could be due to the skill, personality and expectations of the teacher, or it could be due to other factors such as the SES of the pupils in the school, a high proportion of children with English as an additional language in a class or a high proportion of young children in a class. The behaviour of pupils attending schools in deprived areas is often thought to be more problematic than that of those pupils attending schools in more affluent areas. However, Galloway (1976) actually found that schools in areas of socio-economic hardship did not exclude proportionally more children than schools in more affluent areas. Although a strong link between behaviour and exclusion (termed 'suspension' by Galloway) rates would be expected, he suggested that exclusion rates might not give a true reflection of the 'amount or degree of deviant behaviour in a school'. Children with the Combined and Predominantly Hyperactive/Impulsive sub-types of ADHD could well display the kind of behaviour in the classroom that would lead to exclusion. The results reported in the previous section of this chapter indicated that the relationship between SES and inattention, hyperactivity and impulsivity was very weak. Galloway's research and the results of the present study both indicate a weak relationship between SES and the kind of disruptive, inattentive behaviour that could lead to exclusion from school.

The same data from Group C were analysed to determine whether or not significant differences in behaviour between classes existed after controlling for SES, average age of the pupils and the proportion of pupils with English as

an additional language. Because it was not possible to match the home postcodes of many pupils to deprivation index scores due to the reasons explained in the previous section, classes with matched data for fewer than 10 pupils were excluded. The remaining data were less likely to be unfairly biased, although the sample was by no means perfect. After implementing this sampling procedure, the analysis was performed on 310 classes that contained a total of 4504 pupils. Graph 22 shows the mean behaviour score with 95% confidence interval of each class. It demonstrates that before SES, age or first language were controlled for, large differences in mean behaviour scores exist between classes. The mean class scores from the behaviour rating scale can be seen to vary widely from 0 to 8.90.

Graph 22 Mean behaviour rating scale scores by class



Then, after controlling for SES, both one-way ANOVA and, because mean behaviour scores were not normally distributed, the non-parametric Kruskal-

Wallis test still showed highly significant differences between the mean behaviour scores of classes. Similar trends were found when age and first language were controlled for. These factors might have made a small contribution to the differences found between classes but they were clearly not the main explanatory factors.

When the total scores from the behaviour rating scale were divided into the sub-scales of inattention and hyperactivity/impulsivity, highly significant differences between classes were still found, although a difference between the two sub-scales was apparent when the Chi Square values were examined (1148.96 and 908.30 for the inattentive and hyperactive/impulsive sub-scales respectively, degrees of freedom = 309 for both). The higher value for the inattentive sub-scale indicated larger differences between classes than for the hyperactive/impulsive sub-scale. Inattention seemed to be more related to the teacher than hyperactivity/impulsivity. Perhaps this is a reflection of teachers' personalities and classroom management. When reflecting on one's own learning experiences, it is common to remember particular teachers that engaged the full attention of their pupils by the way in which they presented new concepts and the activities that the class completed. It is also common to remember particular teachers in whose lessons everyone found it difficult to maintain interest resulting in chatter and inattention. This may have been because the subject matter was inappropriate or the presentation was uninspiring. This would lead to inattentive behaviour rather than hyperactive and impulsive behaviour. This result is similar to the trends of behaviour found for pupils with English as an additional language, who may

have displayed inattentive behaviour as a result of not understanding the lesson, more than hyperactive or impulsive behaviour.

It is important to be aware of the possible reasons behind inattentive, hyperactive and impulsive behaviour, particularly if medication is to be prescribed to young children. Since behaviour changes as individuals mature, ideally the development of children with high scores on the behaviour rating scale should be further monitored. The impact of these behaviours on academic attainment and progress is also of interest and is discussed later (see Chapter 12 'Results 3, Achievement and Progress). Regardless of whether or not the behaviour is a symptom of ADHD, if it is associated with underachievement in the classroom, it should be investigated and that investigation should include an examination of wider variables such as the teacher and the behaviour of other pupils in the class.

To summarise:

- Teachers appeared to be assessing children with severe behaviour problems relating to inattention, hyperactivity and impulsivity consistently over time.

- The rate of prevalence of severe inattentive, hyperactive and impulsive behaviour, in the classroom setting only, was similar to figures reported in other studies that had assessed behaviour using teacher ratings. The total percentage of children with severe behavioural problems was higher than previous estimates of the rate of prevalence of ADHD (e.g. 3 – 5% of school age children, DSM-IV, 1994).

- The ratio of behaviour related to the three ADHD sub-types was similar to those reported in other studies.

- The difference in behaviour between genders was slightly less than ratios reported in previous studies. This could be due to the participants of the present study being younger than the subjects in other studies.

- Children with English as an additional language were more inattentive, hyperactive and impulsive than children with English as their first language although there was not a consistent pattern across all three cohorts.

- Behaviour was related to age. Younger children were more inattentive, hyperactive and impulsive than the older children in the year group of each cohort.

- The relationship between socio-economic status and behaviour was weak.

- Large differences between the mean behaviour scores of classes were found after controlling for SES.

Chapter 11

Results 2

The Stability Of Inattention, Hyperactivity And Impulsivity Over Time

Introduction

The reliability of the Behaviour Rating Scale was discussed in Chapter 8, 'Reliability And Validity Of The Measures'. The Behaviour Rating Scale was shown to be a useful instrument for identifying children who had behavioural problems relating to inattention, hyperactivity and impulsivity at the end of the reception year. This was supported by the results of Chapter 9, 'Results 1, Distribution of scores from the End of Reception Behaviour Rating Scale'. A moderately high correlation between the initial assessment at the end of reception and the re-assessment of pupils by a different teacher using the same rating scale two years later was found (0.64). The correlation increased when only children who met no criteria and children meeting sufficient criteria to qualify for a diagnosis of ADHD (in the classroom setting only) were analysed. Of course, this increase in the correlation would be expected when only the two extremes of the scale were examined but it did confirm that the children with the most severe behavioural problems relating to inattention, hyperactivity and impulsiveness were being consistently identified, and also that the behaviour of many appeared to be relatively stable over time in a similar way to the symptoms of ADHD. Although the correlation of the scores on the Behaviour Rating Scale between the end of reception and year 2 was modest, it was not perfect (i.e. a correlation of 1) which meant that either the behaviour of some children had changed over time, or the way in which teachers completed the Behaviour Rating Scale differed.

The assessment of the validity of the Behaviour Rating Scale using the Conner's Continuous Performance Test explained some of this variation (for

more details see Chapter 9 - Reliability and Validity Of The Measures and Chapter 13 - Results 4 - Case Studies. The present chapter uses the test/re-test results derived from the sample of 130 children in Group C (see Chapter 8, 'Reliability and Validity Of The Measures' for details of the test/re-test) to investigate the stability of the traits of inattention, hyperactivity and impulsivity over time in more detail than reported earlier.

Differing rates of development will account for some of the variation. Barkley (1997) suggested that the boisterous and inattentive behaviour exhibited by some young children could be caused by immature executive functions rather than a psychological disorder. The behaviour of children such as this would change with increasing age to become less hyperactive and impulsive. Loeber, Keenan, Lahey, Green and Thomas (1993) suggested that symptoms of hyperactivity and impulsivity are typically the earliest to arise in the developmental course of ADHD, usually during the preschool years and so whilst symptoms of hyperactivity and impulsivity might remain stable over time, symptoms of inattention might increase.

Analysis of Changes in Behaviour Over Time

Table 48 (Group C Test/Re-Test Correlation By Sub-scale) shows the correlation of the different sub-scales of criteria on the behaviour rating scale between the end of reception and year 2 for the sample of 130 children from Group C. These are Pearson 'r' correlations.

Table 48 Group C Test/Re-Test Correlation By Sub-scale

	End reception B1	End reception B2	End reception B3	End reception B2 + B3	End reception total score
Year 2 B1	0.58**	0.45**	0.35**	0.44**	0.58**
Year 2 B2	0.42**	0.61**	0.55**	0.63**	0.58**
Year 2 B3	0.26**	0.45**	0.44**	0.49**	0.41**
Year 2 B2 + B3	0.39**	0.60**	0.55**	0.63**	0.57**
Y2 total score	0.56**	0.59**	0.49**	0.59**	0.64**

N=130

B1=9 criteria relating to inattention, B2=6 criteria relating to hyperactivity, B3=3 criteria relating to impulsivity.

** = correlation is significant($p<0.01$)

The figures in Table 48 show that the total score was most stable over time. When the sub-scales of criteria are examined it should be remembered that B3 only contained 3 criteria and so these were also combined with the criteria from B2 (relating to hyperactivity) to form a hyperactive/impulsive sub-scale for which correlations between the end of reception and year 2 were reported. It is interesting to note that the combined traits of hyperactivity and impulsivity were slightly more stable over the time period than inattention. The Spearman correlation coefficient measured stability in the rank order of scores. The Spearman coefficients were generally slightly higher than the Pearson coefficients indicating that the actual behaviour rating scores varied more than the overall rank order of the behaviour of children between the two time points.

The correlation between behaviour at the end of reception and year 2 does not provide any information about how the behaviour of certain children has changed. The table of mean scores below offers more insight:

Table 49 Means and standard deviations of Behaviour Rating Scale scores by sub – scale for children assessed at the end of reception and re-assessed in year 2

	End of Reception mean score	End of Reception standard deviation	Year 2 mean score	Year 2 standard deviation
Zero scores	0.00	0.00	1.44	2.18
Combined	15.08	1.59	10.04	4.11
Predominantly Inattentive	9.65	2.28	6.65	3.42
Predominantly Hyperactive/Impulsive	10.11	2.26	7.33	5.52

The mean behaviour score of children with zero scores at the end of reception remained fairly stable over time, increasing slightly by year 2. The mean behaviour scores of the Combined, Predominantly Inattentive and Predominantly Hyperactive/Impulsive groups decreased over time, the largest change being seen for the Combined group.

It is also interesting to look at whether or not the children with scores above the DSM-IV cut-off point for ADHD at the end of reception maintained that status through to year 2. The correlations and mean scores showed that overall, behaviour was moderately stable over time, but to qualify for a diagnosis of ADHD, children would have to continue to meet a number of criteria above the vital cut-off point. They might still have behavioural problems in year 2 but meet too few criteria to be considered as having ADHD. Table 50 shows the number of pupils who continued to meet sufficient criteria in year 2 to qualify for the same sub-type as they did at the end of reception.

Table 50 Pupils continuing to meet sufficient criteria in year 2 to qualify for the same sub-type as at the end of reception

Sub-type	Number of pupils at the end of reception	Number of pupils at year 2	Pupils changing sub-type over time
Combined	23	7	7 changed to Predominantly Inattentive
Predominantly Inattentive	20	7	
Predominantly Hyperactive/Impulsive	9	1	2 changed to Combined

The suggestion by Loeber, Keenan, Lahey, Green and Thomas (1993) that some children change sub-types from Predominantly Hyperactive/Impulsive to the Combined subtype of ADHD as they grow older applied to two of the children from the original Predominantly Hyperactive group.

Seven of the children from the original Combined group who didn't meet sufficient criteria for the Combined sub-type in year 2 nevertheless met sufficient criteria for the Predominantly Inattentive sub-type. Their hyperactive/impulsive behaviour had become less severe over time but they remained inattentive.

To Summarise:

In general, the test/re-test correlations indicated that the behaviour of many children, particularly those meeting a high number of criteria relating to hyperactivity and impulsivity was stable over time. The mean scores of each group demonstrated that the behaviour of some children with high scores on the behaviour rating scale at the end of reception had changed over time and by year 2 they were meeting fewer criteria. The data presented in this chapter support Barkley's theory that some children have immature executive

functions rather than a psychological disorder. Some of the children in the sample might have been diagnosed as having ADHD by the time they had reached year 2 and be receiving treatment to reduce their symptoms.

Chapter 12

Results 3

Achievement and Progress in Reading and Mathematics

Introduction

Having identified children in reception classes with severe inattention, and/or hyperactivity/impulsivity, this chapter reports their attainment and progress during the first three years at school compared with children who did not meet any criteria on the behaviour rating scale at the end of reception.

The reading and mathematics attainment of all the pupils in each cohort were assessed. For details of the assessments and the time-points at which they were administered, see Chapter 8 - Method. Assessing pupils in three separate cohorts verified that the findings were consistent over time and also provided a larger sample than would be obtained from a single cohort.

Value-added measures (the residuals from regression analysis) were calculated between the following time-points:
start of reception to the end of reception,
end of reception to Year 2.

The combination of the scores from the picture vocabulary and non-verbal ability from the 'Context' section of Assessment 2 provided an indicator of the developed ability of each child. This measure of developed ability was found to be a good predictor of reading and mathematics attainment. The correlation (multiple R) between developed ability and reading attainment was 0.7 ($p<.01$) and the correlation (multiple R) with mathematics attainment was 0.7 ($p<.01$) in Year 2. Value-added scores derived from using the developed ability score as the independent variable are also reported.

Sometimes children started school in the reception class in January or April. Only children who started school in September and therefore completed a full academic year in the Reception class were included in the analysis of attainment and progress in the present study.

The difference in attainment and progress between children who were assigned high or zero scores on the behaviour rating scale at the end of reception was compared. The following scores were considered to qualify as high scores on the behaviour rating scale:

- Combined sub-type: Children should meet 6 or more criteria relating to inattention (criteria on sub-scale B1 of the behaviour rating scale) and 6 or more criteria relating to hyperactivity/impulsivity (criteria on sub-scales B2 and B3 of the behaviour rating scale).
- Predominantly Inattentive sub-type: Children should meet 6 or more criteria relating to inattention (criteria on sub-scale B1 of the behaviour rating scale) but not necessarily any criteria relating to hyperactivity or impulsivity.
- Predominantly Hyperactive/Impulsive sub-type: Children should meet 6 or more criteria relating to hyperactivity/impulsivity (criteria on sub-scales B2 and B3 of the behaviour rating scale) but not necessarily any criteria relating to inattention.

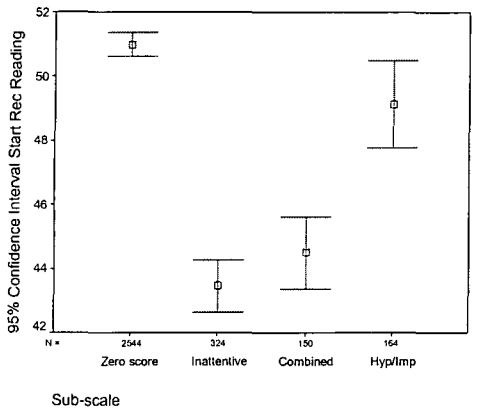
Achievement and progress in reading and mathematics

Graphs 23 to 38 give an initial impression of the differences between children with zero scores and children with high scores of each cohort. They show the attainment of children in each behaviour sub-type at the start of reception, the end of reception and year 2. The attainment scores (on the Y axis) are expressed as z scores with a mean of 50 and standard deviation of 10. The error bars represent the 95% Confidence Interval.

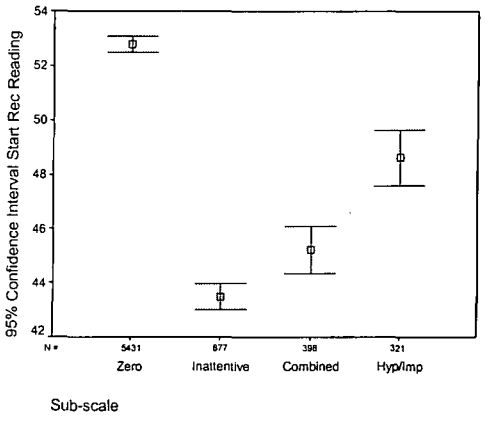
Reading - Start of reception

Graphs 23, 24 and 25 Differences in reading at the start of reception between sub-scales on the behaviour rating scale in Groups C, D and E respectively

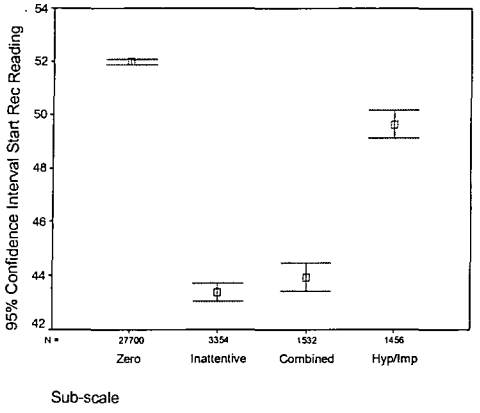
Graph 23 Group C



Graph 24 Group D



Graph 25 Group E



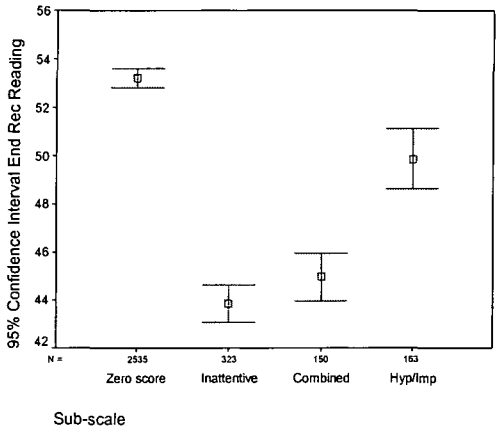
At the start of the reception year, large differences can be seen between the children with zero scores on the behaviour rating scale and children meeting a high number of criteria on the Combined and Predominantly Inattentive sub-scales. The largest difference is between the zero scores and the Predominantly Inattentive sub-scale (around 0.8 standard deviations, depending on the cohort). The difference between the zero scores and the Predominantly Hyperactive/Impulsive sub-scale is much less (between 0.2 and 0.4 of a standard deviation depending on the cohort). The results of each cohort follow a similar pattern and in fact the difference of the mean scores of

each sub-scale between cohorts is relatively small compared to the mean differences between sub-scales.

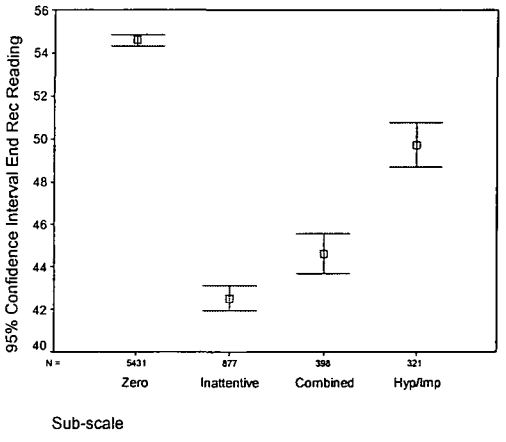
Reading - End of reception

Graphs 26, 27 and 28 Differences in reading at the end of reception between sub-scales on the behaviour rating scale for children in Groups C, D and E respectively

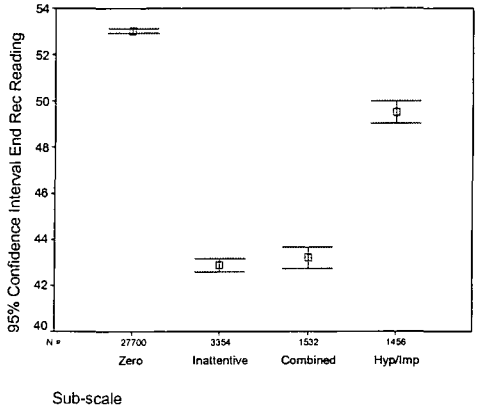
Graph 26 Group C



Graph 27 Group D



Graph 28 Group E



The difference in reading between the zero scores and the three sub-scales had increased slightly by the time the children have been at school for a full year when their behaviour was rated. For example, for the children in Group C, the difference between the children with high scores on the Combined sub-scale and children with zero scores on the behaviour rating scale increased from 0.7 standard deviations at the start of reception to 0.8 standard

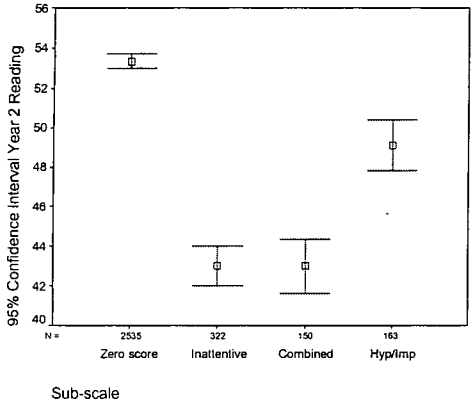
deviations at the end of reception. The difference between the children with high scores on the Predominantly Inattentive sub-scale and children with zero behaviour scores increased from 0.8 standard deviations at the start of reception to 0.9 standard deviations at the end of reception. The difference between the children with high scores on the Predominantly Hyperactive/Impulsive sub-scale and the children with zero behaviour scores was much lower than the other two sub-types at the start of reception (0.2 standard deviations). This difference increased to 0.3 standard deviations by the end of reception.

Reading – year 2

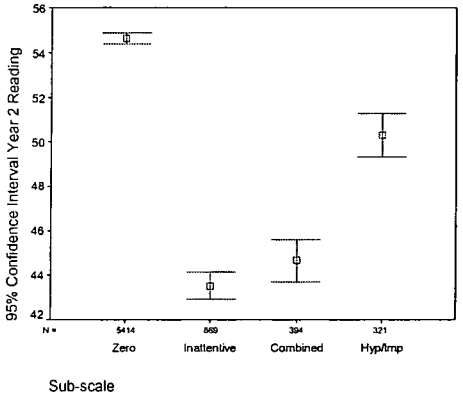
Graphs 29 and 30 below show this trend of increasing differences in reading between the children with high scores and zero scores on the behaviour rating scale continuing with Groups C and D in Year 2.

Graphs 29 and 30 Differences in reading in Year 2 between sub-scales on the behaviour rating scale for children in Groups C and D respectively

Graph 29 Group C



Graph 30 Group D



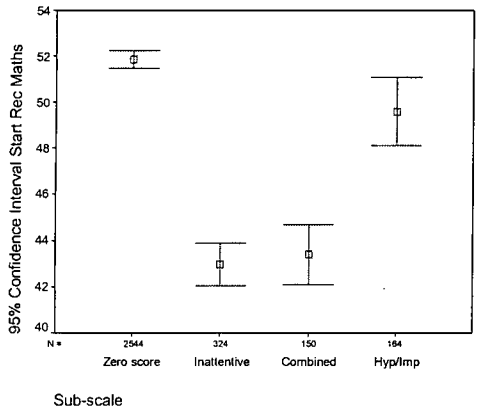
For example, for the children in Group C, the difference in reading between the children with high scores on the Combined sub-scale and children with

zero scores on the behaviour rating scale increased from 0.8 standard deviations at the end of reception to 1 standard deviation by Year 2. The difference in reading between the children with high scores on the Predominantly Inattentive sub-scale and children with zero behaviour scores increased from 0.9 standard deviations at the end of reception to 1 standard deviation in Year 2. The difference in reading between the children with high scores on the Predominantly Hyperactive/Impulsive sub-scale and the children with zero behaviour scores increased from 0.3 standard deviations at the end of reception to 0.4 standard deviations in Year 2.

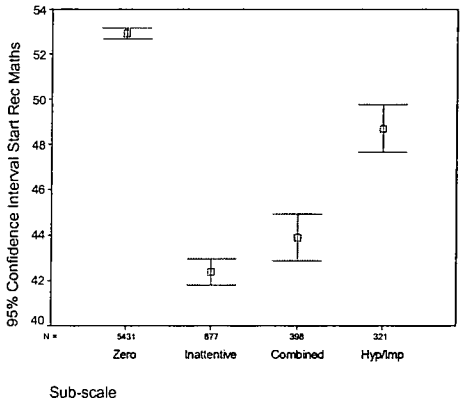
Mathematics – start of reception

Graphs 31, 32 and 33 Differences in mathematics at the start of reception between sub-scales on the behaviour rating scale for children in Groups C, D and E respectively

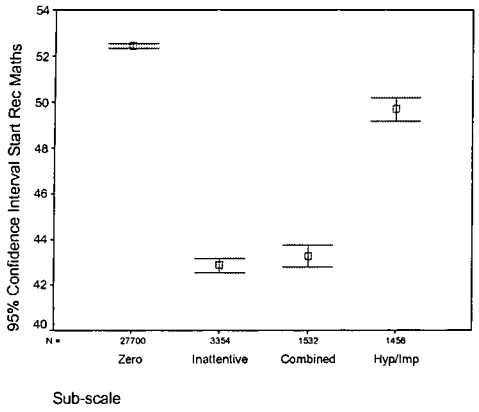
Graph 31 Group C



Graph 32 Group D



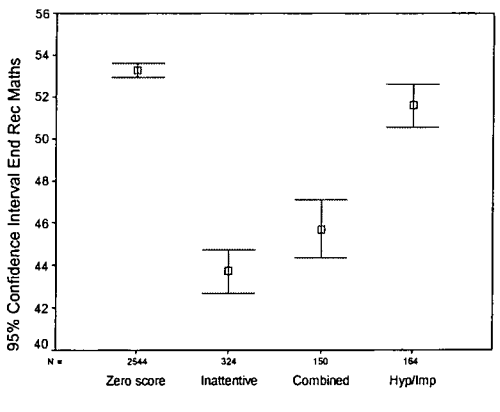
Graph 33 Group E



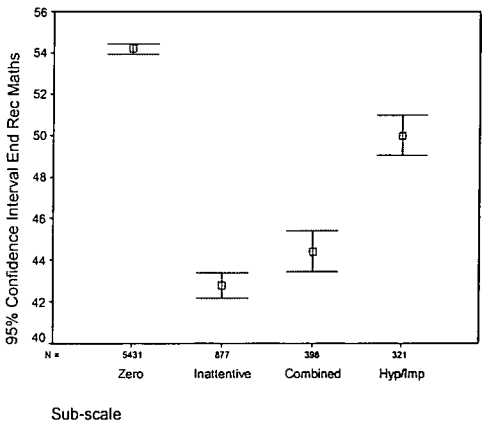
Mathematics – end of reception

Graphs 34, 35 and 36 Differences in mathematics at the end of reception between sub-scales on the behaviour rating scale for children in Groups C, D and E respectively

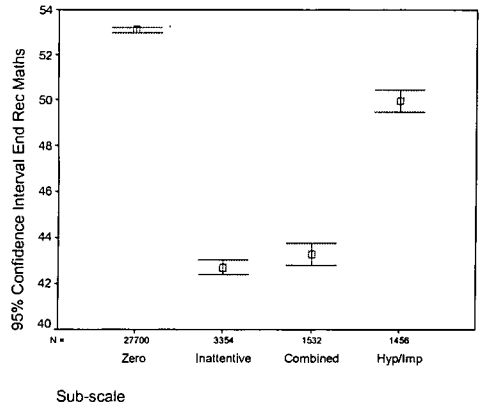
Graph 34 Group C



Graph 35 Group D



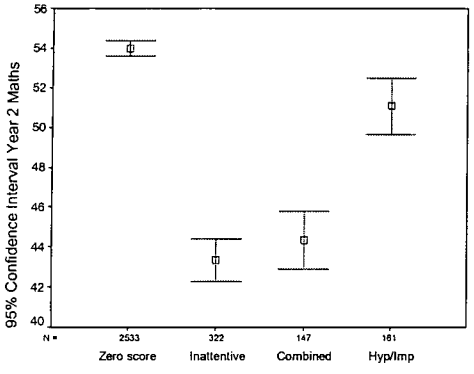
Graph 36 Group E



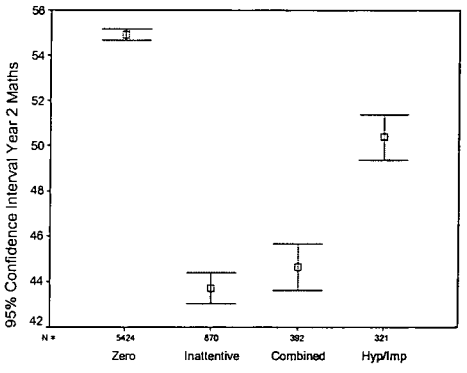
Mathematics – year 2

Graphs 37 and 38 Differences in mathematics in Year 2 between sub-scales on the behaviour rating scale for children in Groups C and D respectively

Graph 37 Group C



Graph 38 Group D



The maths scores followed the same trends as reading with larger differences between the children with zero scores and children with high scores on the Combined and Predominantly Inattentive sub-scales than between children with zero scores and children with high scores on the Predominantly Hyperactive/Impulsive sub-scale. For example, for the children in Group C, the differences in mathematics achievement between the start of reception of children with high scores for the three sub-scales and children with zero scores on the behaviour rating scale were 0.9 standard deviations for the Combined and Predominantly Inattentive groups, and 0.2 standard deviations

for the Predominantly Hyperactive/Impulsive group. These differences continued to increase and by Year 2 they were 1 standard deviation for the Combined and Predominantly Inattentive groups, and 0.3 standard deviations for the Predominantly Hyperactive/Impulsive group.
Again, the differences between cohorts were small compared to differences between sub-scales.

Even though the cohorts were different sizes and included different pupils and schools, the general trends were similar across them for the reading and maths attainment of children with zero scores and children with high scores on each sub-scale of the behaviour assessment.

Graphs are a useful means of expressing results in order to gain an initial impression of the data. The differences between the reading and mathematics attainment of children in relation to their scores on the behaviour rating scale were examined in more detail. The actual size of these differences was expressed as Effect Sizes. Effect Sizes provide a standardised measure, which makes it possible to compare the achievement of different cohorts of children. An effect size of 0.2 is considered low, 0.5, medium, and 0.8, quite large (Cohen, 1979, Fitz-Gibbon and Morris, 1987). It is calculated using the following formula:

Effect Size = $\frac{\text{(mean Y for E group) – (mean Y for C group)}}{\text{pooled standard deviation of Y}}$

Where:

Y = Outcome measure

E group = children with a high score on the ADHD teacher rating scale

C group = children with a zero score on the ADHD teacher rating scale

At the time of writing this study, matched data were available from the start of reception to the end of Year 2 for the children in Group C, the start of reception to Year 2 for children in Group D, and the start of reception to the end of reception for children in Group E.

Table 51 Number of pupils with zero and high scores on the behaviour rating scale included in analysis of attainment and value-added (Matched data for Start of reception to Year 2 for Groups C and D, *matched data for Start of reception to End of reception for Group E*)

	Group C			Group D			Group E		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Zero scores	1151	1393	2544	2173	3258	5431	11645	16055	27700
Combined sub-type	119	31	150	294	104	398	1148	384	1532
Predominantly Inattentive sub-type	211	113	324	611	266	877	2237	1117	3354
Predominantly Hyperactive/Impulsive sub-type	112	52	164	227	94	321	1012	436	1448

Table 52 shows the differences between the reading attainment of children with high scores and zero scores on the behaviour rating scale.

Table 52 Effect sizes for differences in reading attainment

	Effect Sizes for Reading Attainment								
	Combined			Predominantly Inattentive			Predominantly Hyperactive/ Impulsive		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Start of reception reading score	-0.64**	-0.73**	-0.69**	-0.72**	-0.89**	-0.79**	-0.19*	-0.15	-0.19*
	-0.70**	-0.63**	-0.73**	-0.82**	-0.98**	-0.89**	-0.29**	-0.58**	-0.40**
	-0.60**	-0.58**	-0.67**	-0.66**	-0.77**	-0.72**	-0.20**	-0.13*	-0.22**
End of reception reading score	-0.77**	-0.79**	-0.83**	-0.84**	-1.01**	-0.92**	-0.28**	-0.36**	-0.34**
	-0.93**	-0.72**	-0.91**	-1.00**	-1.13**	-1.08**	-0.38**	-0.57**	-0.48**
	-0.91**	-0.95**	-0.99**	-0.90**	-1.07**	-1.01**	-0.32	-0.31	-0.38
Year 2 reading score	-1.06**	-0.87**	-1.07**	-0.97**	-1.11**	-1.04**	-0.36**	-0.53**	-0.45**
	-0.97**	-0.82**	-1.00**	-0.98**	-1.16**	-1.08**	-0.35**	-0.56**	-0.48**
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

** Significant ($p \leq 0.01$)

* Significant ($p \leq 0.05$)

Top row contains results from Group C

Middle row contains results from Group D

Bottom row contains results from Group E

N/A = data not available at time of analysis

The Effect Sizes in Table 52 at the start of reception indicated quite large differences in reading achievement between zero and high scoring children for the Combined and Predominantly Inattentive sub-scales in all three cohorts. Large differences were apparent for both boys and girls. The difference between zero and high scoring children on the Predominantly Hyperactive/Impulsive sub-scale was small at the start of reception, although nevertheless statistically significant (with the exception of the girls in Group C).

The differences between the reading achievement of children with high scores and children with zero scores generally increased over time for the Combined and Predominantly Inattentive sub-scales. One exception to this trend was

the boys in Group D for whom the difference between the end of reception and year 2 was very slightly reduced (by 0.02 of an Effect Size).

The difference between the reading achievement of children with high scores and children with zero scores in Groups C and E on the Predominantly Hyperactive/Impulsive sub-scale increased over time, the difference in Group D was more stable, but had been larger than the other two cohorts at the start and end of reception. By Year 2, the differences in Groups C and D were of a similar scale.

Table 53 shows the difference between the mathematics attainment of children with high scores and zero scores on the behaviour rating scale.

Table 53 Effect Sizes for differences in mathematics attainment

	Effect Sizes for Mathematics Attainment								
	Combined			Predominantly Inattentive			Predominantly Hyperactive/ Impulsive		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Start of reception maths score	-0.84**	-0.75**	-0.86**	-0.86**	-0.89**	-0.89**	-0.21*	-0.22*	-0.24**
	-1.02**	-0.72**	-0.94**	-1.00**	-1.11**	-1.07**	-0.40**	-0.58**	-0.45**
	-0.99**	-0.84**	-0.94**	-0.97**	-1.10**	-0.99**	-0.38**	-0.28**	-0.29**
End of reception maths score	-0.82**	-0.74**	-0.88**	-0.96**	-1.13**	-1.05**	-0.18*	-0.17	-0.20**
	-1.07**	-0.96**	-1.08**	-1.12**	-1.30**	-1.18**	-0.39**	-0.56**	-0.46**
	-1.03**	-1.06**	-1.07**	-1.00**	-1.13**	-1.09**	-0.32**	-0.36**	-0.33**
Year 2 maths score	-0.97**	-1.04**	-0.99**	-1.00**	-1.13**	-1.05**	-0.33**	-0.28**	-0.30**
	-1.15**	-0.96**	-1.13**	-1.07**	-1.35**	-1.16**	-0.47**	-0.63**	-0.51**
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

** Significant ($p \leq 0.01$)

* Significant ($p \leq 0.05$)

Top row contains results from Group C

Middle row contains results from Group D

Bottom row contains results from Group E

N/A = data not available at time of analysis

The pattern of differences between the mathematics achievement of children with zero scores and children with high scores was similar to the reading achievement. Much larger differences were seen between children with zero scores and high scores on the Combined and Predominantly Inattentive sub-scales than the Predominantly Hyperactive/Impulsive sub-scale. All differences were statistically significant.

Unlike reading attainment, the Effect Sizes of the Predominantly Inattentive sub-scale whilst large did not continue to increase between the end of reception and year 2 (Groups C and D, no data available for Group E). They remained stable. However, they were still larger than the Effect Sizes for the Combined sub-scale in Year 2.

The Effect Sizes of the Predominantly Hyperactive/Impulsive sub-scale for Groups C and D remained generally stable between the start and end of reception but started to increase between the end of reception and year 2. The Effect Size of the Predominantly Hyperactive/Impulsive sub-scale for Group E increased slightly between the start and end of reception. No data were available for year 2.

Tables 54, 55 and 56 show the Effect Size of the value-added scores in reading of the three sub-types.

Table 54 Effect Sizes for differences in reading residuals (Combined group)

		Effect Sizes for Reading Residuals		
Outcome	Control for	Combined		
		Boys	Girls	Total
End of Recept-ion	Start of reception	-0.47** -0.58** -0.65**	-0.38** -0.36** -0.69**	-0.49** -0.53** -0.70**
Year 2	End of reception	-0.61** -0.43** N/A	-0.38** -0.35** N/A	-0.59** -0.45** N/A
Year 2	Developed ability	-0.64** -0.54** N/A	-0.41** -0.50** N/A	-0.73** -0.64** N/A

Table 55 Effect Sizes for differences in reading residuals (Predominantly Inattentive group)

		Effect Sizes for Reading Residuals		
Outcome	Control for	Predominantly Inattentive		
		Boys	Girls	Total
End of Recept-ion	Start of reception	-0.50** -0.62** -0.63**	-0.54** -0.61** -0.72**	-0.54** -0.62** -0.68**
Year 2	End of reception	-0.42** -0.37** N/A	-0.49** -0.42** N/A	-0.46** -0.42** N/A
Year 2	Developed ability	-0.41** -0.50** N/A	-0.61** -0.64** N/A	-0.55** -0.67** N/A

Table 56 Effect Sizes for differences in reading residuals (Predominantly Hyperactive/Impulsive group)

		Effect Sizes for Reading Residuals		
Outcome	Control for	Predominantly Hyperactive/Impulsive		
		Boys	Girls	Total
End of Recept-ion	Start of reception	-0.22** -0.26** -0.25**	-0.35** -0.22** -0.32**	-0.28** -0.25** -0.30**
Year 2	End of reception	-0.18* -0.09 N/A	-0.40** -0.18* N/A	-0.27** -0.15** N/A
Year 2	Developed ability	-0.31** -0.11 N/A	-0.52** -0.61** N/A	-0.47** -0.30** N/A

** Significant ($p \leq 0.01$)

* Significant ($p \leq 0.05$)

Top row contains results from Group C,

Middle row contains results from Group D

Bottom row contains results from Group E,

N/A = data not available at time of analysis

The Effect Sizes for the reading value-added scores (residuals) indicated that those children with high scores on all sub-scales of the behaviour rating scale generally made less progress in reading between the start and end of reception than children with zero scores. In other words, the children with high scores on the behaviour rating scale started the reception year with lower attainment scores in reading and than many of their peers and then generally made less progress during the reception year than other children with similar scores at the start of reception, thus falling even further behind. The differences between the residuals of children with zero and high scores on the Predominantly Hyperactive/Impulsive sub-type were generally smaller than the other two sub-types although they were nevertheless statistically significant.

The Effect Size of the reading residual for the total sample of the Combined sub-scale increased between the end of reception and year 2 for Group C but not for Group D. This meant that although the children from Group D with high scores on the Combined sub-scale continued to fall behind the children with zero scores on the behaviour rating scale in terms of expected progress in reading between the end of reception and Year 2, the decline was less than between the start and end of reception. The Effect Sizes of the reading residuals for total samples of the Predominantly Inattentive and Predominantly Hyperactive/Impulsive sub-scales showed a similar trend between the end of reception and Year 2. In other words, although children with high scores on the behaviour rating scale tended to have lower reading attainment scores than the children with zero scores at all time points, between the end of

reception and year 2, this gap did not widen as much as it did between the start and end of reception (with the exception of the Combined sub-scale of Group C).

The combination of picture vocabulary and non-verbal ability as an indicator of a child's developed ability in the multiple regression analysis to predict achievement added a further dimension to the analysis. If meeting a high number of criteria on the behaviour rating scale was strongly related to learning difficulties in general, children with high scores on the behaviour rating scale may be expected to have low developed ability scores i.e. poor vocabulary and non-verbal ability. This would in turn predict low achievement scores. When the developed ability is used to predict reading or mathematics achievement, the residual scores (value-added) of children of low ability should still be close to zero if they are achieving the predicted level of attainment[1].

[1] Research by Kaplan *et al.* (2000) showed that the Full-Scale IQ of children with ADHD was normally distributed and the distribution of scores was not significantly lower than the distribution of the normal population. Other studies (e.g. Warner-Rogers *et al.*, 2000) found that the Full-Scale IQ of children with inattentive behaviour was significantly lower than a control group of children with no behavioural problems and that the Full-Scale IQ of children with hyperactive or combined behaviour did not differ from the control group. Analysis of data from Groups C and D of the present study (excl. children with English as an additional language) showed that the developed ability of groups of pupils with high scores on the behaviour rating scale was normally distributed but unlike the findings of Kaplan *et al.*, there was a significant difference between children with high scores on one of the three sub-scales of the behaviour rating scale and children with zero scores on the behaviour rating scale. Further details of the analysis can be found in Table 57 in Appendix 4.

The Effect Sizes for the difference in the residuals calculated using developed ability as the predictor of attainment were moderate for the Combined and Predominantly Inattentive scales, and slightly smaller but nevertheless statistically significant for the Predominantly Hyperactive/Impulsive sub-scale. This shows that in general, children with high scores on the behaviour rating scale were still underachieving in reading after controlling for their ability. These findings suggest that the low achievement could be a consequence of behavioural problems relating to inattention, hyperactivity and impulsivity rather than a result of other learning difficulties.

Tables 58, 59 and 60 show the Effect Size of the value-added scores in mathematics of the three sub-types.

Table 58 Effect Sizes for differences in mathematics residuals (Combined Group)

		Effect Sizes for Mathematics Residuals		
Outcome	Control for	Combined		
		Boys	Girls	Total
End of Reception	Start of reception	-0.38** -0.60** -0.55**	-0.32** -0.46** -0.57**	-0.38** -0.54** -0.55**
Year 2	End of reception	-0.60** -0.52** N/A	-0.76** -0.48** N/A	-0.61** -0.51** N/A
Year 2	Developed ability	-0.55** -0.70** N/A	-0.60** -0.46** N/A	-0.64** -0.73** N/A

Table 59 Effect Sizes for differences in mathematics residuals (Predominantly Inattentive Group)

		Effect Sizes for Mathematics Residuals		
Outcome	Control for	Predominantly Inattentive		
		Boys	Girls	Total
End of Reception	Start of reception	-0.58** -0.62** -0.57**	-0.67** -0.64** -0.62**	-0.62** -0.61** -0.58**
Year 2	End of reception	-0.54** -0.44** N/A	-0.65** -0.62** N/A	-0.56** -0.49** N/A
Year 2	Developed ability	-0.53** -0.60** N/A	-0.65** -0.77** N/A	-0.61** -0.72** N/A

Table 60 Effect Sizes for differences in mathematics residuals (Predominantly Hyperactive/Impulsive Group)

		Effect Sizes for Mathematics Residuals		
Outcome	Control for	Predominantly Hyperactive/ Impulsive		
		Boys	Girls	Total
End of Reception	Start of reception	-0.06 -0.21** -0.16**	-0.03 -0.14 -0.23**	-0.06 -0.15** -0.17**
Year 2	End of reception	-0.26** -0.23** N/A	-0.20* -0.32** N/A	-0.22** -0.25** N/A
Year 2	Developed ability	-0.26** -0.22** N/A	-0.13 -0.38** N/A	-0.27** -0.29** N/A

** Significant ($p \leq 0.01$)

* Significant ($p \leq 0.05$)

Top row contains results from Group C

Middle row contains results from Group D

Bottom row contains results from Group E

N/A = data not available at time of analysis

The Effect Sizes for the mathematics value-added scores (residuals) were similar to those for the reading value-added. They indicated that children with high scores on all sub-scales of the behaviour rating scale generally made less progress in mathematics between the start and end of reception than

children with zero scores. The differences between the residuals of children with zero and high scores on the Predominantly Hyperactive/Impulsive sub-scale were smaller than the other two sub-scales particularly the mathematics residuals of the children in Group C, which were not significantly different to the children with zero scores.

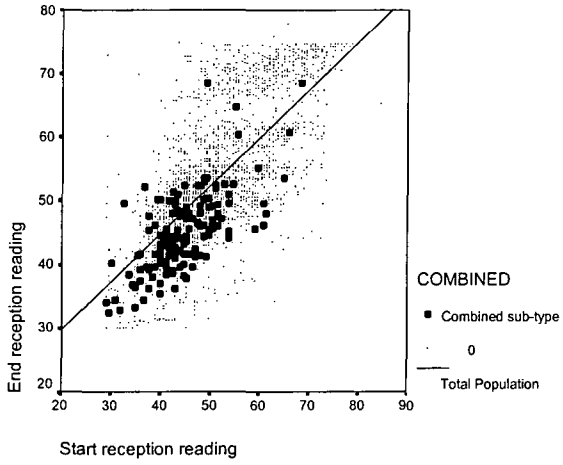
Like the reading, the Effect Size of the mathematics residual for the total sample of the Combined sub-scale increased between the end of reception and year 2 for Group C but not for Group D. The children with high scores on the Combined sub-scale continued to fall behind the children with zero behaviour scores in terms of the progress made in mathematics between the start of reception and the end of reception. Between the end of reception and Year 2, this decline was less rapid for the children in Group D with high scores on the Combined sub-scale. The Effect Sizes of the mathematics residuals for the total samples of the Predominantly Inattentive sub-scale did not increase between the end of reception and Year 2. Again, the children with high scores on the Predominantly Inattentive sub-scale did continually fall behind their peers but the rate of decline between the end of reception and year 2 was less than between the start and end of reception. The Effect Sizes of the mathematics residuals for total samples of the Predominantly Hyperactive/Impulsive sub-scale did however increase between the end of reception and Year 2, indicating that children with high scores fell further behind children with zero scores on the behaviour rating scale in mathematics between the end of reception and year 2 than they did between the start and end of reception.

In terms of their developed ability, the Effect Sizes indicated that children were underachieving in mathematics, particularly the children with high scores on the Combined and Predominantly Inattentive sub-scales. The Effect Sizes for the children with high scores on the Predominantly Hyperactive/Impulsive sub-scale were also moderately large, particularly for the girls.

Graphs 39 to 56 clearly illustrate the underachievement in reading and maths of children with high scores on the behaviour rating scale that has already been expressed in terms of Effect Sizes. The added benefit of presenting the data graphically is that it is possible to see that the children with high scores on the behaviour rating scale were not all at the lower end of the ability range particularly in terms of developed ability. Some very able children had high scores on the behaviour rating scale and were underachieving. Plots of the z scores for reading and mathematics between the start of reception to the end of reception, and the end of reception to year 2, for children in Group C with high scores and zero scores on the behaviour rating scale are presented. Reading and mathematics achievement (z scores) have also been plotted against developed ability (z scores). The line of best fit has been plotted on each graph and then the children with high scores on the behaviour rating scale have been highlighted against this line. Only the data of the children in Group C have been plotted because they are a complete dataset across all time points, and demonstrate the general trends found across all cohorts.

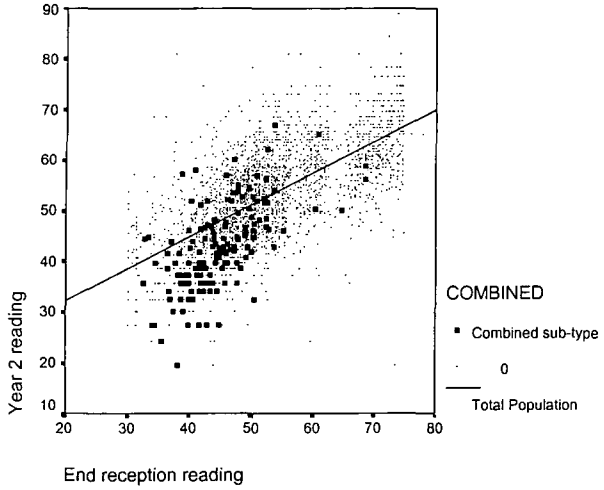
Reading

Graph 39 Start of reception reading (z score) against end of reception reading (z score) highlighting children with high scores on the Combined sub-scale from Group C



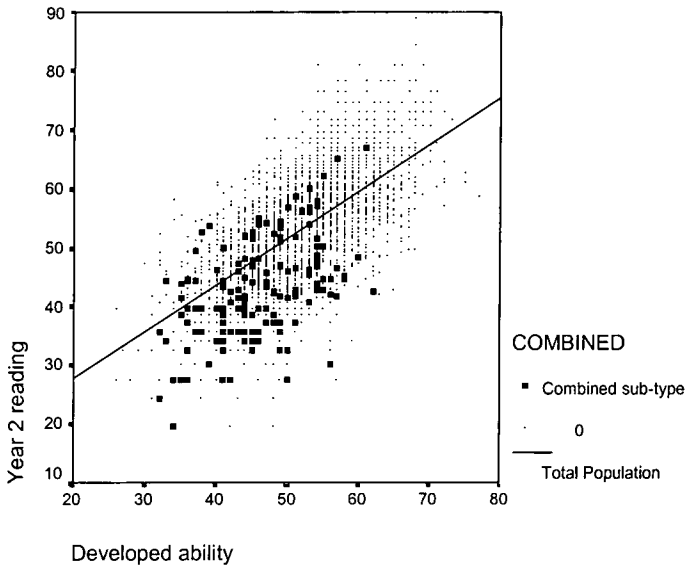
Many of the children who met a high number of criteria on the Combined sub-scale were below the line of best fit. Given their start of reception reading score, they had not made as much progress as children with zero scores on the behaviour rating scale and similar reading achievement at the start of reception.

Graph 40 End of reception reading (z score) against Year 2 reading (z score) highlighting children with high scores on the Combined sub-scale for Group C



The distance between the Year 2 reading scores of many children with high scores on the Combined sub-scale and the line of best fit increased which demonstrated how these children were falling even further behind their peers.

Graph 41 Year 2 reading (z score) against developed ability (z score) highlighting children with high scores on the Combined sub-scale for Group C



Graph 41 shows how many children with high scores on the Combined sub-scale of the behaviour rating scale were underachieving in reading in Year 2 given their developed ability.

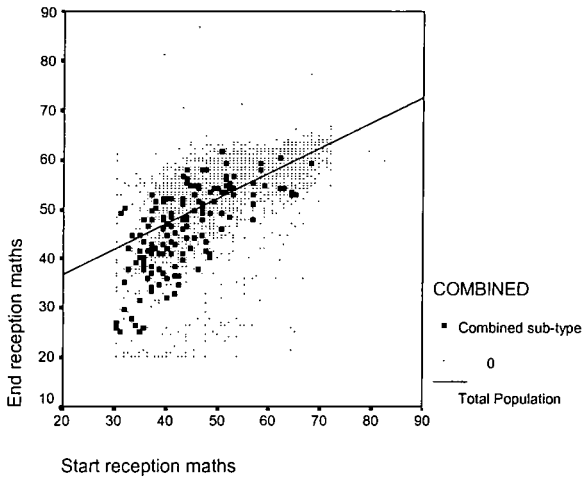
Graphs for the Predominantly Inattentive and Predominantly Hyperactive/Impulsive sub-scales can be viewed in Appendix 4. The general trends for reading of children with high scores on the Predominantly Inattentive sub-scale were similar to those of the Combined sub-scale. Compared to the reading achievement of these two groups, far fewer children with high scores on the Predominantly Hyperactive/Impulsive sub-scale were achieving lower than predicted reading scores when prior achievement was

the independent variable. More did achieve lower scores than expected when developed ability was the independent variable.

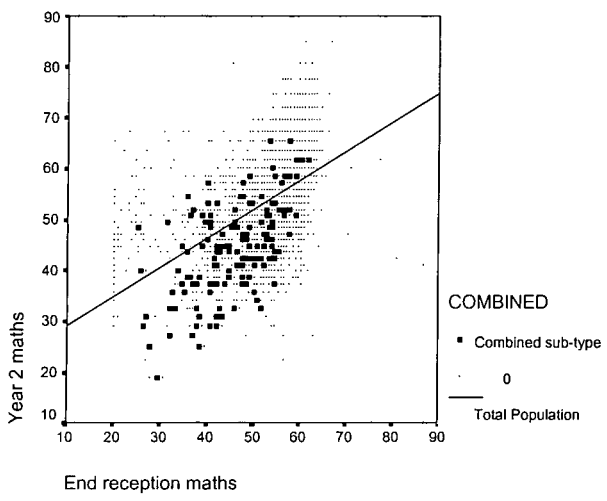
Mathematics

Graphs 48 to 50 below show similar trends for mathematics to those noted for reading.

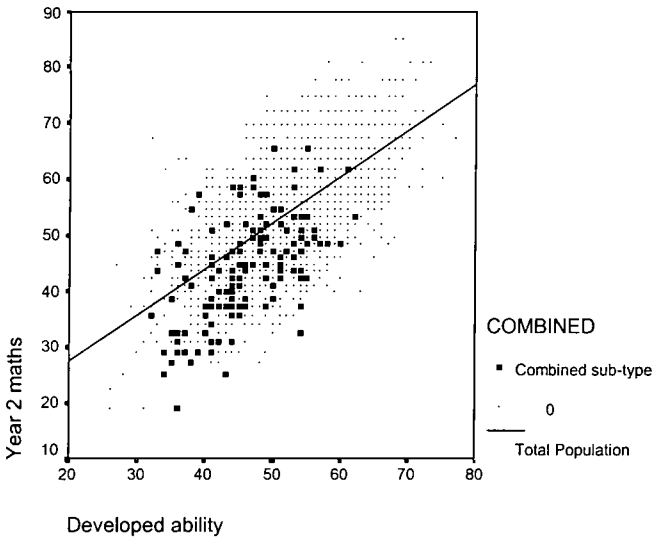
Graph 48 Start of reception maths (z score) against end of reception maths (z score) highlighting children with high scores on the Combined sub-scale from Group C



Graph 49 End of reception maths (z score) against Year 2 maths (z score) highlighting children with high scores on the Combined sub-scale for Group C



Graph 50 Year 2 maths (z score) against developed ability (z score) highlighting children with high scores on the Combined sub-scale for Group C



Graphs for the Predominantly Inattentive and Predominantly Hyperactive/Impulsive sub-scales can be viewed in Appendix 4 demonstrating similar trends to those found for reading.

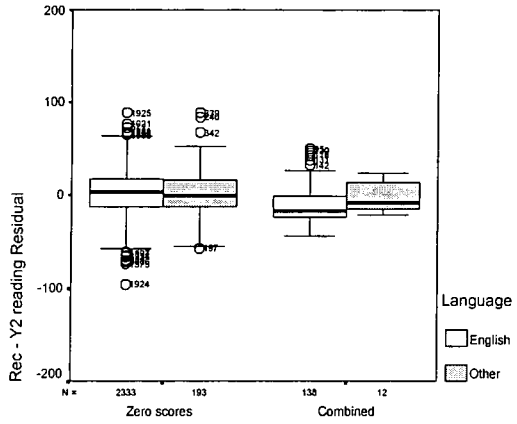
The information presented in these graphs has added further detail to the differences expressed as Effect Sizes between children with high scores and zero scores on the behaviour rating scale. In particular, it is clear that while many children with high scores on the behaviour rating scale fall behind their peers in both reading and mathematics, a large proportion of children with high scores on the behaviour rating scale actually make a similar amount of progress or more than their peers with zero scores on the behaviour rating scale. Within the constraints of the present study, it was not possible to find out exactly why this was although a number of reasons may have contributed. These will be discussed in the next section of this chapter.

Why did some children with high scores on the behaviour rating scale make good progress between the end of reception and year 2?

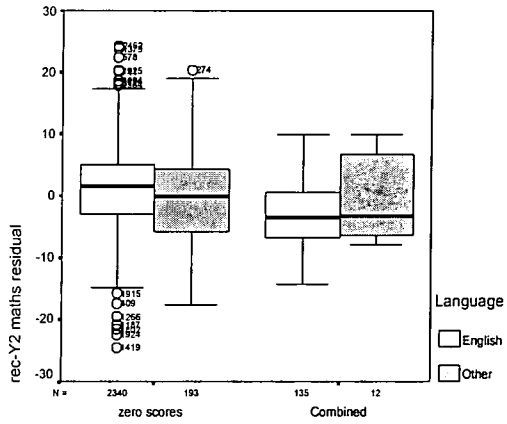
Firstly, these children may have been immature in reception compared to their peers. If their executive functions were less developed than other children when they started school, this would result in inattentive, hyperactive and/or impulsive behaviour in the reception class that would disappear as they grew older and not necessarily have a long term impact on achievement and progress.

Perhaps English was an additional language for some of these children causing them to appear inattentive. Again this problem would be resolved as the children acquired the English language and were able to understand and interact with the teacher and their peers more effectively. This was one of the factors that could be further investigated using the data gathered in the present study. Graphs 57 to 62 are box and whisker plots from Group C of the residuals for reading and mathematics between the end of reception and year 2 grouped by sub-scale on the behaviour rating scale and language.

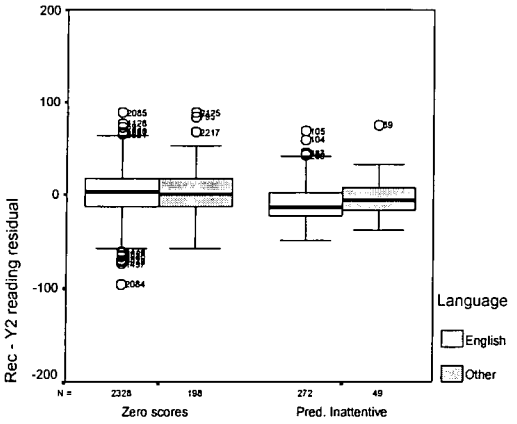
Graph 57 End Reception – Year 2 reading residuals for Combined sub-scale by language



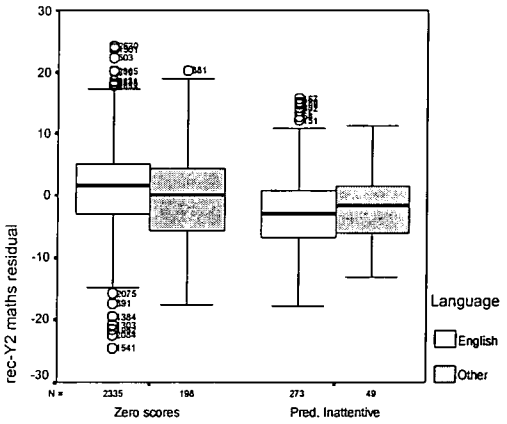
Graph 58 End Reception – Year 2 maths residuals for Combined sub-scale by language



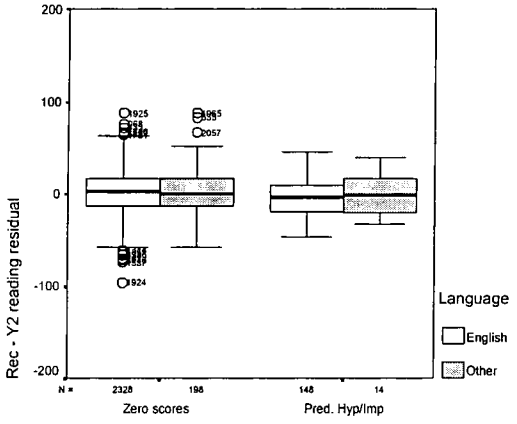
Graph 59 End Reception – Year 2 reading residuals for Predominantly Inattentive sub-scale



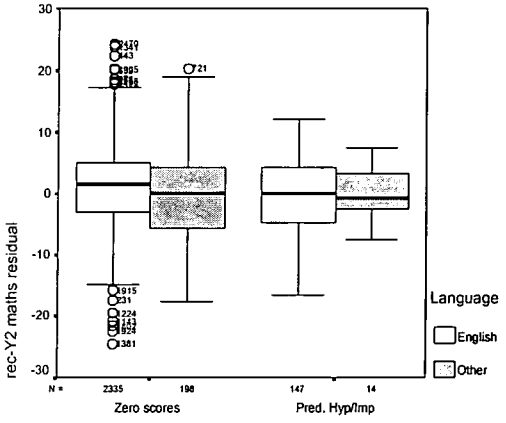
Graph 60 End Reception – Year 2 maths residuals for Predominantly Inattentive sub-scale



Graph 61 End Reception – Year 2 reading residuals for the Predominantly Hyperactive/Impulsive sub-scale



Graph 62 End Reception – Year 2 maths residuals for the Predominantly Hyperactive/Impulsive sub-scale



The residuals are a measure of the relative progress made by pupils. They show the amount of progress made by individuals compared to children with

the same reading/mathematics attainment at the end of reception. A positive residual indicates that a child has made more progress than other children with a similar starting point. The box and whisker plot shows that children with English as an additional language and zero scores on the behaviour rating scale progressed in reading at a similar rate to children with English as their native tongue and zero scores on the behaviour rating scale. A t-test showed that there was no significant difference between the two groups. This is not an indication of their level of attainment. The attainment of children with English as an additional language may have been lower than children with English as their native tongue, but the two groups showed a similar amount of progress in reading.

The information presented in the above box and whisker plots suggested that the behaviour exhibited by some children with English as an additional language could have been a consequence of their poor understanding of English language during the reception year rather than the result of a disorder such as ADHD. Some children with English as an additional language and a high score on the behaviour rating scale were apparently making good progress and had positive residuals. However, t-tests showed that across the groups, the reading residuals of children with English as an additional language and high scores on the behaviour rating scale were not significantly different to the reading residuals of children with English as their first language and high scores on the behaviour rating scale.

A t-test showed the maths residuals of the children with zero scores on the behaviour rating scale and English as their first language to be significantly higher than those of children with English as an additional language. No significant differences were found between the maths residuals of children with high scores on the behaviour rating scale and English as their first or additional language and children with English as an additional language.

The sample sizes of children with high scores on the behaviour rating scale and English as an additional language were small and for a difference to be significant, it would have had to be large. The Effect Sizes of differences between the residuals of children with English as an additional language and children with English as their first language and high scores on the behaviour rating scale are shown in Tables 61 and 62 below:

Table 61 Effect Sizes for the Differences Between Reading Residuals of Children with English as an Additional Language, English as First Language, and High Scores on the Behaviour Rating Scale

Outcome	Control For	Combined	Predominantly Inattentive	Predominantly Hyperactive/Impulsive
Y2 reading	End reception reading	-0.46	0.04	-0.28

N.B. Negative sign shows that the mean for children with English as an additional language is higher than mean for children with English as their first language

Table 62 Effect Sizes for the Differences Between Mathematics Residuals of Children with English as an Additional Language, English as First Language, and High Scores on the Behaviour Rating Scale

Outcome	Control For	Combined	Predominantly Inattentive	Predominantly Hyperactive/Impulsive
Year 2 maths	End reception maths	-0.44	0.20	-0.09

N.B. Negative sign shows that the mean for children with English as an additional language is higher than mean for children with English as their first language

The Effect Sizes demonstrated that having English as an additional language appeared to partly explain why some children with high scores on the behaviour rating scale made more progress (particularly in the Combined group) than expected between the end of reception and year 2. These results indicated that in some instances there were clearly additional factors to behaviour alone influencing the progress of children with high scores on the behaviour rating scale.

Some of the children may have been prescribed medication to treat their behavioural problems and their achievement and progress improved as a consequence.

Alternatively, the behavioural problems may have persisted but some class teachers may be more successful at managing those children and their education than other teachers.

The home background of the child, the number of children in the class with similar behavioural problems, the interaction between pupils in a class, the size of the class or a combination of factors such as these are all possible explanations.

Chapter 13, Results 4 - Case Studies, examines the behaviour, attainment and progress scores of a small number of children in more detail. Comments from class teachers and the head teacher, plus an objective measure of inattention and impulsivity (the Conners Continuous Performance Test) further

explain why some children with high scores on the behaviour rating scale at the end of reception made good progress between the end of reception and year 2.

If the behaviour of all pupils was monitored on a regular basis, for example each time a PIPS assessment was administered, it would be possible to identify children whose behavioural problems were temporary or due to immaturity and to partly explain the some of the outcomes of the data analysis. Once children have been highlighted as being severely inattentive, hyperactive and/or impulsive it is important that they are monitored so that appropriate action may be taken. Scotti *et al.* (1996) argued that the DSM-IV classification provided a useful starting point for the diagnosis of ADHD, but once children meeting a high number of the diagnostic criteria had been identified, any diagnosis should also utilise functional analysis. Functional analysis considers the behavioural symptoms within the context of the individual, with the aim of implementing an effective treatment plan. The two complementary methods used to diagnose ADHD may be equally applied to the identification and management of children who display similar behavioural problems but not necessarily have the disorder. The functional analysis supplements the information from the DSM-IV criteria and helps in the development of treatment strategies. For example, from the crude behaviour rating scale, which was based on the DSM-IV criteria it was possible to identify children who were severely inattentive, hyperactive and/or impulsive. Functional analysis would then have begun to put these problems into the context of the individual. Perhaps the child did not speak English when they

started school. This child would require a very different treatment plan to a child who had been observed to display this type of behaviour at nursery before starting school and also at home. Therefore, implementing functional analysis would be a logical step forward after completing the behaviour rating scale.

Gender Differences

Separate results for boys and girls were reported. Although the proportion of boys with high scores on the behaviour rating scale far exceeded the girls (see Chapter 10, Results – 1, Distribution of Scores from the End of Reception Behaviour Rating Scale), there were very few stable significant differences in attainment and progress between them for those children with high scores on any sub-scale of the behaviour rating scale. The boys with high scores on the inattentive sub-scale of Group C were significantly poorer than the girls in just one area – the mathematics residual between the start and end of reception (p=0.03). Whilst the difference was statistically significant, the actual difference between the mean scores of boys and girls was very small (0.4 of a mark, 0.04 of a standard deviation). Differences between boys and girls with high scores on the behaviour rating scale in Group D were found on the hyperactive/impulsive sub-scale where boys were made significantly less progress than girls in reading between the end of reception and year 2 (p = 0.03, the actual difference was 0.6 marks, less than 0.1 of a standard deviation), and on the combined sub-scale where boys were poorer in reading at the start of reception (p = 0.004, difference = 2.2 marks, about 0.2 of a standard deviation), and in mathematics at the start of

reception (p = 0.008, difference = 3.89 marks, about 0.4 of a standard deviation). The girls with high scores on the combined sub-scale of Group D were underachieving more than boys in maths in relation to their developed ability (p = 0.003, difference = 2.61 marks, about 0.2 of a standard deviation). There were three differences between boys and girls with high scores on the behaviour rating scale in Group E (note that these children had not been assessed in year 2 at the time of this analysis). On the hyperactive/impulsive sub-scale, boys were poorer at reading at the start of reception (p = 0.04, difference = 1.5 marks, about 0.15 standard deviations). On the combined sub-scale, boys were poorer at reading at the start of reception (p = 0.001, difference = 2.4 marks, 0.24 of a standard deviation) and mathematics at the end of reception (p = 0.02 difference = 1.72 marks, about 0.2 of a standard deviation).

The attainment and progress of children with high scores on the behaviour rating scale compared with children with ADHD

One of the aims of this study was to compare the academic attainment of young children who were reported by their class teachers as being exceptionally inattentive, hyperactive and/or impulsive with previous research on the academic attainment of children with ADHD. If similar trends were found, children with behavioural problems of the type described above but no formal diagnosis of ADHD may well be at risk of similar outcomes to children with ADHD (see Chapter 6 - ADHD from an Educational Perspective). The results reported in the tables and graphs above have shown that regardless of

whether or not a child has been diagnosed as having ADHD, severe inattention, hyperactivity and/ or impulsivity do appear to have a negative impact on reading and mathematics achievement and progress of many children with behavioural problems of this type between the start of reception and Year 2. It has also been possible to quantify the extent of this in terms of Effect Sizes. The findings of this study are in agreement with previous research, which has shown that children with ADHD experience problems with mathematics and reading, and are likely to achieve lower grades at school than their peers (for example Barkley, Fischer, Edelbrock and Smallish, 1990). The results of the present study indicated that children who met a high number of criteria on the Combined or Predominantly Inattentive sub-scales of the behaviour rating scale achieved lower scores than children with zero scores on the behaviour rating scale for both reading and mathematics equally. Nussbaum *et al.* (1990) found a significant negative relationship for children with ADD (either with or without hyperactivity) between age and some areas of academic functioning. Although their data were from quite a small sample of children (n = 79) and was cross-sectional rather than longitudinal, they nevertheless showed the same kinds of trends to the ones found in this study. Unfortunately their work was published in 1990 before the diagnostic criteria for the three ADHD sub-types in DSM-IV were published and therefore cannot be directly compared to the outcomes of this study. Solanto (1990) discussed the need for longitudinal data on the academic performance of children with ADHD on a large scale, in his commentary on the work of Nussbaum *et al.* (1990). This study goes some way towards addressing that

requirement, although with the limitation of the behaviour of the participating children being observed in the classroom situation only.

Looking in more detail at children diagnosed with each sub-type of ADHD, Lahey *et al.* (1994) reported that teacher ratings of children's academic impairment differed significantly between individuals diagnosed as the Combined or Predominantly Inattentive sub-types of ADHD and children who did not have ADHD or were diagnosed with the Predominantly Hyperactive/Impulsive sub-type. Children with the Combined or Predominantly Inattentive sub-types were significantly more impaired than the other children. The authors suggested that the results must be treated with caution because the individuals were all clinic referrals, and it is also important to note that academic achievement was assessed by means of teacher ratings rather than a standardised assessment completed by the children. Even so, the general trends are similar to those found in the larger school based population of the present study. Gaub and Carlson (1997) also found the same tendency of pupils who met a high number of criteria relating to the combined or predominantly inattentive sub-types of ADHD to be under achieving compared to children without ADHD or children with the Predominantly Hyperactive/Impulsive sub-type. However, like the study by Lahey *et al.*, academic performance was assessed by class teachers, and also the children diagnosed as having ADHD were not matched to children in the control group by IQ.

Marshall *et al.* (1997) investigated the mathematics and reading achievement of a sample of children aged between 6 years and 12 years 10 months, with either ADHD or Attention Deficit Disorder without hyperactivity (ADD/no hyperactivity). They reported mean scores and standard deviations for each group, which enabled Effect Sizes for the differences between the two groups and the normal population to be computed (see Chapter 5 - ADHD from an Educational Perspective, Table 3 The difference in achievement between a non-disabled sample and pupils with ADHD and ADD/no ADHD, from Marshall *et al.*, 1997). In general, larger differences were found for mathematics than reading between the two groups and the normal population. The Effect Sizes were lower than those reported in the present study. This may partly be due to many of the children being older than the subjects of the present study. As the data collected for the present study did not extend to pupils older than 7 years, it was not possible to make direct comparisons and further comments in terms of the effect of age. Also, the ADHD group contained a mixture of the DSM (IV) Combined and Predominantly Hyperactive/Impulsive sub-types. The results of the present study showed low Effect Sizes for the difference in achievement of the children with high scores on the hyperactive/impulsive sub-type of the behaviour rating scale and children with zero scores, which would further explain the smaller differences in achievement between the ADHD group and the normal population reported by Marshall *et al.* The sample size (24 students with ADHD and 20 students with ADD/no hyperactivity) was also much smaller than the present study and may not have been truly representative of the population as a whole.

Marshall *et al.* reported larger differences for mathematics than reading between the ADHD groups and the normal population with one exception, whereas the results of the present study showed similar Effect Sizes for the differences in reading and mathematics achievement of individuals with zero or high scores on each sub-scale of the behaviour rating scale. The differences found by Marshall *et al.* between the reading and mathematics achievement of individuals with ADHD, and also individuals with severe problems related to inattention, hyperactivity and impulsivity, may be a consequence of the type of assessment as well as the function of the brain.

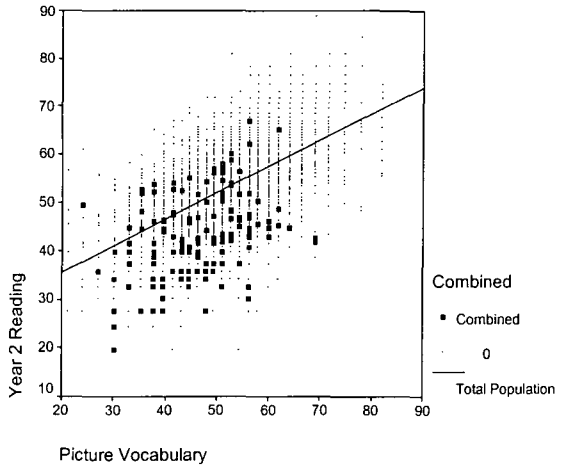
The research on the connection between ADHD and executive functions discussed earlier (see Chapter 4 - Understanding ADHD from a Biological and Psychological Perspective) indicated that the executive functions of individuals with ADHD could be impaired. One such executive function is working memory, which if impaired would lead to difficulty with holding and manipulating information in the brain. This skill is required to be able to perform mental calculations and would explain the larger differences in mathematics attainment reported by Marshall *et al.* (1997) and other researchers (Zentall, Harper and Stormont-Spurgin, 1993, Zentall, Smith, Lee and Wieczorek, 1994). Similarly, if a reading assessment required the subject to hold and manipulate information, differences in reading achievement would also be found. Indeed, Marshall *et al.* found differences between ADHD groups on the WRMT-R Passage Comprehension assessment. The mathematics assessments used in the present study

required subjects to manipulate and process information. Elements of the reading assessment completed by pupils in year 2 also required these skills. The pupils were presented with a passage or a page of information and then required to answer multiple-choice questions relating to the information. Not all the questions were factual recall. Some required the pupil to process the information. Barkley (1996) also suggested that poor reading comprehension skills often observed in children with ADHD could be attributed to the lack of ability to internalise speech and relate present events to past experiences, techniques also advantageous to children in year 2 of the present study when completing the reading assessments. The assessments at the start and end of reception largely depended on the recollection of previously learned information such as letter and word identification, and vocabulary. As part of the prolongation phase of executive functioning, Barkley (1996) suggested that the working memory constructs a sense of past experiences, which can be related to future events. Children who are inattentive, hyperactive and impulsive may not have successfully constructed the past experiences in relation to learning to identify letters and simple words, whereas other young children have been assimilating this information as they matured from looking at books and other media both with and without adults.

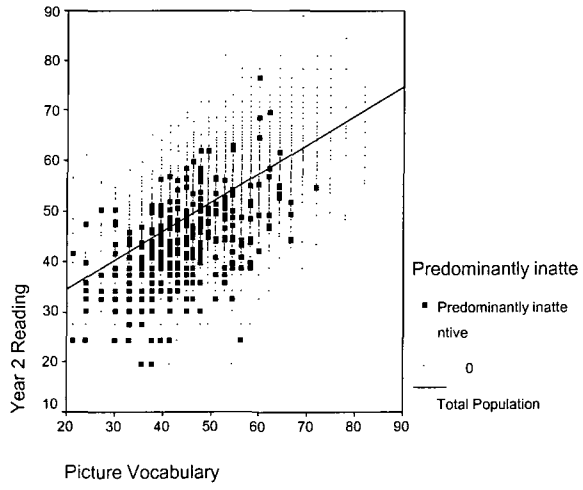
Pennington, Grossier and Welsh (1993) found that children with ADHD did not generally experience problems with phonological processing, and Purvis and Tannock (1997) who suggested that the language deficits of children with ADHD were a consequence of difficulties in self-monitoring and organisation, in contrast to children with reading difficulties who appeared to have poor

understanding of the basic sub-systems of language (e.g. semantics and syntax). In other words, children with ADHD do have knowledge and understanding of language and mathematical concepts, but their problems lie in the application of this. One way of beginning to investigate whether or not these theories applied to the children with high scores on the behaviour rating scale of the present study would be to plot vocabulary against reading achievement (the picture vocabulary assessment completed by children in year 2 is an indicator of language development, (Tymms, 1999)). Graphs 63 to 65 below are scatterplots of vocabulary against reading of Group C pupils in year 2.

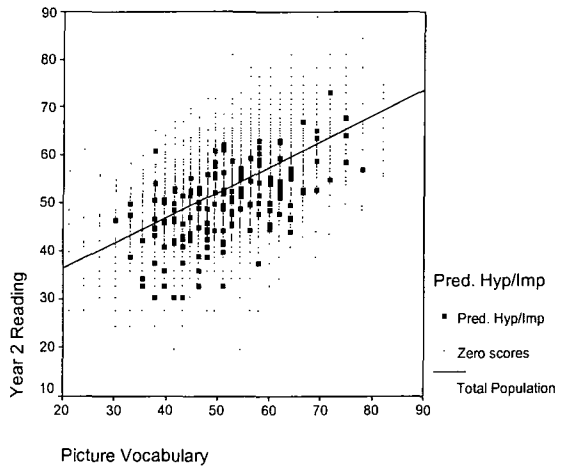
Graph 63 Year 2 picture vocabulary (z score) against Year 2 reading (z score) highlighting children with high scores on the Combined sub-scale from Group C



Graph 64 Year 2 picture vocabulary (z score) against Year 2 reading (z score) highlighting children with high scores on the Inattentive sub-scale from Group C



Graph 65 Year 2 picture vocabulary (z score) against Year 2 reading (z score) highlighting children with high scores on the Hyperactive/Impulsive sub-scale from Group C



Graphs 63, 64 and 65 show a wide range of vocabulary scores for the children with high scores with high scores on each sub-scale of the behaviour rating scale, and reading attainment is lower than expected for many, when compared to children with zero scores on the behaviour rating scale. Similar trends were found for the children in Group D. Although vocabulary is a basic indicator of language development which does not directly assess the basic sub-systems of language, the results indicated that children with high scores on each sub-scale might indeed be encountering problems with organisation and application rather than problems resulting from poor language development. Furthermore, specific assessments would have to be administered to these children in order to be able to draw any firm conclusions. It should also be remembered when interpreting the scatterplot that the data on behaviour was collected 18 months before the Year 2 assessment took place and will be inaccurate for some children.

The time taken to complete an assessment is an issue for all children but particularly for those who are inattentive, hyperactive and impulsive. Cherkes-Julkowski and Stolzenberg (1991) and Brock and Knapp (1996) found that the performance of children with ADHD on a reading comprehension test declined as the length of the text increased. This may have been a consequence of children with ADHD having difficulty organising and manipulating large chunks of information as described earlier, or it may simply have been caused by an inability to concentrate after a certain amount of time. The time taken for the PIPS assessments to be completed might have been a contributing factor towards the performance of children with high

scores on the behaviour rating scale. However, efforts were made during the design of the assessments to make them as novel and stimulating as possible. The assessments at the start and end of reception were administered to children individually, enabling the teacher to interact with the child keeping them focused on the task in hand and take short breaks if necessary. The assessment in year 2 was split into sections, each one taking no longer than 25 minutes. The items in the mathematics section were each read out to the class/group with teachers checking that every child had attempted to answer a question before moving on to the next, which should have reduced the chance of children 'day dreaming' or being distracted and not answering. The developed ability section was split into short parts. The teacher once again interacted frequently with the class/group when administering the picture vocabulary assessment. Children were left to complete the non-verbal ability assessment independently within a strict time limit of exactly eight minutes, which might have caused problems for children with high scores on the behaviour rating scale. Those children with high scores on the Inattentive sub-scale might have become easily distracted from the task in hand after one or two minutes and not demonstrated their full potential. Children with high scores overall or high scores on the Hyperactive/Impulsive sub-scale may have answered the problems hastily, without proper consideration, in order to complete the task as quickly as possible in a manner similar to the observed behaviour of children with ADHD completing a Continuous Performance Test (Reid-Lyon and Krasnegor, 1996). This pattern of behaviour results in a high number of errors. The reading assessment was completed without any interaction with the teacher.

Children were required to independently complete as much as possible within the time allowed. The opportunity to become distracted or to 'switch off' from the task was greatest in the reading section. The methods of assessment could have further contributed to the Effect Sizes between children with high and zero scores on the behaviour rating scale.

Some of children with high scores on the behaviour rating scale might also have had difficulties with reading and mathematics that were not a consequence of their behaviour. In fact, their behaviour may have been a result of having problems with reading and mathematics rather than the cause. One argument in favour of the behaviour causing the problems with reading and mathematics lies in the timing of the behaviour assessment. This was carried out at the end of reception and was based on the observations made by teachers over a period of at least six months. The end of the reception year would be a very early stage for children to become disillusioned and frustrated as a result of their inability to grasp language and mathematical concepts. The Curriculum Guidance for the Early Years (QCA 2000) recommend a practical approach to teaching children in the foundation stage and attitude measures of children at the end of reception generally show that they are happy and contented. Tymms (1999) reported that the attitude of children in year 2 was generally positive.

Other pupils may have had ADHD with comorbid reading or mathematics difficulties. As discussed above, Purvis and Tannock (1997), August and Garfinkel, (1989), and Pennington et.al., (1993), found that the skills of

children with ADHD and comorbid reading difficulties differed from children with just ADHD. The language deficits of children with ADHD were a consequence of difficulties in self-monitoring and organisation, in contrast to children with ADHD and comorbid reading difficulties, who appeared to have poor understanding of the basic sub-systems of language, e.g. semantics and syntax. It is possible that the children highlighted on the scatterplots above (Graphs 63, 64 and 65) with very low vocabulary and lower that expected reading scores may have ADHD with a comorbid disorder. It was not possible using the data used in the present study to extract and analyse items assessing just the understanding of the basic sub-systems of language in order to be able to compare these groups.

To summarise:

- The reading and mathematics attainment of children with high scores on the behaviour rating scale was generally lower than children with zero scores.
- The progress made in reading and mathematics between the start and end of reception, and the end of reception and year 2, by children with high scores on the behaviour rating scale was generally lower than that made by children with zero scores.
- Attainment in reading and mathematics in relation to developed ability was generally lower than expected for children with high scores on the behaviour rating scale.
- The size of these differences was quantified in terms of Effect Sizes. The reading and mathematics attainment and value-added of children with high scores on the Combined or Predominantly Inattentive sub-scales of the behaviour rating scale were found to be educationally and statistically significantly lower than children with zero scores. There was a much smaller difference between the children with a high score on the Predominantly Hyperactive/Impulsive sub-scale and children with a zero behaviour score.
- The general trends of the lower attainment and progress of children with high scores on the behaviour rating scale were similar to previous studies on the attainment of children with ADHD.

Chapter 13

Results 4

Case Studies

Introduction

Although the analysis of the PIPS data from each cohort shows general trends, it is important to validate these findings. The reliability of the behaviour rating scale and PIPS assessments have been assessed and the results reported earlier (Chapter 9, - Reliability and validity of the measures). A further technique is to investigate the progress and behaviour of a few particular children in greater detail using data gathered from a range of different sources.

A small number of children from Group C were selected for more in-depth study. They attended schools in Newcastle Education Authority already using PIPS assessments who had expressed an interest in taking part in further research on children with ADHD. Parental consent for this part of the project was required which reduced the number of children available.

From the total number of pupils for whom parental permission to participate in the research was granted, individuals were selected on the basis of their scores from the behaviour rating scale. To gain as much information as possible, a range of pupils with different scores on on each sub-section of the behaviour rating scale were selected.

The 'Conners Continuous Performance Test' provided the opportunity to validate the scores from the behaviour rating scale. Comments from school staff and observations by the author made during the administration of the

Conners CPT were included where available. These comments and observations were considered alongside the other measures.

As well as validating the behaviour rating scale, the scores from PIPS assessments were related to behaviour. The analysis in Chapter 12, 'Results 3 - Achievement and Progress in Reading and Mathematics' demonstrated that many children with high scores on the behaviour rating scale had lower rates of attainment and made less progress in reading and mathematics than their peers. The analysis of the case studies in this chapter is intended to add more detail to the general findings and demonstrate that when more information about the child is available, unusual results can often be explained and the conclusion that the behaviour rating scale in unreliable is not necessarily true.

For each child selected as a case study, data from the following assessments had been collected:

PIPS Start of Reception Assessment.

PIPS End of Reception Assessment including the teacher behaviour rating scale completed by the reception teacher.

PIPS Year 2 Assessments.

Behaviour rating scale completed by year 2 teacher.

Conners Continuous Performance Test (CPT)

Comments from staff (sometimes not available)

Observations of behaviour and attitude towards the CPT by the author.

Details of each of these assessments can be found in Chapter 7 'Method'.

The results of the PIPS assessments have been expressed as T-scores (mean = 50, standard deviation = 10).

The behaviour scores were expressed as raw scores.

The CPT provides scores for a number of different variables. These are usually expressed as T-scores (mean = 50, standard deviation = 10) and percentiles. The age of the individual assessed is recorded and the mean score and standard deviation relate to a general population of the same age and gender. A description of each variable can be found in Appendix 5.

In order to simplify the interpretation of the test results, Conners (1995) converted some of the measures with reversed scales. He suggested that "high T-scores (i.e. 60 or above) ..... for percentiles, scores of 90 or above usually indicate attention problems". The more measures from the CPT indicating a problem, the stronger the evidence for concluding that an attention difficulty exists. Conners suggested that one high score should not be regarded as indicating an attention problem, 2 or more high scores should be regarded more seriously.

A total of eleven pupils were selected for the case studies. They attended three different schools:

Pupil	School	Behaviour rating scale total score at end of reception		
		B1	B2	B3
Jamie C	1	9	3	2
Dean C	1	5	1	0
Daniel F	1	1	1	0
Daniel M	1	7	0	1
Kim P	1	0	0	0
Sarah H	1	3	0	0
Andrew C	2	6	2	0
Tony Y	2	0	1	1
Steven W	2	0	2	3
Michael B	3	6	4	2
Aidan A	3	0	0	0

(B1, B2 and B3 refer to the sub-sections of the behaviour rating scale and relate to Inattention, Hyperactivity and Impulsivity respectively.)

Table 63 below summarises the average year 2 PIPS standardised scores and the residuals of each school:

Table 63 Mean Year 2 PIPS scores for case study schools

School	Reading	Maths	Context	Reading residual	Maths residual
1	51.35	54.25	50.83	0.38	3.25
2	47.36	48.77	47.37	-0.77	0.82
3	53.37	59.73	51.01	1.94	8.20

The mean residual scores are not standardized and were calculated using the context scores as the independent variable.

The context scores of pupils in the case study schools was derived from a combination of the picture vocabulary and non-verbal ability sections along with a measure of the child's home background. This was intended to provide

a measure of the child's ability from which their expected reading and maths scores could be predicted. The residual value was the difference between the expected reading and maths scores and the actual ones. A positive residual means that a child is performing better than would be expected given their context. A negative residual means that a child is not performing as well as expected given their context.

Attitudes towards reading, maths and school life in general were also assessed in year 2. Each attitude measure was the mean score of several items (5 for maths, 4 for reading and 7 for school). Each item was scored on a 3-point scale. If in general, a child responded positively to the statements in the assessment, he or she would score 3, a generally neutral response would score 2, and a generally negative response would score 1. Tymms (1999) reported that children aged 7 tend to have a positive attitude towards reading, maths and school.

Table 64 below summarises the average year 2 PIPS attitude scores of each school:

Table 64 Mean Year 2 PIPS attitude scores for case study schools

School	Attitude to Maths	Attitude to Reading	Attitude to school
1	2.10	2.05	2.04
2	2.49	2.34	2.48
3	2.53	2.47	2.35

School 1

Jamie C

Table 65 Jamie C Standardised scores for PIPS assessments

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	36	33	N/A	N/A	N/A
End of Reception	36	28	N/A	N/A	N/A
Year 2	20	34	35	29	33

Table 66 Jamie C Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	-4.56	-12.65
End of reception standardised score	Year 2 standardised score	-21.19	-3.75
Standardised context score	Year 2 standardised score	-17.25	-2.70

Jamie's year 2 attitude scores are reported below:

	Attitude
Reading	3
Maths	3
School	3

Table 67 Scores for Jamie C assigned by class teachers on the behaviour rating scale at the end of reception and Year 2:

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	9	3	2	14
Year 2	9	1	0	10

The Conners CPT

Jamie talked throughout the CPT assessment. He didn't appear to be interested in the program or at looking at the computer screen and had to be frequently prompted to look at the screen otherwise I think he would have ignored it completely.

Table 68 CPT scores for Jamie C

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	238 (73.5%)		97.08	Markedly atypical
Omissions	86 (26.5%)		97.08	Markedly atypical
Commissions	18 (50.0%)	39.69	17.63	Good performance
Hit RT	740.09	17.82	1.00	Atypically slow
Hit RT Std. Error	33.80	82.04	99.00	Markedly atypical
Variability of Std. Errors	39.68	56.19	73.17	Within average range
Attentiveness (d')	0.61	55.90	75.49	Within average range
Risk taking (β)	0.83	73.35	98.95	Markedly atypical
Hit RT block change	0.00	44.44	28.92	Within average range
Hit SE block change	-0.02	37.02	9.71	Within average range
Hit RT ISI change	0.21	83.56	99.00	Markedly atypical
Hit SE ISI change	0.19	54.43	67.10	Within average range
Overall Index	15.11			Markedly atypical

Several of the results from the CPT indicated that Jamie had attention problems. The mean hit reaction time was extremely slow (the T-score showed it to be more than 3 standard deviations below the mean). Jamie also often failed to respond to the letters, demonstrated by the unusually high number of omission errors. However, the perceptual sensitivity score (d') was within average range, confirming that he did not experience any problems discriminating between target and non target letters. The hit reaction time standard error was high (over 3 standard deviations above the mean) which was a sign of fluctuating attention. The high β score was a further indication that Jamie did not pay attention to the task.

If an individual achieves T-scores of 60 or higher (a percentile of 90 or higher) on two or more of the measures, Conners suggested they are likely to have an attention problem. Jamie achieved high scores on 5 of the measures and his overall index was 15.11. This suggested that he did indeed have problems with attention. The scores from the behaviour rating scale indicated similar problems. He achieved high scores on the criteria relating to inattention at the end of reception and in year 2. At the end of reception he

also met 5 of the criteria relating to hyperactivity and impulsivity, although by year 2 these criteria were no longer met. On both occasions he met sufficient criteria in the classroom to be considered as having the Predominantly Inattentive sub-type of ADHD.

The results from three different assessments over time (behaviour rating scale at the end of reception and year 2, and the CPT in year 2) have consistently shown that Jamie had attention problems. What impact may these problems have had on his progress in reading and maths? At the start of reception, his standardised reading and maths scores were well below average. He was in the bottom 16% of the population. At the end of reception his standardised reading score had not changed. He appears to have made the expected amount of progress, but, because of the effect of 'regression to the mean', the residual score for reading between the start and end of reception was in fact negative[1].

[1] If the correlation at the start of reception standardised reading score and the end of reception standardised reading score was exactly 1, Jamie C would achieve the same standardised score at the start and end of reception and the residual would be zero. The correlation between the scores achieved on two assessments taken at different time points is commonly less than one. As this correlation decreases, so the regression to the mean increases. Regression to the mean has a larger effect on extreme (low or high) scores in a normal distribution than on average scores in the centre of the distribution. Therefore, the residual scores for reading and maths seem more negative than expected for Jamie C because his reading and maths standardised scores were very low.

Jamie's progress in maths between the start and end of reception was less than expected. An initial inspection of the standardised scores demonstrates this. At the end of reception his maths score was more than 2 standard deviations below the mean. The negative residual is again larger than the simple difference between the two scores because of the effect of regression to the mean.

By his second term in year 2, Jamie appeared to be making slightly more progress than expected in maths (although still resulting in a negative residual) but he had significantly fallen behind in reading. The context score demonstrated that his developed ability was very low and considering this he was achieving a slightly lower score than expected in maths, but was failing to make progress in reading. It is interesting to compare the residual scores derived from using the context score as the independent variable with residual scores derived from using prior achievement as the independent variable. The context provides a concurrent measure of value-added. It is an indicator of Jamie's reading and maths achievement compared to children of the same ability whereas the prior achievement provides an indicator of his rate of progress over time. The difference between these two variables is low for maths in year 2 but there is a larger difference between the reading residual scores in year 2. Part of this difference will be attributed to the reliability of the assessments and the correlation between the dependent and independent variables. But it would also appear that even when the context is accounted for, Jamie still made less progress than expected in reading between the end of reception and year 2.

In spite of his attention problems and underachievement, Jamie had a very positive attitude towards maths, reading and school.

The low reading and maths scores obtained by Jamie reflect the general findings of the research described earlier (Chapter 5 'ADHD from an Educational Perspective') that children with ADHD generally experience problems in reading and maths even when IQ is controlled for. Lahey *et al.* (1994), and Gaub and Carlson (1997) noted that children with the Predominantly Inattentive sub-type of ADHD achieve significantly lower scores in academic subjects than those children with the Combined or Predominantly Hyperactive/Impulsive sub-types. Nussbaum (1990) found that children with ADHD were less likely to fall behind their peers in vocabulary than reading comprehension. More recently Barkley (1997) attributed the reading difficulties experienced by children with ADHD to impaired executive functions, in particular, the process of internalising speech and relating it to past and future events which is necessary in order to be able to process passages of text.

Jamie achieved a much higher score (35) in the Year 2 vocabulary assessment than the Year 2 reading assessment (20), which was in agreement with the theories and previous studies summarized above. The year 2 reading assessment included a variety of tasks, most requiring the pupil to read, understand and recall, or use facts from passages of text.

The Year 2 mathematics assessment was administered in a different way to the reading. Rather than each pupil being left alone to complete as much of the assessment as possible, all the questions were read aloud twice and the teacher was required to ensure that the whole class had finished one question before moving on to the next. This method of administration may have been beneficial to Jamie. The teacher reading each question aloud eliminated one level of processing. Also, the brisk pace and constant monitoring by the teacher may have helped to keep Jamie's mind focused on the task. Children with ADHD also find mental arithmetic tests difficult because they rely heavily on the executive function of working memory. The year 2 mathematics assessment included many items which measured the pupil's understanding on mathematical concepts and also allowed answers using pencil and paper if desired.

All of the measures collected to date indicated that Jamie had ADHD (Predominantly Inattentive sub-type) although it should be remembered that the DSM-IV requires that an individual meets the diagnostic criteria in more than one situation and a description of Jamie's behaviour at home would have been very interesting although this was not available.

Dean C

Comments from the head teacher:

When Dean was in year 2, the head teacher described him as an anxious child. His mother always wished to be present at any medical examinations such as eye tests where most other children were not accompanied.

Table 69 Dean C Standardised scores for PIPS assessments

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	43	49	N/A	N/A	N/A
End of Reception	46	53	N/A	N/A	N/A
Year 2	48	49	53	43	50

Table 70 Dean C Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	0.51	1.72
End of reception standardised score	Year 2 standardised score	0.42	-2.83
Standardised context score	Year 2 standardised score	-2.36	-1.68

	Attitude
Reading	3
Maths	3
School	3

Table 71 Scores for Dean C assigned by class teachers on the behaviour rating scale at the end of reception and year 2

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	5	1	0	6
Year 2	1	0	0	1

The Conners CPT

Dean sat very still on the edge of his chair. He didn't take his eyes off the screen or talk.

Table 72 CPT scores for Dean C

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	319 (98.5%)		3.78	Good performance
Omissions	5 (1.5%)		3.78	Good performance
Commissions	25 (69.4%)	50.44	51.75	Within average range
Hit RT	499.38	44.04	27.58	Within average range
Hit RT Std. Error	10.22	41.07	18.61	Within average range
Variability of Std. Errors	14.45	38.12	11.75	Good performance
Attentiveness (d')	1.56	42.36	22.29	Within average range
Risk taking (β)	0.14	36.41	8.73	Mildly atypical
Hit RT block change	0.04	56.70	77.90	Within average range
Hit SE block change	0.03	42.59	26.12	Within average range
Hit RT ISI change	0.09	58.62	83.16	Within average range
Hit SE ISI change	0.08	48.28	43.16	Within average range
Overall Index	0.00			

None of the CPT measures indicated that Dean had attention problems. Most of the variables were within the average range of a comparison population of the same age and gender, and the overall index was zero. At the end of reception he met 5 of the criteria on the behaviour rating scale relating to inattention. Although quite high, this would not have been sufficient to qualify as a diagnosis of ADHD (Predominantly Inattentive sub-type). The year 2 teacher thought Dean met only one of the criteria relating to inattention. The CPT scores bear out the year 2 teacher's opinion.

Dean's maths and reading scores were generally slightly below average. His reading scores increased steadily across time, whilst his maths scores increased at the end of reception and then dropped a little again in year 2. The residual scores confirmed that Dean made the expected amount of progress in the reception class. He made slightly less progress than expected between the end of reception and year 2 in maths and given his overall

context score, his reading and maths scores were slightly less than would have been expected although not to a significant extent.

Scores and comments relating to Dean's behaviour pointed towards a child who was generally anxious to do well at school. His attitude scores showed that he enjoyed school. Although his reception teacher thought he appeared to be inattentive, his progress in reading and maths was steady. Perhaps his quiet, anxious manner was mistaken as inattention if he was reluctant to interact with teachers and other pupils when he first started school.

Daniel F

In Year 2, the head teacher described Daniel as being a bright child who knew lots of numbers when he was assessed at the start of reception. Before starting school, he had frequently traveled on buses and had apparently been interested in the bus numbers. His brother died whilst he was in year 1 and since then he seemed to have had intermittent problems with his concentration. The staff hoped that this would pass.

Table 73 Daniel F Standardised scores for PIPS assessments:

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	58	68	N/A	N/A	N/A
End of Reception	61	62	N/A	N/A	N/A
Year 2	52	59	43	65	51

Table 74 Daniel F Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	3.2	0.14
End of reception standardised score	Year 2 standardised score	-5.9	0.91
Standardised context score	Year 2 standardised score	0.2	6.53

	Attitude
Reading	3
Maths	3
School	3

Table 75 Scores assigned to Daniel F by class teachers on the behaviour rating scale at the end of reception and Year 2.

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	1	1	0	2
Year 2	0	0	1	1

The Conners CPT

Daniel seemed to lose concentration on the program sometimes.

Table 76 CPT scores for Daniel F

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	270 (83.3%)		92.83	Markedly atypical
Omissions	54 (16.7%)		92.83	Markedly atypical
Commissions	23 (63.9%)	47.37	39.63	Within average range
Hit RT	458.02	49.81	53.21	Within average range
Hit RT Std. Error	13.04	49.42	47.69	Within average range
Variability of Std. Errors	35.38	54.14	66.03	Within average range
Attentiveness (d')	0.60	56.16	73.09	Within average range
Risk taking (β)	0.68	65.44	93.85	Markedly atypical
Hit RT block change	0.03	52.62	64.10	Within average range
Hit SE block change	0.00	39.02	13.61	Within average range
Hit RT ISI change	0.03	46.40	35.95	Within average range
Hit SE ISI change	0.23	56.91	78.53	Within average range
Overall Index	4.44			

Three of the CPT scores were markedly atypical compared with others of the same age. A high number of omission errors was an indicator of inattention. The risk taking value was higher than average showing that Daniel sometimes appeared to choose not to respond to targets. This may have been due to lapses in concentration which would back up the Head Teacher's comments and his behaviour during the assessment. Alternatively, given that the commission errors were within average range, the high β value may have been a result of his concern about pressing the key in response to an 'X' by mistake. The overall index was not high enough to indicate serious attention problems, although the three atypical results confirm the pattern of behaviour described by the Head Teacher.

Daniel made more progress than expected in reading during the reception year, although his score had dropped significantly by year 2 (by almost one standard deviation between the end of reception and year 2). When the residual was derived from using the context score as the predictor, Daniel was

actually achieving the expected level in reading given his ability. Daniel's start of reception maths score was well above average. It had dropped by the end of reception and further still by year 2 although the residual scores indicated that he was progressing as expected in maths and given his ability his level of achievement was higher than expected. The high start of reception maths score means that the residual maths score for the start to end of reception will have been effected by regression to the mean. Therefore although the maths score fell between the start and end of reception, the residual was still not negative. Daniel's interest in numbers before he started school (reported by the Head Teacher) may have artificially inflated his maths score at the start of reception. Although he was able to identify lots of digits, he may not have understood their value, reflected in later scores.

The picture vocabulary score was below average but the non-verbal ability score was very high. When these scores were combined to produce the context score, given his ability, Daniel was doing as well as expected in reading and better than expected in maths in year 2.

In conclusion, Daniel's slight problems with concentration and attention and fluctuating maths and reading scores are most likely due to his home circumstances and of a temporary rather than a chronic nature.

Daniel M

Table 77 Daniel M Standardised scores for PIPS assessments:

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	56	53	N/A	N/A	N/A
End of Reception	53	53	N/A	N/A	N/A
Year 2	55	57	64	45	57

Table 78 Daniel M Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	-2.1	-0.12
End of reception standardised score	Year 2 standardised score	-2.57	4.83
Standardised context score	Year 2 standardised score	-1.25	0.08

	Attitude
Reading	3
Maths	3
School	3

Table 79 Scores assigned to Daniel M by class teachers on the behaviour rating scale at the end of reception and Year 2

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	7	0	1	8
Year 2	8	0	2	10

The Conners CPT

There were occasional lapses in concentration and Daniel started to make the occasional comment about 8 minutes into the assessment. Chatted a little more after 10 minutes.

Table 80 CPT scores for Daniel M

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	279 (86.1%)		91.26	Markedly atypical
Omissions	45 (13.9%)		91.26	Markedly atypical
Commissions	30 (83.3%)	58.11	79.13	Within average range
Hit RT	522.08	41.08	18.63	Within average range
Hit RT Std. Error	13.80	51.36	55.40	Within average range
Variability of Std. Errors	28.31	50.14	50.58	Within average range
Attentiveness (d')	0.13	62.88	91.73	Mildly atypical
Risk taking (β)	0.87	75.75	99.00	Markedly atypical
Hit RT block change	0.03	54.15	66.09	Within average range
Hit SE block change	0.14	52.97	65.42	Within average range
Hit RT ISI change	0.06	53.05	61.96	Within average range
Hit SE ISI change	0.02	44.97	34.35	Within average range
Overall Index	4.44			

The results of the CPT showed that the T-scores (or percentiles) of four of the variables were more than 1 standard deviation from the mean. The high number of omissions indicated inattentiveness. I noted that Daniel began to chat more frequently as the program progressed which confirmed this decline in attention, however when Daniel chose to respond to items, the response time itself was consistent. In more severe cases of inattention, the response time varies. The high score for attentiveness suggested that Daniel had perceptual problems. It could also be taken as an indicator of inattention if he wasn't concentrating on the screen fully, but simply pressing the key each time he noted a letter, or he may be impulsive or hyperactive and unable to prevent himself from responding to all letters. If this had been a consequence of an impulsive or hyperactive nature, Daniel would have obtained high scores in some of the other sections which indicate these traits such as the number of commission errors, hit RT and risk taking. This was in fact the case.

Daniel obtained a fairly high number of commission errors and a very high risk taking score. The interpretation of the CPT scores complement the teacher scores which indicated serious problems of inattention and also of impulsiveness.

Given the problems of inattention and impulsiveness found by Daniel's class teachers and the CPT, it might be expected that he was failing in reading and maths. The PIPS assessment results were slightly higher than average and did not decrease over time. Four out of six of the residual scores were slightly although not significantly negative. Daniel had a good vocabulary (almost one and a half standard deviations above the mean); however his non- verbal ability was poor. Given Daniel's general ability, he was performing almost as well as can be expected in reading and maths – a credit to his teachers whose accurate assessment of his behaviour suggested that they were obviously aware of his problems. However, his poor non-verbal ability score could perhaps have been a result of his attention problems. It has been noted earlier that children with ADHD experience fewer problems with vocabulary than other tasks because it does not appear to require a high level of sustained attention (Nussbaum, 1990). Perhaps the non-verbal ability section was exactly the type of task that Daniel found difficult to concentrate on for an extended period of time and as such did not give a true indication of Daniel's non-verbal ability. If this had matched his vocabulary score, then he would have been under-achieving in maths and reading.

In conclusion, several independent measures indicated that Daniel had problems with attention and was impulsive (to a lesser extent but still more severe than other children). He met sufficient criteria within the classroom environment to qualify for a diagnosis of ADHD (Predominantly Inattentive sub-type), although obviously information about his behaviour at home would be necessary before a proper diagnosis could be given. In spite of his behaviour problems, Daniel was making steady progress in reading and maths. This raises the interesting question of exactly how Daniel and his teachers worked together to make sure he succeeded at school.

Kim P

Table 81 Kim P Standardised scores for PIPS assessments:

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	54	54	N/A	N/A	N/A
End of Reception	52	54	N/A	N/A	N/A
Year 2	59	62	69	50	60

Table 82 Kim P Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	-1.02	-1.83
End of reception standardised score	Year 2 standardised score	7.22	8.58
Standardised context score	Year 2 standardised score	0.10	2.96

	Attitude
Reading	3
Maths	3
School	3

Table 83 Scores assigned to Kim P by class teachers on the behaviour rating scale at the end of reception and Year 2.

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	0	0	0	0
Year 2	0	0	0	0

The Conners CPT

Kim looked at the screen throughout. She didn't talk and appeared to be concentrating hard.

Table 84 CPT scores for Kim P

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	297 (97.1%)		83.27	Within average range
Omissions	27 (8.3%)		83.27	Within average range
Commissions	15 (41.7%)	37.23	10.11	Good performance
Hit RT	566.33	38.49	12.51	Quite slow
Hit RT Std. Error	9.56	47.22	39.04	Within average range
Variability of Std. Errors	17.63	49.88	53.50	Within average range
Attentiveness (d')	1.61	47.74	45.01	Within average range
Risk taking (β)	0.38	50.88	57.46	Within average range
Hit RT block change	0.03	58.28	79.58	Within average range
Hit SE block change	-0.07	35.92	9.55	Within average range
Hit RT ISI change	-0.02	38.56	14.87	Within average range
Hit SE ISI change	-0.023	31.54	4.06	Within average range
Overall Index	0.00			

Neither the teacher ratings or the results of the CPT suggested that Kim had any problems with attention, hyperactivity or impulsiveness. Her reaction time on the CPT was quite slow. She also made very few commission errors. The combination of these scores suggested that Kim was taking her time and being careful.

Her maths and reading scores were above average and she made much more progress than expected between the end of reception and year 2. Given her context score, she was performing slightly better than expected in both subjects in year 2. The pattern of results indicated that when she started school her baseline score did not reflect her true ability. She was a bright child with higher than average ability. Her experiences before starting school may have been limited, resulting in a lower than expected baseline score.

In conclusion, the results of the CPT confirmed the teacher's ratings. Kim did not have any behavioural problems and appeared to be making good progress.

Sarah H

Table 85 Sarah H Standardised scores for PIPS assessments

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	42	50	N/A	N/A	N/A
End of Reception	44	44	N/A	N/A	N/A
Year 2	56	52	43	48	45

Table 86 Sarah H Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	1.79	-5.35
End of reception standardised score	Year 2 standardised score	10.14	4.93
Standardised context score	Year 2 standardised score	9.52	4.98

	Attitude
Reading	3
Maths	3
School	3

Table 87 Scores assigned to Sarah H by class teachers on the behaviour rating scale at the end of reception and year 2

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	3	0	0	3
Year 2	0	0	0	0

The Conners CPT

Sarah looked at the screen throughout. She didn't talk and appeared to be concentrating hard.

Table 88 CPT scores for Sarah H

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	299 (92.3%)		81.33	Within average range
Omissions	25 (7.7%)		81.33	Within average range
Commissions	9 (25.0%)	27.98	1.78	Good performance
Hit RT	572.56	37.71	12.96	Quite slow
Hit RT Std. Error	12.33	53.05	61.98	Within average range
Variability of Std. Errors	20.15	52.01	57.95	Within average range
Attentiveness (d')	2.08	41.35	19.39	Within average range
Risk taking (β)	0.47	53.28	62.86	Within average range
Hit RT block change	0.01	54.14	66.05	Within average range
Hit SE block change	0.12	53.88	68.70	Within average range
Hit RT ISI change	0.06	53.08	62.08	Within average range
Hit SE ISI change	-0.11	38.34	12.21	Within average range
Overall Index	0.00			

The results of the CPT did not suggest that Sarah had any attention, hyperactivity or impulsivity problems. At the end of reception she did meet three criteria relating to inattention but the scores of the year 2 teacher matched those of the CPT. Sarah seemed keen to take her time with the CPT and minimise errors.

Her reading scores increased steadily reflected by the residual scores from below average at the start of reception, to above average by year 2. Her maths score dropped at the end of reception but had improved again by year 2. Given her context score, she was performing much better than expected in both maths and reading.

Overall, Sarah did not seem to have any serious behaviour problems and apart from a drop in maths achievement between the start and end of reception she was making good progress in reading and maths.

School 2

Andrew C

The Head Teacher described Andrew as being inattentive in reception but was now settled in the classroom. When completing the behaviour rating scale, the year 2 teacher specified that Andrew was reluctant to engage in tasks that required sustained mental activity and fidgeted at a level which was more frequent and severe than other children in the class.

Table 89 Andrew C Standardised scores for PIPS assessments:

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	57	51	N/A	N/A	N/A
End of Reception	54	58	N/A	N/A	N/A
Year 2	49	46	62	50	57

Table 90 Andrew C Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	-2.45	6.31
End of reception standardised score	Year 2 standardised score	-3.61	-9.41
Standardised context score	Year 2 standardised score	-7.09	-11.12

	Attitude
Reading	3
Maths	2
School	2

Table 91 Scores assigned to Andrew C by class teachers on the behaviour rating scale at the end of reception and year 2

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	6	2	0	8
Year 2	1	1	0	2

The Conners CPT

Andrew chatted frequently throughout the program.

Table 92 CPT scores for Andrew C

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	301 (92.9%)		70.80	Within average range
Omissions	23 (7.1%)		70.80	Within average range
Commissions	30 (83.3%)	58.11	79.13	Within average range
Hit RT	354.17	66.95	96.37	Atypically fast
Hit RT Std. Error	11.39	44.79	33.69	Within average range
Variability of Std. Errors	22.42	45.97	38.10	Within average range
Attentiveness (d')	0.52	57.21	76.42	Within average range
Risk taking (β)	0.53	57.09	76.06	Within average range
Hit RT block change	0.02	49.35	47.42	Within average range
Hit SE block change	0.06	45.28	31.85	Within average range
Hit RT ISI change	0.12	64.4	92.47	Atypical
Hit SE ISI change	0.16	52.87	65.04	Within average range
Overall Index	9.39			

Andrew met sufficient criteria on the behaviour rating scale at the end of reception to be diagnosed as having ADHD (Predominantly Inattentive sub-type) and also met two criteria relating to hyperactivity.

By year 2, the Head Teacher thought he had settled down considerably and his year 2 teacher considered that he only met 2 of the criteria on the teacher rating scale (1 relating to inattention and the other to hyperactivity). Only two of the variables on the CPT were outside the normal range, again, one indicated inattention (Hit RT ISI change - Andrew's reaction time varied as the time between targets varied), the other impulsivity or hyperactivity (a fast reaction time). The overall index from the CPT was borderline. At the end of reception Andrew was considered to be extremely inattentive and to a lesser degree, hyperactive, whilst in year 2, three independent sources indicated that he still had mild problems but had improved considerably.

If Andrew's reading and maths scores are compared to his behaviour, a steady increase would be expected between the start of reception and year 2

as his behavioural problems decreased. There was no evidence of this trend. Instead, his reading declined steadily and his maths increased at the end of reception but dropped again by year 2. Given his context score, he was performing very much worse than expected by year 2, especially in maths.

Interestingly, whilst Andrew enjoyed all aspects of reading, his attitude towards maths and school were neutral. Children in Year 2 usually have very positive attitudes. The year 2 teacher specified that Andrew was reluctant to engage in tasks that required sustained mental activity. Perhaps this was due to Andrew's attitude rather than impaired executive functions. If he tended to be a little bit lazy and lacked motivation, this would have influenced his progress in reading and maths. The high scores on the behaviour rating scale at the end of reception may have reflected a boy who was bored and not motivated rather than a boy with ADHD.

Tony Y

The year 2 teacher specified that Tony was easily distracted, ran about or climbed in situations where it was inappropriate to do so and answered questions before they had been completed at a level which was more frequent and severe than other children in the class.

Table 93 Tony Y Standardised scores for PIPS assessments:

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	59	67	N/A	N/A	N/A
End of Reception	59	60	N/A	N/A	N/A
Year 2	69	60	62	62	59

Table 94 Tony Y Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	1.05	-0.25
End of reception standardised score	Year 2 standardised score	12.25	3.20
Standardised context score	Year 2 standardised score	10.73	1.31

	Attitude
Reading	2
Maths	3
School	3

Table 95 Scores assigned to Tony Y by class teachers on the behaviour rating scale at the end of reception and year 2

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	0	1	1	2
Year 2	1	1	1	3

Conners CPT

Tony didn't talk and appeared to concentrate on the program.

Table 96 CPT scores for Tony Y

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	319 (98.5%)		3.78	Good performance
Omissions	5 (1.5%)		3.78	Good performance
Commissions	27 (75.0%)	53.11	67.38	Within average range
Hit RT	370.36	63.99	93.28	Very fast
Hit RT Std. Error	6.48	25.47	1.00	Very good performance
Variability of Std. Errors	5.86	21.98	1.00	Very good performance
Attentiveness (d')	1.38	44.93	34.20	Within average range
Risk taking (β)	0.15	37.22	10.09	Mildly atypical
Hit RT block change	0.01	44.85	33.93	Within average range
Hit SE block change	0.06	45.41	32.34	Within average range
Hit RT ISI change	0.01	41.58	22.94	Within average range
Hit SE ISI change	-0.05	41.35	19.37	Within average range
Overall Index	0.00			

Tony performed very well on the CPT. His reaction time was very fast, he made very few errors and his response times were very consistent which indicated that he was able to process information very quickly and efficiently. His fast reaction time and slightly elevated β score might be a result of an impulsive nature. On the behaviour rating scale he met 2 criteria relating to hyperactivity and impulsivity at the end of reception and 1 criteria in each group in year 2. His year 2 teacher found that he was physically active, easily distracted and often answered questions before they had been completed. These are traits which characterise an individual who is impulsive and hyperactive although in Tony's case they were obviously not severe enough to cause problems. Indeed, the CPT scores show that they were beneficial to his performance. He was alert and attentive.

Tony's reading score was almost one standard deviation above average when he started school and increased by one standard deviation between reception and year 2. His maths score dropped between reception and year 2 although it still remained one standard deviation above average. His vocabulary and

non-verbal ability scores indicated that he was a bright child and given this ability he was still achieving higher than expected scores in reading and maths.

Overall, Tony's behaviour seemed to reflect a child who is enthusiastic and energetic. He appeared to channel his energy in a positive way towards his school work and his behaviour was an asset rather than a problem.

Steven W

The year 2 teacher specified that Steven did not appear to listen when spoken to directly, left his seat in situations where sitting was expected and had difficulty awaiting his turn at a level which was more frequent and severe than other children in the class.

Table 97 Steven W Standardised scores for PIPS assessments:

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	48	50	N/A	N/A	N/A
End of Reception	54	55	N/A	N/A	N/A
Year 2	63	67	64	64	63

Table 98 Steven W Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	4.44	3.60
End of reception standardised score	Year 2 standardised score	10.15	13.85
Standardised context score	Year 2 standardised score	2.01	5.18

	Attitude
Reading	3
Maths	1
School	1

Table 99 Scores assigned to Steven W by class teachers on the behaviour rating scale at the end of reception and year 2

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	0	2	3	5
Year 2	1	1	1	3

Conners CPT

Steven looked at the computer screen throughout the CPT assessment.

Table 100 CPT scores for Steven W

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	321 (99.1%)		2.99	Good performance
Omissions	3 (0.9%)		2.99	Good performance
Commissions	27 (75.0%)	53.51	67.38	Within average range
Hit RT	406.26	57.80	81.03	Within average range
Hit RT Std. Error	7.71	31.42	3.17	Good performance
Variability of Std. Errors	10.76	32.84	5.31	Good performance
Attentiveness (d')	1.65	41.03	18.50	Within average range
Risk taking (β)	0.08	33.19	4.65	Markedly atypical
Hit RT block change	-0.01	38.39	12.32	Within average range
Hit SE block change	-0.03	35.68	9.18	Within average range
Hit RT ISI change	0.09	58.05	78.95	Within average range
Hit SE ISI change	-0.04	41.84	23.72	Within average range
Overall Index	0.00			

Several of Steven's CPT results were very good in relation to the comparison population. His response time was fast and he made very few omissions. His commission errors were within average range indicating that although he was fast, he was also accurate. The 'risk taking' score was very low which is an indication that Steven may have been impulsive, however, this did not seem to have any detrimental effect on his performance.

At the end of reception, Steven met 5 criteria relating to hyperactivity and impulsivity on the behaviour rating scale. He still met 2 of the criteria in Year 2, confirming the CPT scores.

Steven made good progress in maths and reading between the start of reception and year 2, and given his ability, he was achieving a higher level than would be expected. It is interesting to compare Steven's scores to the general trends found in the large data sets where children who meet a high number of criteria relating to hyperactivity and impulsivity make progress in

reading and maths at the same rate as those children who do not meet any of the criteria. It would seem that children with a hyperactive and impulsive nature do not significantly fall behind their peers. Steven's scores mirror this finding.

Although Steven was making good progress academically, he had a negative attitude towards maths and school. This attitude might be partly attributed to his hyperactive and impulsive nature. Steven's Year 2 teacher considered that he only met 2 criteria relating to hyperactivity and impulsivity and that in particular he did not appear to listen when spoken to directly, left his seat in situations where sitting was expected and had difficulty awaiting his turn. It is possible that she had been trying to address this behaviour (and judging by the reduced number of criteria that Steven met, she considered her interventions to be successful) but as a result, Steven was not enjoying school.

School 3

Michael B

Michael was described by his year 2 teacher as being inattentive. He was not disruptive in the classroom, spoke with a 'posh' accent rather than a local one and his parents were thought to be 'sensible'.

His teacher had noticed a problem with his attention but had not been able to successfully help him to overcome it. He had been prescribed Ritalin in the past but was not taking it at the time he was assessed with the CPT.

Table 101 Michael B Standardised scores for PIPS assessments:

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	42	37	N/A	N/A	N/A
End of Reception	43	37	N/A	N/A	N/A
Year 2	52	52	51	46	49

Table 102 Michael B Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	-2.11	-6.65
End of reception standardised score	Year 2 standardised score	6.45	9.10
Standardised context score	Year 2 standardised score	2.11	1.60

	Attitude
Reading	3
Maths	3
School	3

Table 103 Scores assigned to Michael B by class teachers on the behaviour rating scale at the end of reception and year 2

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	6	4	2	12
Year 2	8	1	0	9

Conners CPT

During the CPT Michael paid virtually no attention to the task. He frequently sat and did absolutely nothing. He wasn't talking or looking at the computer screen. He didn't seem to be looking at anything. Then after one or two minutes he would continue with the CPT again.

Table 104 CPT scores for Michael B

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	193 (59.6%)		98.20	Markedly atypical
Omissions	131 (40.4%)		98.20	Markedly atypical
Commissions	18 (50.0%)	39.69	17.63	Good performance
Hit RT	593.12	32.57	5.05	Atypically slow
Hit RT Std. Error	41.19	88.81	99.00	Markedly atypical
Variability of Std. Errors	80.57	68.86	97.64	Markedly atypical
Attentiveness (d')	0.25	61.06	86.55	Mildly atypical
Risk taking (β)	0.97	80.72	99.00	Markedly atypical
Hit RT block change	-0.05	25.63	1.04	Within average range
Hit SE block change	-0.01	38.44	12.42	Within average range
Hit RT ISI change	0.28	99.16	99.00	Markedly atypical
Hit SE ISI change	0.34	62.91	91.77	Mildly atypical
Overall Index	15.11			

The scores which Michael achieved on eight of the CPT variables were outside the average range (T-scores greater than 50 or percentiles greater than 90) resulting in a high overall index. These scores strongly suggested problems with attention. Looking at the variables in more detail, Michael's mean reaction time was very slow and inconsistent and as the time between the letters increased, Michael's responses became slower and more inconsistent. When response times and consistence were considered alongside the high number of omissions it was clear that he was not paying attention to the program. Michael also made a very small number of commission errors. If this had been accompanied by a fast reaction time it would have indicated fast, accurate processing. However, the combination of the low number of commission errors, high number of omissions and variable reaction time suggested it was more likely to be a consequence of not looking

at the screen and missing the 'X' through inattention rather than intentionally. The low 'attentiveness' (d') score generally indicates poor perceptual sensitivity, but again it was more likely to be an outcome of not looking at the screen rather than poor discrimination between letters.

The results of the behaviour rating scale at both the end of reception and year 2 confirmed the CPT results. At the end of reception, Michael also met six criteria relating to hyperactivity and impulsivity. By year 2 these had been reduced, and likewise there was no evidence of this kind of behaviour on the CPT, denoted by the very high 'risk taking' score.

The PIPS context score showed that Michael was of average ability. Reading and maths scores were well below average at the start of reception. At the end of reception they had remained constant, although the negative residual scores meant that he was not achieving the expected level. By year 2, Michael had made significant progress and was doing better than expected. This is quite an achievement given his behaviour. The teacher commented that Michael had been prescribed Ritalin and gave the impression that he had a supportive home background. Perhaps Michael's improvement could be attributed to the co-ordinated effort and awareness of his parents and teachers along with medication. He also had a very positive attitude to reading, maths and school which could reflect a positive input from school and home. Without detailed classroom observation, it is not possible to speculate exactly how Michael's teachers and parents have helped him to raise his level of achievement and cope with his inattentive nature.

Aidan A

Table 105 Aidan A Standardised scores for PIPS assessments

	Reading	Maths	Picture vocab-ulary	Non-verbal ability	Context
Start of Reception	55	45	N/A	N/A	N/A
End of Reception	72	59	N/A	N/A	N/A
Year 2	63	67	54	71	60

Table 106 Aidan A Residual scores (Unstandardised)

Independent variable	Dependent variable	Reading residual	Maths residual
Start of reception standardised score	End of reception standardised score	16.88	9.97
End of reception standardised score	Year 2 standardised score	-2.07	11.57
Standardised context score	Year 2 standardised score	4.42	7.71

	Attitude
Reading	2
Maths	3
School	3

Table 107 Scores assigned to Aidan A by class teachers on the behaviour rating scale at the end of reception and year 2

	B1 Inattention Max.score 9	B2 Hyperactivity Max. score 6	B3 Impulsivity Max. score 3	Total Max score 18
End of Reception	0	0	0	0
Year 2	0	0	0	0

Conners CPT

Aidan looked at the screen throughout. He didn't talk and appeared to be concentrating hard.

Table 108 CPT scores for Aiden A

MEASURE	VALUE	T-SCORE	PERCENTILE	GUIDELINE
Hits	316 (97.5%)		4.97	Good performance
Omissions	8 (2.5%)		4.97	Good performance
Commissions	24 (66.7%)	48.90	49.62	Within average range
Hit RT	374.24	63.27	90.76	A little fast
Hit RT Std. Error	7.45	30.25	2.43	Good performance
Variability of Std. Errors	10.16	31.82	4.30	Good performance
Attentiveness (d')	1.61	41.56	22.88	Within average range
Risk taking (β)	0.14	36.22	8.44	Mildly atypical
Hit RT block change	0.03	54.05	65.71	Within average range
Hit SE block change	-0.03	35.96	9.61	Within average range
Hit RT ISI change	0.07	54.41	67.01	Within average range
Hit SE ISI change	-0.07	40.07	16.04	Within average range
Overall Index	0.00			

Two of Aidan's measures on the CPT were unusual; 'Hit RT' was fast (T-score = 63.27, percentile = 90.76) and 'Risk taking' was low (T-score = 36.22, percentile = 8.44). These results indicated that Aidan tended to have an impulsive nature. This was not perceived as a problem by his teachers.

At the start of reception, Aidan's maths was below average and his reading was just above average. The end of reception data indicated that he had made good progress in both subjects. He continued to make very good progress in maths up to year 2 but his progress in reading was not as good although his score was still more than 1 standard deviation above average. Given his context score, he was doing better than expected in both reading and maths in year 2. Being slightly impulsive may actually have been an advantage to Aidan if his eagerness and enthusiasm was channelled towards his school work. Aidan's performance in reading and maths followed the general pattern found in other results that children who were impulsive and hyperactive made as much progress as children with no behavioural problems.

It is interesting to note Aidan's attitude scores. His neutral attitude towards reading corresponded to his lower reading residual score. This relationship has been found with other children for example Steven W who was impulsive and like Aidan was making more progress at school than would have been expected given his context score. Steven had a negative attitude towards maths and although he was making good progress, his maths residual score was lower than his reading residual.

Discussion of Case Studies

One purpose of the case studies was to further validate the data collected from schools using the PIPS assessments and the behaviour rating scale. The large data sets of each cohort showed general trends and it was important to confirm that when individuals were investigated, their results either replicated these findings or could be explained by other factors. The Conners CPT provided objective information which should have corresponded to the information supplied by the behaviour rating scale if both were accurate instruments. The CPT scores also gave a detailed profile of the pupils' levels of attention, hyperactivity and impulsivity which could help to explain their everyday behaviour.

The behaviour of many children is likely to change between starting school and year 2 as they mature and settle into the classroom routine. Teachers will have been aware of the behaviour of each child, and have been addressing any problems and trying different strategies in their attempts to resolve them. This would hopefully have a positive effect on the pupils' progress. The analysis of case studies explored reasons why the behaviour of some children appeared to change over time (whether this was due to a difference in opinion between teachers, effective classroom practice or the child simply maturing), and why some children had made more progress than would have been expected given their behaviour at the end of reception. The case studies did not in any way attempt to diagnose any child with the condition of ADHD.

The average year 2 PIPS reading, maths and context scores indicated that the three schools from which the pupils for the case studies were selected were about average. The residual scores indicated that on the whole, children were progressing as expected. None of the classes were failing to progress significantly in either area (although it should be remembered that individuals within the class may have been). The year 2 class at School 3 were making excellent progress in maths compared to other schools. The average rate of progress of the class may well have had an effect on the progress of the individuals in the case studies. One example of this was Michael B in School 3 who was a pupil in a class who were progressing very well in maths. It was impossible to say *why* they were progressing so well from the PIPS data, but being part of this group was seemingly beneficial to Michael. If he had been placed in a different school, perhaps his progress would have been less impressive and more indicative of other children with similar attention difficulties.

In general, the CPT scores have confirmed the scores from the behaviour rating scale and the comments supplied by teachers. The attitude of some of the pupils has also helped in the interpretation of their behaviour, attainment and progress. Children with low residuals frequently had either neutral or negative attitudes towards subjects although this is not generally true.

All of the children who were inattentive had higher picture vocabulary scores than non-verbal ability scores. This trend was not found for the whole dataset but for the case study children it supports the findings of Nussbaum (1990) discussed earlier. The picture vocabulary assessment was not the type of

activity which is heavily reliant on executive functions. The non-verbal ability assessment required sustained effort over time requiring the child to remember and manipulate information. Tony Y and Steven W were both slightly impulsive. They both achieved equally high scores on both the picture vocabulary and non-verbal ability and positive residuals. Interestingly, they both had neutral or negative attitudes towards some aspects of school.

The information about each case study was reasonably consistent. There were very few instances where the scores from different assessments conflicted. When this did occur, explanations were usually discovered when the teacher's comments, the attitudes of the pupils and the dynamics of the class of which the child was a member, were considered.

To summarise:

These case studies added a further dimension to the reliability and validity measures reported in earlier chapters. When childrens' behaviour changed, or their achievement or progress was different to that expected, these uncharacteristic results were often explained when the extra information gathered in the case studies was considered. The case studies also demonstrated using information from a variety of sources is essential when making a diagnosis of ADHD and that once a diagnosis has been made, the usefulness of functional analysis in deciding the most appropriate course of action.

Chapter 14

Results 5

A Survey Of Teaching Methods Used With Children With High Scores On The Behaviour Rating Scale Compared To Children With Zero Scores, And Their Effectiveness

Introduction

The symptoms of ADHD can be treated in many ways. Research into the effectiveness of some of these strategies was discussed in Chapter 7, - The Treatment of ADHD. In treating the symptoms of ADHD, it is natural to assume that success in other areas such as academic achievement will be increased although this is not always true. Further research is required into exactly how effective various treatments, particularly classroom interventions, are at improving the academic achievement and progress of children with each subtype of ADHD. Some strategies may be more useful for children with the Combined and Predominantly Hyperactive/Impulsive subtypes than for children with the Predominantly Inattentive subtype and *vice versa*. The next consideration is whether or not the psychosocial strategies used for treating children with ADHD are also effective with children who have severe behavioural problems similar to those of ADHD in the classroom but have not been formally diagnosed with the disorder. Teachers intuitively use a range of teaching strategies to help all the pupils in their classes.

This chapter reports the results of a questionnaire sent to a sample of teachers to find out what kind of teaching and classroom management strategies are currently used in schools, and their perceived success with children who were assigned either high scores or zero scores on the behaviour rating scale administered at the end of the reception year. The definition of 'high scores' is the same as has been used in previous analyses of the present study. The data are discussed in relation to previously published research.

Teachers were also asked whether or not they were familiar with ADHD and Hyperkinetic disorder, and if they had attended any courses about ADHD. This information was intended to provide an insight into whether they were implementing strategies intuitively or because through training, they had learned that they were effective with children who were inattentive, hyperactive and/or impulsive.

Refer to Appendix 2 for a copy of the questionnaire used in this survey (Survey 1).

A sample of 432 pupils from Group C were selected for this part of the study on the basis of their scores from the behaviour rating scale administered at the end of reception. Class teachers were asked to complete the 'Survey 1' questionnaire during the pupils' second term 2 of year 1. The 432 pupils were from 138 different schools, therefore some teachers were asked to complete questionnaires for more than one of their pupils. In larger schools with two or three classes in the year group, more than one teacher returned completed questionnaires.

From the total of 432 questionnaires distributed, 192 were returned, completed by 81 teachers from 70 different schools.

Twenty eight of the returned questionnaires referred to children with zero scores of the behaviour rating scale, 89 referred to children with high scores

on the combined sub-scale, 43 questionnaires referred to children with high scores on the predominantly inattentive sub-scale, and 32 questionnaires referred to children with high scores on the predominantly hyperactive/impulsive sub-scale.

Results of Survey 1

The results from the first section, in which the teachers were asked if they had heard of ADHD or Hyperkinetic Disorder, and whether or not they had attended any courses about ADHD are reported in Table 109.

Table 109 Responses from Section 1 of Survey 1

	Yes	No
Had the teacher heard of ADHD?	85% (n=69)	15% (n=12)
Had the teacher heard of Hyperkinetic Disorder?	20% (n=16)	80% (n=65)
Had the teacher attended any courses on ADHD?	6% (n=5)	94% (n=76)

A large proportion of teachers who returned questionnaires had heard of ADHD. The term ADHD was far more widely recognised than Hyperkinetic Disorder, even though historically, the ICD-10 criteria for the diagnosis of Hyperkinetic Disorder were more widely used in Britain than the DSM criteria for the diagnosis of ADHD. Increasing media interest in ADHD and the controversy about the type of medication used to treat it might have been instrumental in raising the awareness of teachers to the disorder. Although many teachers had heard of ADHD, only 5 (6% of those surveyed) had attended a course about it. The strategies used by teachers to assist children with the disorder or similar behaviour problems were more likely to be a consequence of reading information or intuition and experience. Alternatively,

members of staff other than those surveyed, such as special needs coordinators, might have attended courses about ADHD and disseminated the advice to colleagues.

For questions 1 to 13 of the second section of the questionnaire relating to the use and perceived effectiveness of strategies to assist the concentration and attention of pupils, teachers were asked to consider the way they taught the child named on the questionnaire. They were asked whether or not they used each strategy and then if they did, to rate its effectiveness.

The responses were coded in the following way:

0 = strategy not used

1 = Strategy was ineffective in encouraging the child's concentration and attention

2 = Strategy was occasionally effective

3 = Strategy was effective about half the time

4 = Strategy was effective most of the time

5 = Strategy was effective every time

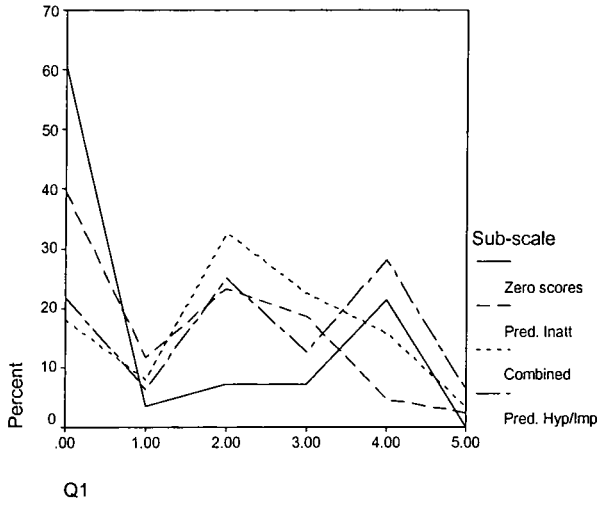
The number and percentage of scores for each item on the questionnaire are presented in Tables 110 to 113, which can be viewed in Appendix 6.

The data in are easier to interpret when they are presented together in graphs. The results from each question (1 to 13) are plotted. The mean

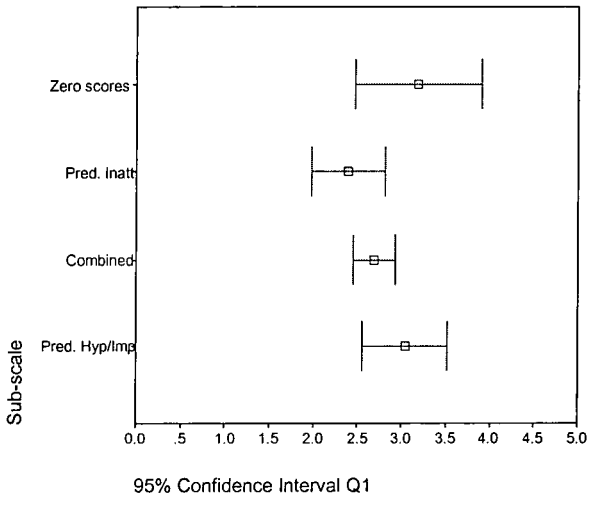
scores with 95% confidence intervals of each group of children are also plotted. The results of each strategy are discussed.

Question 1 Did you try moving the child to work in a place that was free from distraction (away from doors and windows)?

Graph 66 Question 1 on teaching strategies from Survey 1



Graph 67 Mean scores with 95% confidence intervals for Question 1 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used



Teachers reported that they did not employ this strategy with many of the children (60.7%) with zero scores on the behaviour rating scale (the 'Zero' group). This result is entirely expected. This group of children would be generally capable of working independently without being overly distracted by others entering and leaving the room, or by events outside, unless these were

unusual. In the few cases that this strategy was employed (n = 11), it was most commonly found to be effective between half and most of the time (mean = 3.2).

The teachers of children with high scores on the Combined and Predominantly Hyperactive/Impulsive sub-scales (the 'Combined' and 'Predominantly Hyperactive/Impulsive' groups) reported not using this strategy with approximately 20% of the children. It was far more widely used with these children than with the children in the Zero group. When the strategy was employed (in approximately 80% of cases), the mean score was 2.7 for the Combined group and 3.0 for the Hyperactive/Impulsive group, indicating that it was effective up to half of the time for many children in these groups. It was effective occasionally for some of the children in the Predominantly Hyperactive/Impulsive group, and effective most of the time for others. The behaviour of these children would naturally tempt teachers to move them away from potentially distracting situations. These children have met 6 of the 9 criteria relating to hyperactivity and impulsivity, indicating that they talk excessively, intrude on other people's activities, fidget and leave their seat when seating is expected. If seated near windows and open doors, these children would find it extremely difficult not to react to novel events outside the classroom. It is not surprising that this strategy was quite successful for some of these children, although used in isolation it was not sufficient to improve concentration and attention all the time. Within the classroom itself, there will often be further distracting situations generated by fellow pupils which will have more of an effect on the Combined and Predominantly

Hyperactive/Impulsive groups than the Zero group. The lower level of success of this strategy with the Combined may be due to the inattention element, which is discussed more fully below.

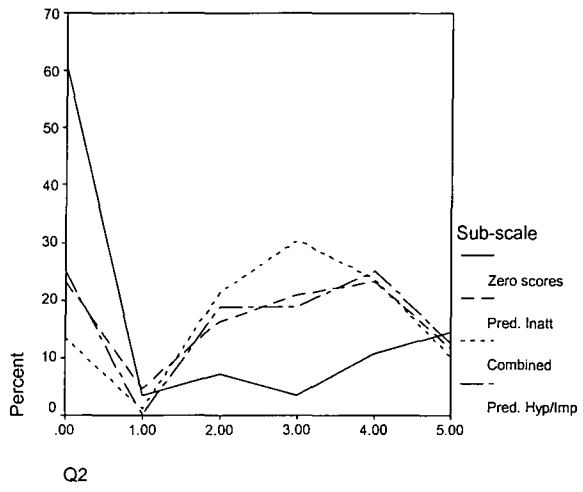
The teachers of children with high scores on the Predominantly Inattentive sub-scale (the 'Predominantly Inattentive' group) reported that they did not use this strategy with 40% of these pupils. When they did use the strategy, the mean score was 2.4.

Children in the Combined and Predominantly Inattentive groups have met at least 6 of the 9 criteria relating to inattention in the classroom (see Appendix 1 for the list of criteria). Moving these children away from the doors and windows might reduce some of the distractions by irrelevant stimuli (criterion H), although there are other factors to be considered. The behaviour described by the other 8 criteria is not directly addressed by the employment of this strategy. Barkley (1997) indicated that in order to improve the attention and concentration of children with ADHD, treatments should focus on providing assistance for the child's poor executive functions. Although changing the dynamics of the classroom environment are important in an indirect way, it is more important to assist the child by addressing their deficit in behavioural inhibition, working memory, internalised speech, self regulated motivation and reconstitution. For example, Barkley suggested that distracting stimuli should be replaced with information to prompt and assist. This strategy removed some of the potential sources of distraction, but did not

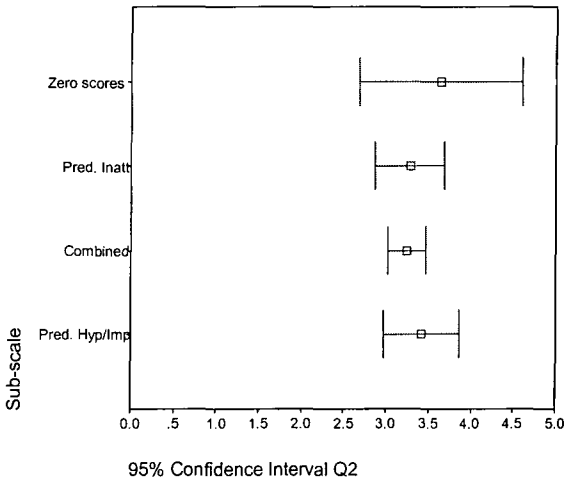
replace them with assistance in the form of frequent verbal instructions and motivation from the teacher.

Question 2 Did you try seating the child close to you?

Graph 68 Question 2 on teaching strategies from Survey 1



Graph 69 Mean scores with 95% confidence intervals for Question 2 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used

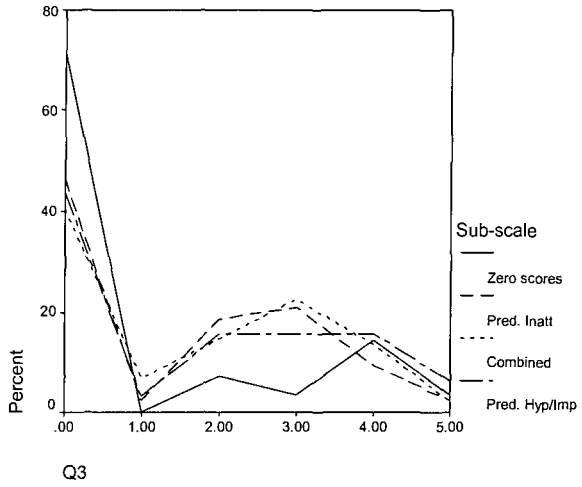


If Barkley's argument was correct, seating the child close to the teacher should be more effective in increasing the child's concentration and attention than simply seating them away from distractions such as the classroom door and windows. By doing this, it is assumed that the teacher will provide the pupil with feedback about their work and behaviour more frequently than if they were sat further away.

Once again, teachers reported that they did not use the strategy with 60% of the Zero group. The strategy was found to be effective to different extents for the other three groups. The mean scores were 3.2 for the Combined group, 3.4 for the Predominantly Hyperactive/Impulsive group and 3.3 for the Predominantly Inattentive group. As predicted, the results were an improvement over Question 1 for all groups.

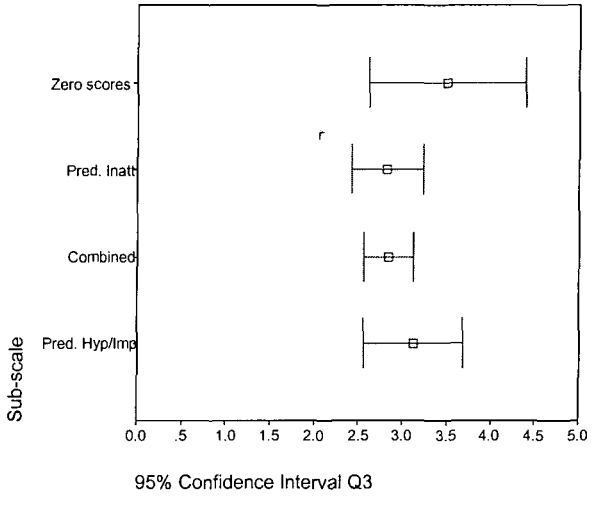
Question 3 Did you give the child an opportunity to work in a designated 'quiet area'?

Graph 70 Question 3 on teaching strategies from Survey 1



The graph demonstrates that many teachers did not use this strategy with approximately 70% of the Zero group, and approximately 45% of the other groups.

Graph 71 Mean scores with 95% confidence intervals for Question 3 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used

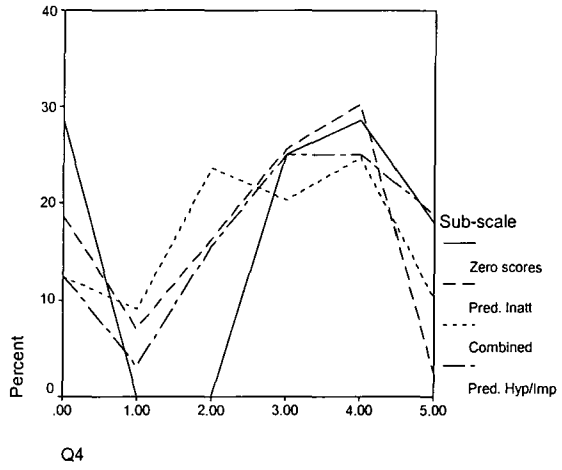


Of the children who were able to work in a designated 'quiet area', the mean scores for this strategy were 2.8 for the Combined group, 3.1 for the

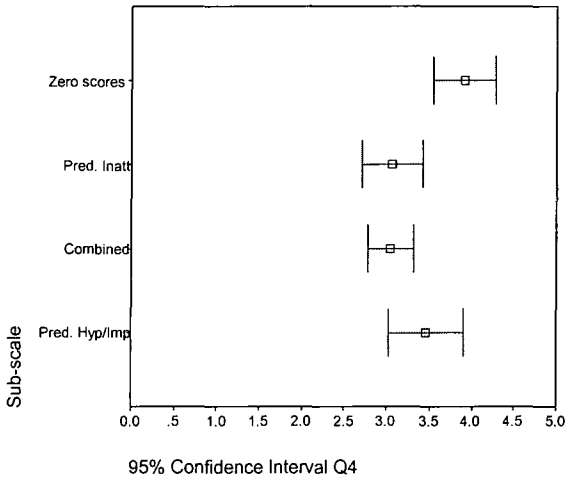
Predominantly Hyperactive/Impulsive group and 2.8 for the Predominantly Inattentive group. Although this strategy was recommended by Cooper and Ideus (1996), if used in isolation, would probably not improve childrens' concentration due to the lack of interaction and motivation with an external source such as a teacher or classroom assistant. The strategy was marginally more effective with the Predominantly Hyperactive/Impulsive group who presumably were able to focus on a task more efficiently as a result in the reduction of distractions.

Question 4 Did the child have the opportunity to work on a computer?

Graph 72 Question 4 on teaching strategies from Survey 1



Graph 73 Mean scores with 95% confidence intervals for Question 4 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used

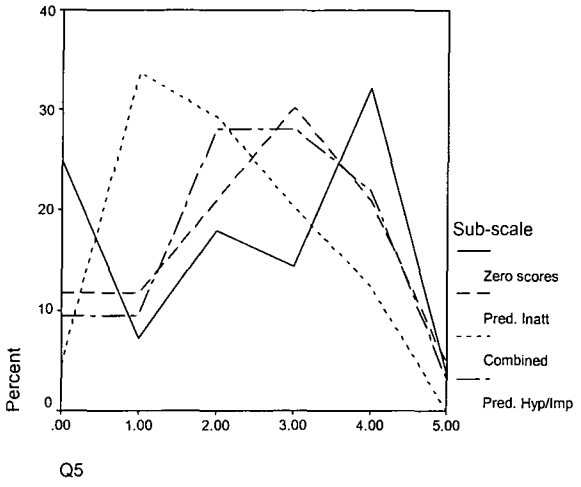


In some circumstances, a computer can provide feedback and motivation to a child, particularly if the program is interactive with sound and animation. It can provide stimulation when attention from the teacher is not available. It would therefore be expected to be an effective method for sustaining a child's concentration and attention. The results in the graphs demonstrate that this was found to be the case for many children across all groups with mean scores of 3.0 for the Combined group, 3.5 for the Predominantly

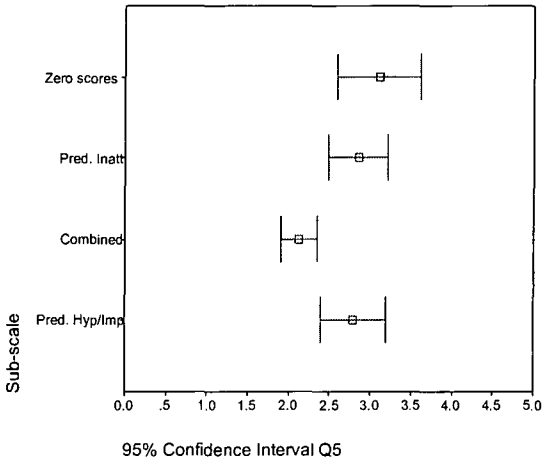
Hyperactive/Impulsive group and 3.1 for the Predominantly Inattentive group. The strategy was not particularly successful for a small number of children in each group. Interestingly the graphs peaked at the 'effective most of the time' category and the 'effective every time' category was markedly lower, especially for the Combined and Predominantly Inattentive groups. This may have been due to teachers differentiating between different types of computer program and indicating that tasks such as straightforward word processing may not have been as interesting.

Question 5 Did the child have the opportunity to work in a group with at least 3 other children?

Graph 74 Question 5 on teaching strategies from Survey 1



Graph 75 Mean scores with 95% confidence intervals for Question 5 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used

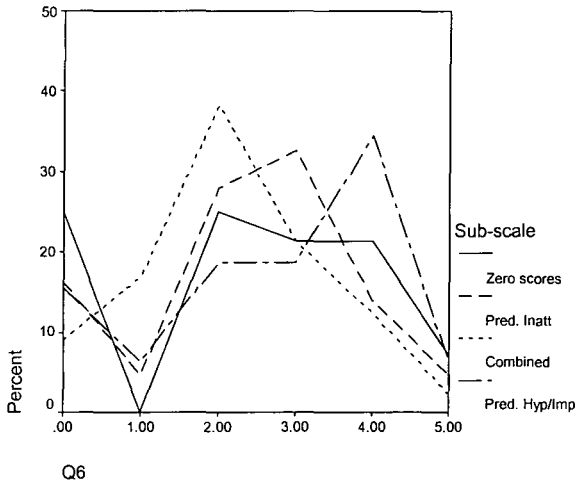


Teachers reported using this strategy with more pupils than those already discussed. Working with other children would enable an inattentive, hyperactive or impulsive child to share their ideas, and if working together, the other children would provide stimulation as opposed to distraction. However, the grouping must be chosen with care. Ideus and Cooper (1996) advised that children with ADHD work best in pairs rather than group situations

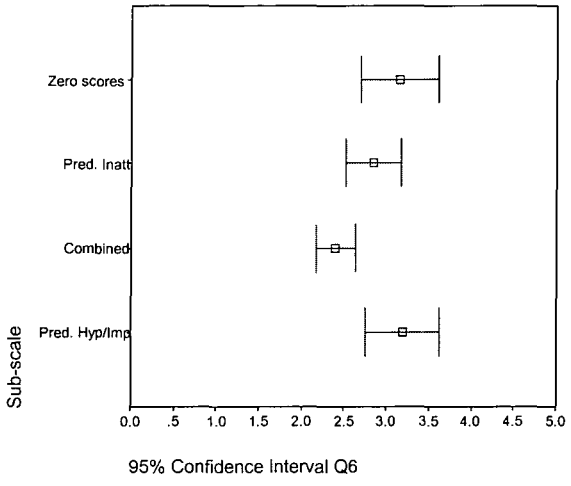
because group situations may be over – stimulating and can also stretch their limited social skills. Although teachers reported using this strategy with many children, the graph shows that its success was variable with mean scores of 2.1 for the Combined group compared with 2.8 for the Predominantly Hyperactive/Impulsive group and Predominantly Inattentive groups. The mean scores tend to mask the variability in scores demonstrated on Graph 74. The complex combination of problems of inattention, hyperactivity and impulsivity of the children in the Combined group appeared to make group work unproductive in many instances.

Question 6 Did the child have the opportunity to work with another child in a pair?

Graph 76 Question 6 on teaching strategies from Survey 1



Graph 77 Mean scores with 95% confidence intervals for Question 6 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used



Teachers reported using this strategy with children in the Combined, Predominantly Inattentive and Predominantly Hyperactive/Impulsive groups less frequently than the strategy of placing children in a group with at least three other children. When employed, the strategy was perceived to be most successful with the children in the Predominantly Hyperactive/Impulsive and

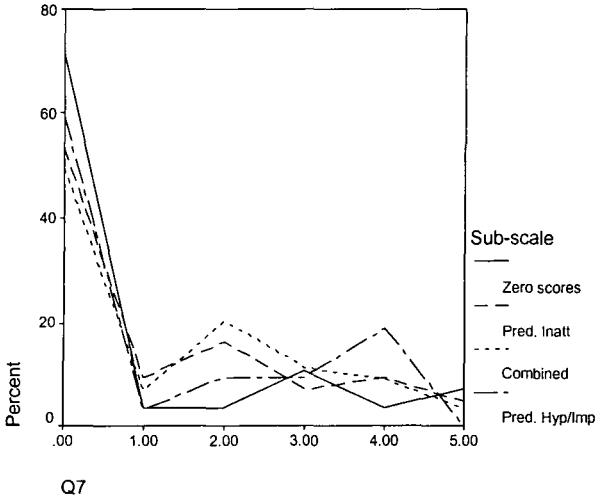
less successful with the children in the Combined group and Predominantly Inattentive groups (mean scores of 2.4 for the Combined group, 3.2 for the Predominantly Hyperactive/Impulsive group and 2.8 for the Predominantly Inattentive group). This strategy would be expected to be effective with all children. A partner can provide stimulation and the distractions which can arise from the interactions between a larger group of children are reduced. Perhaps the children in the Combined and Predominantly Inattentive groups required the expertise of the teacher to externalise their thoughts, and provide help to organise and develop them.

Question 7 Did you allow the child to stop the task they were working on if they became frustrated and have a short break on some other activity before returning to the original task?

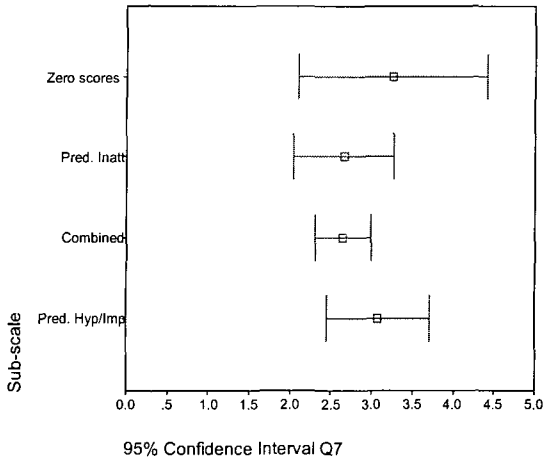
Question 8 Did you allow the child to stop the task they were working on if they became frustrated and have a short break outside the classroom (perhaps by delivering a message to another member of staff)?

These strategies were similar to the 'time – out' strategy often employed by teachers, which essentially consists of isolating the child from the rest of the class for a short time when they are misbehaving (Cooper and Ideus, 1996). The strategies suggested in questions 7 and 8 of the questionnaire did not isolate the child, but nevertheless removed them from the source of frustration.

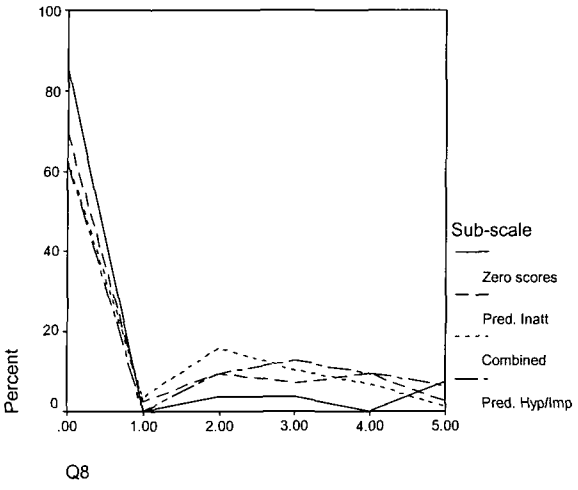
Graph 78 Question 7 on teaching strategies from Survey 1



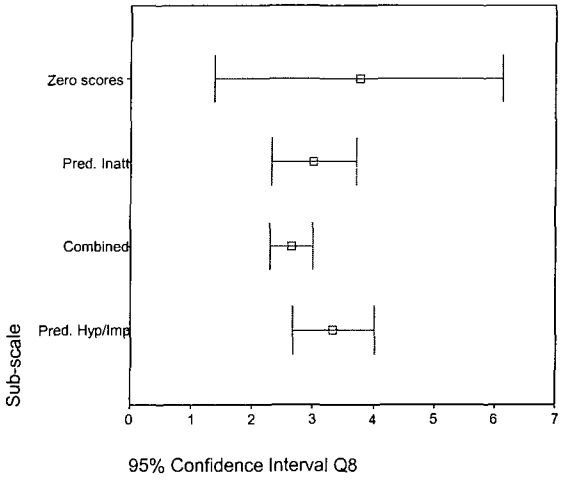
Graph 79 Mean scores with 95% confidence intervals for Question 7 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used



Graph 80 Question 8 on teaching strategies from Survey 1



Graph 81 Mean scores with 95% confidence intervals for Question 8 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used

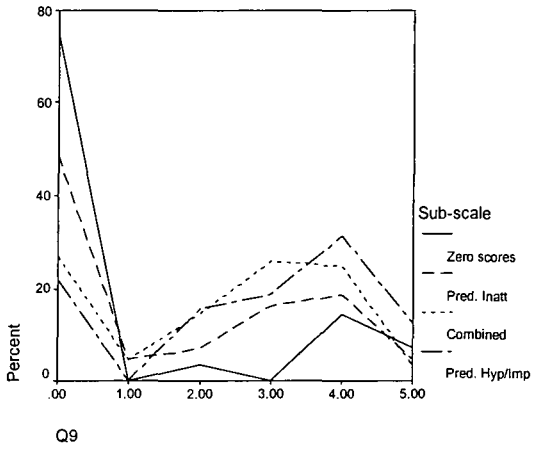


Graphs 78 and 80 show that teachers rarely employed these strategies. When used, the mean scores were Combined group = 2.6, Predominantly Hyperactive/Impulsive group = 3.1, Predominantly Inattentive group = 2.7 for changing tasks (question 7). This was found to be successful most or all of the time for quite a number of children in the Predominantly Hyperactive/Impulsive group, reflected in the mean scores. Again, letting the child leave the classroom (question 8) was not frequently employed but when it was used it was reported to be effective occasionally or half the time with children in any group (mean scores were Combined group = 2.6, Predominantly Hyperactive/Impulsive group = 3.3, Predominantly Inattentive group =3.0. Again, the children in the Predominantly Hyperactive/Impulsive group responded most positively to the strategy.

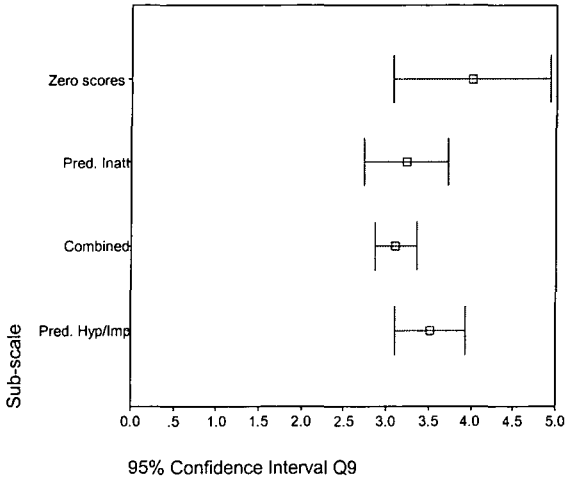
Question 9 If the child misbehaved, did you move them to a quiet area (either inside or outside the classroom) where they could calm down?

This strategy almost replicated the 'time – out' strategy described above. In some schools it is not practicable or safe to take the child outside the classroom. If the teacher is the only adult present, they cannot leave the rest of the class unsupervised, nor can they leave a child who is upset unsupervised outside the classroom. Therefore, the question included the removal of the child in question to a quiet area either inside or outside the classroom.

Graph 82 Question 9 on teaching strategies from Survey 1



Graph 83 Mean scores with 95% confidence intervals for Question 9 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used



This strategy was much closer to the advice given by Cooper and Ideus. Graph 82 shows that it was more frequently employed with children in the Combined and Predominantly Hyperactive/Impulsive groups than the strategies in questions 7 and 8, but not with the children in the Zero group or the Predominantly Inattentive group. Children with the Combined and Predominantly Hyperactive/Impulsive sub-types of ADHD have been found to exhibit more disruptive, non-compliant behaviour than children with the Predominantly Inattentive sub-type of ADHD (Gaub and Carlson, 1997, Karustis *et al.* 1997, Morgan *et al.*,1996). The children in the Zero and Predominantly Inattentive groups were unlikely to misbehave as frequently as the children in the other groups, and therefore the strategy was clearly not required. When employed, it was found to be successful generally slightly more often than half of the time (mean scores were Combined group = 3.1, Predominantly Hyperactive/Impulsive group = 3.5, Predominantly Inattentive group = 3.2). Presumably it was an effective method of stopping disruptive, inattentive behaviour, after which the child could resume their work. If the nature of the work was the source of frustration, it would then be necessary for the teacher to intervene further because in its own right, the intervention would not directly encourage concentration and attention to a task.

Question 10 Did you make a point of immediately praising any and all good behaviour of the child?

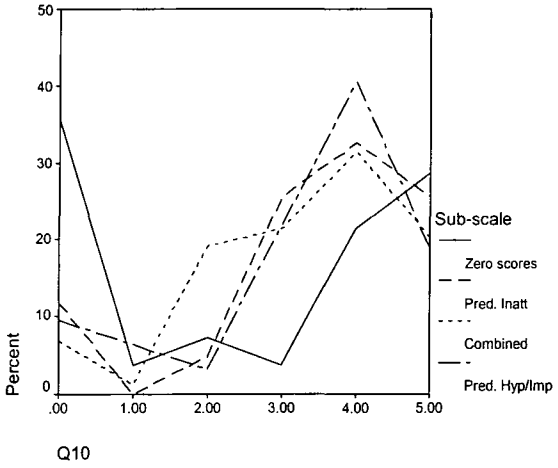
Question 11 Did you give frequent and immediate rewards for good behaviour?

Question 12 Did you offer rewards for good behaviour, which were to be given at a later time? (e.g. Allowing a choice of activity in the afternoon if the child worked well during the morning?)

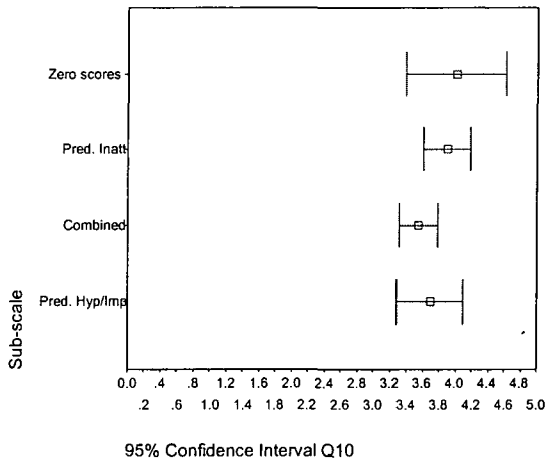
Question 13 Did you use a reward system for behaviour such as a star chart?

The strategies in questions 10 – 13 are positively reinforcing good behaviour. Children with ADHD have been found to respond positively to praise and rewards (Cooper and Ideus, 1996, Du Paul and Eckert, 1997, Fiore *et al.*, 1993) and therefore it would be expected that teachers would employ these strategies frequently and that they would be successful. Children with ADHD have problems with temporal organisation (Barkley, 1997, Reid Lyon, 1996) and so the strategy in question 12 may be less effective than the others, given that a child has to understand the element of timing associated with the reward.

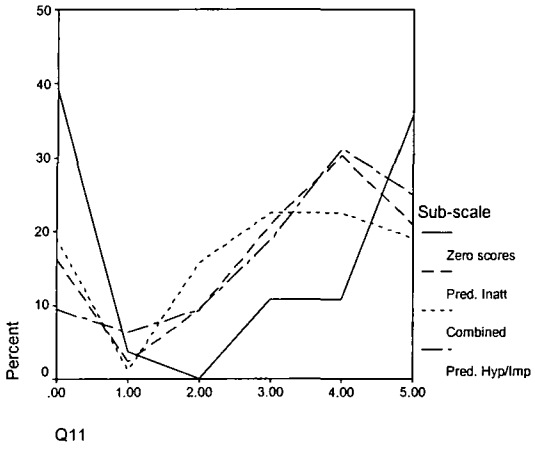
Graph 84 Question 10 on teaching strategies from Survey 1



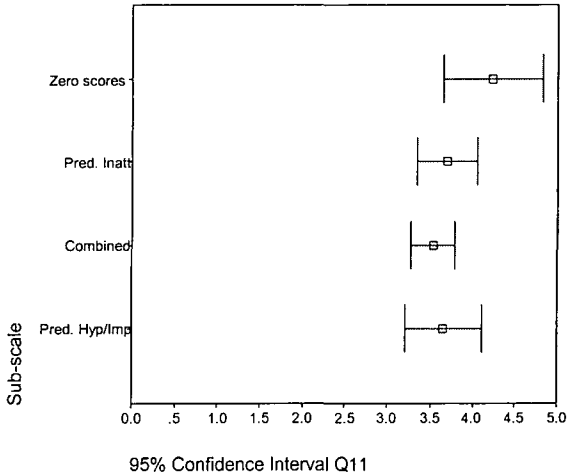
Graph 85 Mean scores with 95% confidence intervals for Question 10 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used



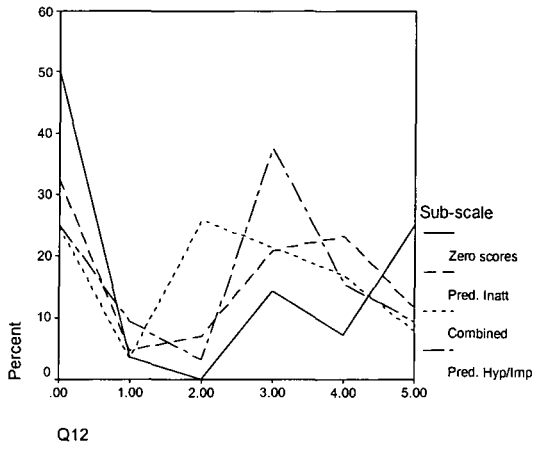
Graph 86 Question 11 on teaching strategies from Survey 1



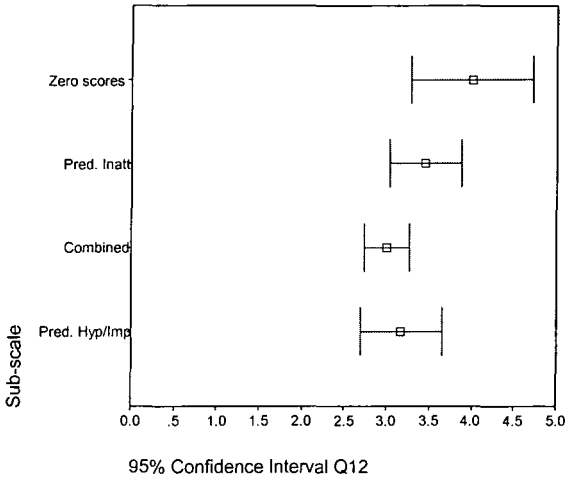
Graph 87 Mean scores with 95% confidence intervals for Question 11 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used



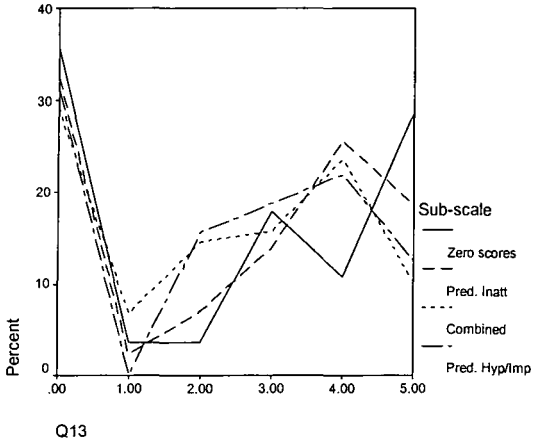
Graph 88 Question12 on teaching strategies from Survey 1



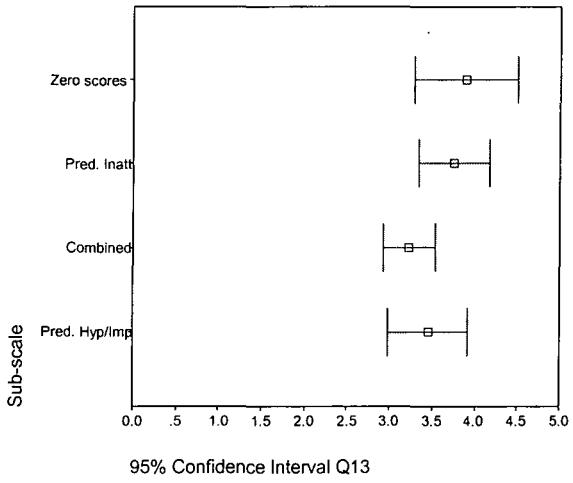
Graph 89 Mean scores with 95% confidence intervals for Question 12 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used



Graph 90 Question 13 on teaching strategies from Survey 1



Graph 91 Mean scores with 95% confidence intervals for Question 13 on teaching strategies from Survey 1, excluding pupils for whom the strategy was not used



When used, the strategies in questions 10 and 11 were effective at least half of the time with all groups. Mean scores for question 10 were 3.5 for the Combined group, 3.7 for the Predominantly Hyperactive/Impulsive group and 3.9 for the Predominantly Inattentive group. Mean scores for question 11 were 3.5 for the Combined group, 3.7 for the Predominantly Hyperactive/Impulsive group and 3.7 for the Predominantly Inattentive group.

The success of offering a reward for good behaviour that was to be taken at a later time (question 12) was more variable, appearing to be most effective for the Zero and Predominantly Inattentive groups. Mean scores for question 12 were 3.0 for the Combined group, 3.2 for the Predominantly Hyperactive/Impulsive group and 3.5 for the Predominantly Inattentive group. This result supports the theory of children with ADHD having problems associated with behavioural inhibition and temporal organisation. Brown (1998) suggested that the Predominantly Inattentive sub-type of ADHD may have a different root cause to the other two sub-types and that these children do not necessarily have impaired behavioural inhibition, but that the other

executive functions are nevertheless impaired. This begins to explain why the Predominantly Inattentive group were able to work towards the promise of a later reward more effectively than children in the Combined and Predominantly Hyperactive/Impulsive groups.

Providing concrete rewards in the form of stars on a chart (question 13) was also found to be effective when the strategy was used. Mean scores were 3.2 for the Combined group, 3.5 for the Predominantly Hyperactive/Impulsive group and 3.8 for the Predominantly Inattentive group. This is another immediate way of praising good behaviour that gives the child a permanent reminder of their achievement rather than verbal praise, which is probably more quickly forgotten.

To summarise:

Overall, the results from teachers agreed with the findings of previous research. Teachers were asked about the effectiveness of each strategy in its own right. It would be interesting to follow this survey up with more detailed research perhaps in the form of interviews, about the effect of combining strategies and the order in which strategies are employed. For example, it was reported that moving a child to a quiet area if they misbehaved was effective with children in the Combined and Predominantly Hyperactive/Impulsive groups, but presumably further action was also required to deal with the source of the child's frustration to prevent an immediate re-occurrence.

Although quite limited, the data do provide information about the types of strategies currently being used to improve the concentration and attention of children with high scores on the behaviour rating scale. The results were very similar to those found in research studies of children who had been formally diagnosed as having ADHD, and they also supported the theory of the nature of ADHD proposed by Barkley (1997). Of course every pupil has a different temperament and responds differently to situations, which is demonstrated in some of the graphs where strategies are differentially successful. Therefore whilst the data reported above is useful in demonstrating general trends, a functional analysis of each child would perhaps result in more effective individualised behavioural management programmes.

The results of Survey 1 reported perceived improvements in the concentration of children. Further research is now required to systematically determine the extent to which an improvement in concentration leads to an improvement in academic achievement and progress.

Chapter 15

Conclusions

Since the beginning of this study, five years ago, public awareness of ADHD has increased as a result of articles in newspapers and magazines, and information presented in television programmes. Theories of the underlying biological causes of ADHD and their psychological consequences have been proposed, and evidence gathered to support them. The treatment of the condition remains an issue. In their Consensus Development Conference Statement on the Diagnosis and Treatment of Attention Deficit Hyperactivity Disorder (1998), the National Institutes of Mental Health (NIMH) suggested that new research was needed to develop a more systematic treatment strategy for ADHD than was currently available. In response to this recommendation, literature reviews of treatment (e.g. 'The treatment of attention deficit/hyperactivity disorder: An evidence report', McMaster University Evidence-Based Practice Center, 1998) have recently been published and large-scale studies such as the Multi-modal Treatment of Attention Deficit Hyperactivity Disorder (MTA) study sponsored by the NIMH have started to systematically investigate the effects of different types of treatment over a considerably longer time span than previous studies.

The NIMH also suggested that research to investigate the effects of instructional treatments on the academic performance of children with ADHD were required. Although the children investigated in this study did not necessarily have a formal diagnosis of ADHD, they met the number of criteria recommended in the DSM-IV for a diagnosis of the condition (in the classroom setting only). This enabled comparisons with previous studies of the academic outcomes of children with ADHD to be made and also provided

new information, such as the quantitative differences in achievement and progress of large samples of young children meeting criteria for each sub-type of ADHD. This new information provides a baseline from which the impact of the kind of intervention studies suggested by the NIMH could be compared.

In Chapter 1, the rationale and aims of the study were set out. In the next part of this concluding chapter, the main findings will be discussed in relation to these initial aims with the intention of showing how the results have provided new information to augment existing ideas, particularly in relation to the high number of young children with severe behavioural problems of inattention and/or hyperactivity and impulsivity in the classroom but no formal diagnosis of ADHD, and also how the results will be valuable to both teachers and researchers.

The first aim was to estimate the proportion of children displaying severe inattentive and/or hyperactive/impulsive behaviour in the reception classes of a nationally representative sample of schools in England and to compare the findings with previously published estimates of the prevalence of ADHD. This included investigating differences between genders, children with English as an additional language and children with English as their first language, age and the possible relationship between behaviour and socio-economic status.

To begin with, an assessment of behaviour was required. A teacher rating scale based on the diagnostic criteria from the DSM-IV was used, which enabled children with severe ADHD symptoms in the classroom setting to be

identified and classified into one of the three recognised ADHD sub-types. This was found to be a reasonably reliable method of highlighting these children and could be a useful tool for teachers to monitor the behaviour of pupils suspected to be at risk of ADHD.

The results from the behaviour rating scale indicated that the rate of prevalence of children with severe inattention and/or hyperactive behaviour in reception classes was found to be similar to the rates reported in other research which assessed behaviour using teacher ratings based on the diagnostic criteria for ADHD in the DSM-IV. However these rates were higher than the rates of prevalence of ADHD reported by the American Psychiatric Association (1994), emphasising the important distinction that should be made between teacher ratings of ADHD symptoms in the classroom and a formal diagnosis of ADHD. The ratio of children meeting criteria relating to the three ADHD sub-types was similar to previously reported figures and proportionately more boys were identified with severe ADHD symptoms than girls. A relationship between age and behaviour was found with younger children tending to be more inattentive, hyperactive and impulsive than older ones. The relationship between behaviour and socio-economic status was negative but weak.

The closeness of these results with those from previous research that used teacher ratings helped to validate the rating scale used to assess behaviour. It was evident that teachers were identifying a small proportion of children with severe ADHD symptoms. This was an important point to establish if the

results from the later analysis of achievement and progress were to be meaningfully compared with previous studies on the achievement of children actually diagnosed with ADHD. One point to note was that after controlling for socio-economic status, age and first language, significant differences between the mean behaviour scores of classes remained. The analysis in Chapter 9 – Reliability and Validity of the Measures indicated that the behaviour rating scale was found to be reasonably reliable and valid but it must nevertheless be remembered that significant differences between mean behaviour scores of classes existed which might be attributed to the teacher rather than the pupils. The data from this study at class level were limited. Often, several pupils from classes had to be excluded from the analysis because their postcodes were missing and therefore their socio-economic status could not be obtained. Future research to establish the causes of differences between the mean behaviour scores using complete classes would increase the reliability of the findings.

The analysis of data from three successive cohorts of reception children indicated that the proportion of children with severe ADHD symptoms did not increase over time, contradicting suggestions that ADHD is a rising problem (Bushby, 1996). Perhaps as the profile of children with ADHD has increased, parents and teachers have more readily sought assessment and expected treatment for children with behavioural problems. Increasing prescription of medication gives the appearance that the condition itself is becoming more widespread.

Although it cannot be overstressed that the data collected in this study were not from children with a formal diagnosis of ADHD, and this point should be borne in mind throughout the interpretation of the results and the conclusions, the information about the prevalence of reception children exhibiting severe ADHD symptoms in the classroom gave an indication of trends in England over three successive years on a sample size that no other study to date appears to have reported. It has raised issues of the relationship between age, gender, English as an additional language and behaviour, all of which have implications for the composition of classes in schools with more than one class per year group. The proportion of children identified with severe ADHD symptoms in classrooms also demonstrates that these children are a reality and many will require special educational strategies.

The next aim of the study was to quantify the impact of severe behavioural problems of inattention and/or hyperactivity and impulsivity on the academic achievement and progress of children during their first three years at school. Much of the previous research about the academic achievement of children with ADHD did not analyse the data by ADHD sub-types but treated children with ADHD as a single group. It has recently been suggested that the Predominantly Inattentive sub-type of ADHD might form a disorder in its own right (e.g. Barkley, 1997, Conners, 1997, Houghton, 1998), which makes analysis by sub-type crucial. A further advantage of the results of this study is that differences between groups were reported as Effect Sizes, providing more comprehensive information than simply stating whether or not differences between groups were statistically significantly different. It is also

then possible to compare the results of several different studies in future in meta-analyses.

When the academic achievement of children with a high number of ADHD symptoms was compared with that of children with no ADHD symptoms, large differences were found between the Predominantly Inattentive and Combined sub-types and the group of children with no ADHD symptoms for both reading and mathematics. The differences increased between the start of reception and year 2 indicating that the Predominantly Inattentive and Combined sub-types started school with poorer reading and mathematics than children with no ADHD symptoms and then made less progress, falling further behind relatively, over the next three years. Much smaller differences were found between the Predominantly Hyperactive/Impulsive sub-type and the group of children with no ADHD symptoms, although these differences nevertheless increased between the start of reception and year 2 indicating that the Predominantly Hyperactive/Impulsive sub-type also made less progress during the first three years of school than children with no ADHD symptoms. These findings were similar to those of previous studies. They add to existing research because they are expressed as Effect Sizes, which are useful for the reasons stated above, and they are also based on younger children than most other studies tend to assess. Children make an enormous amount of progress during the reception year (Tymms, Merrell and Henderson, 2000) and so it is desirable that any children at risk of underachieving during this important initial phase of their education because of behavioural problems are identified and helped.

Achievement was also compared to ability, providing a further measure of value-added. This demonstrated that given their ability, many children with the Predominantly Inattentive and Combined sub-type of ADHD in the classroom setting and fewer of the children with the Predominantly Hyperactive/Impulsive sub-type were still underachieving in reading and mathematics.

Teachers undoubtedly employ strategies to improve the concentration, attention and hopefully the academic achievement of pupils with ADHD related behavioural problems; however, differences between two of the ADHD sub-types and children with no ADHD symptoms were still large. Although details of the teaching methods applied to every child in the study were not known, these results will still form a useful comparison with the findings of future studies that aim to assess the impact of interventions on the academic achievement of children with ADHD or ADHD symptoms.

The teaching strategies used with some children were investigated in the survey whose results are reported in Chapter 14, Results – 5. The degree to which these were perceived by teachers to be effective at improving the attention and concentration of the children in question were similar to their effectiveness found with children with ADHD. It appeared that these strategies would be useful for children with ADHD symptoms in the classroom but no formal diagnosis of ADHD. Some strategies were perceived to be more useful than others. For example, placing a child with a high number of

ADHD symptoms in a position free from distractions such as doors and windows was not perceived to be effective. Seating a child close to the teacher appeared to be more successful. Removing a child from the classroom after misbehaving and providing them with the opportunity to calm down was useful with children who had high scores on the Combined and Predominantly Hyperactive/Impulsive sub-scales of the behaviour rating scale. Reward systems were found to have variable success. A newsletter informing teachers of these strategies and the results obtained from investigating them to date would no doubt be a useful resource. The next step is to research these interventions and others in a more systematic way and monitor their effect on the academic achievement of children as well as on their behaviour. Strategies can be employed at class, school and Local Authority levels. Providing schools and class teachers with information about the achievement and progress of children with a high number of ADHD symptoms and suggestions of strategies to help to control them would be one intervention. The frequency and degree to which these strategies were implemented needs to be carefully monitored with data collection instruments including teacher-questionnaires and possibly diaries to record personal comments. The effectiveness of implementing interventions at Local Authority level could also be informative. When children are identified as having behavioural problems, other agencies outside the school can become involved. Raising the awareness of the relevant agencies might also have an effect on improving the achievement and progress of these children. Possible interventions could include the provision of information about children with ADHD and ADHD symptoms in resource packs, conferences by leading

researchers to disseminate the findings of recent studies, the monitoring of the actions of multi-agency groups of professionals within authorities, designed to provide help for these children. The NIMH recommended that long-term intervention studies are carried out and so the length time over which strategies are implemented is also important.

Although the theory of ADHD proposed by Barkley (1997) explains why some interventions are more successful than others, the context of each child's problems is different and treatments need to be tailored to their individual needs as suggested by Scotti, Morris, McNeil and Hawkins (1996) Ervin, R.A., DuPaul, G.J., Kern, L., *et.al.* (1998). This point was illustrated by the results from the case studies described in Chapter 13, Results – 4. When a variety of assessments were used, they tended to agree and when discrepancies were found, they were often explained by the teacher's comments about the home background or significant disturbing events such as the death of a close relative. The case studies were useful in demonstrating that although research on large samples has a place, when dealing with children in the classroom, functional assessment is vital.

Overall, this research has indicated that young children with severe behavioural problems of inattention and/or hyperactivity and impulsivity are at risk of similar outcomes to those of children with a formal diagnosis of ADHD. The types of teaching and classroom management strategies that are effective with children with ADHD also appear to be effective with children who display ADHD symptoms but have not been formally diagnosed with the

disorder. Systematic research is now required, both large-scale over several years and case studies of the use of functional analysis, to find ways of reducing the differences in achievement and progress between children with severe ADHD symptoms and their peers.

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Appendix 1

The Criteria for the diagnosis of ADHD published in the DSM-IV (American Psychiatric Association, 1994) and the teacher behaviour rating scale used in this study

The Criteria for the diagnosis of ADHD published in the DSM-IV (American Psychiatric Association, 1994)

A. Either (1) or (2)

(1) six (or more) of the following symptoms of **inattention** have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Inattention

(a) often fails to give close attention to details or makes careless mistakes in schoolwork, work or other activities

(b) often has difficulty sustaining attention in tasks or play activities

(c) often does not seem to listen when spoken to directly

(d) often does not follow through on instructions and fails to finish schoolwork, chores or duties in the workplace (not due to oppositional behaviour or failure to understand instructions)

(e) often has difficulty organizing tasks and activities

(f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)

(g) often loses things necessary for tasks and activities (e.g. toys, school assignments, pencils, books or tools)

(h) is often easily distracted by extraneous stimuli

(i) is often forgetful in daily activities

(2) six (or more) of the following symptoms of **hyperactivity-impulsivity** have persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level:

Hyperactivity

(a) often fidgets with hands or feet or squirms in seat

(b) often leaves seat in classroom or in other situations in which remaining

seated is expected

(c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)

(d) often has difficulty playing or engaging in leisure activities quietly

(e) is often "on the go" or often acts as if "driven by a motor"

(f) often talks excessively

Impulsivity

(g) often blurts out answers before questions have been completed

(h) often has difficulty awaiting turn

(i) often interrupts or intrudes on others (e.g., butts into conversations or games)

(B) Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.

(C) Some impairment from the symptoms is present in two or more settings (e.g., at school (or work) and at home).

(D) There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.

(E) The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another mental disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

Behaviour rating scale

(as presented to teachers as part of this study)

Score 1 mark for each statement which has generally applied to the child during their time in your class. Consider a criterion met only if the behaviour has persisted for at least six months and is considerably more frequent than that of most other children of the same gender and developmental level.

Section B1

A Makes careless mistakes in school work or other activities.

B Has difficulty sustaining attention in tasks or play activities.

C Does not seem to listen when spoken to directly.

D Does not follow through instructions, fails to finish work.

E Has difficulty organising tasks and activities.

F Is reluctant to engage in tasks which require sustained mental activity.

G Loses equipment necessary for activity e.g. pencils, books.

H Is distracted by extraneous stimuli.

I Forgetful in daily activities.

Section B2

A Fidgets with hands or feet or squirms in seat.

B Leaves seat in classroom or in other situations where remaining seated is expected.

C Often runs about excessively in situations in which it is inappropriate.

D Has difficulty in playing quietly.

E Is often 'on the go' as if driven by a motor.

F Talks excessively.

Section B3

A Blurts out answers before questions have been completed.

B Has difficulty awaiting turn.

C Interrupts or intrudes on others e.g. pushes into conversations or games.

The behaviour rating scale includes the same number of items as the diagnostic criteria from the DSM-IV. Items on the behaviour rating scale generally differ from the diagnostic criteria in the DSM-IV when the diagnostic criteria refer to behaviour being apparent outside school or are more applicable to adults or older children. For example, 1(d) of the DSM-IV (often does not follow through on instructions and fails to finish schoolwork, chores or duties in the workplace (not due to oppositional behaviour or failure to understand instructions)) has been shortened in the behaviour rating scale to 'Does not follow through instructions, fails to finish work.' This was considered to be appropriate to younger children and it was intended that teachers would assume the criteria applied after they were sure that the child had understood what was required of them. Criteria 1(f), 1(g), 2(c) and 2(d) from the DSM-IV were abbreviated in the behaviour rating scale for the same reasons. The word 'often' was not included on each item of the behaviour rating scale. It was considered unnecessary in view of the fact that when teachers were advised to decide whether or not each item 'generally applied' to each child, this implied that the behaviour was exhibited on a regular basis.

Both the DSM-IV and the behaviour rating scale advised that the behaviour should have been present at a significant level for at least six months but the behaviour rating scale suggested that teachers compare the behaviour of children of the same gender and developmental level whereas the DSM-IV only compares individuals of the same developmental level. The behaviour rating

scale was used with children who were younger than 7 years of age, therefore that proviso was not included. Additionally, since it was an assessment of behaviour and not a diagnostic system, therefore the requirements for the behaviour to be present in two or more settings, the symptoms not to be better accounted for by a different disorder to ADHD and evidence of clinically significant impairment in social, academic or occupational functioning were not included.

Appendix 2

Survey 1 – Teachers' awareness of ADHD and their teaching strategies

		Please circle
1.	Before reading the attached letter had you heard of ADHD?	Yes / No
2.	Have you heard of Hyperkinetic Disorder?	Yes / No
3.	Have you attended any courses about ADHD?	Yes / No

Please answer the questions which follow (by circling 'Yes' or 'No') in respect of the time spent in your class by child named at the top of the page.

If your response is 'Yes' to any question, please specify the degree to which you think the measure was effective in encouraging the child's concentration and attention using the 5 point scale:

1 = Ineffective
2 = Occasionally effective
3 = Effective about half the time
4 = Effective most of the time
5 = Effective every time

			If yes ...
1.	Did you try moving the child to work in a place that was free from distraction (away from doors and windows)	Yes / No	1 2 3 4 5
2.	Did you try seating the child close to you?	Yes / No	1 2 3 4 5
3.	Did you give the child an opportunity to work in a designated 'quiet area'?	Yes / No	1 2 3 4 5
4.	Did the child have the opportunity to work on a computer?	Yes / No	1 2 3 4 5
5.	Did the child have the opportunity to work in a group with at least 3 other children?	Yes / No	1 2 3 4 5
6.	Did the child have the opportunity to work with another child in a pair?	Yes / No	1 2 3 4 5
7.	Did you allow the child to stop the task they were working on if they became frustrated and have a short break on some other activity before returning to the original task?	Yes / No	1 2 3 4 5
8.	Did you allow the child to stop the task they were working on if they became frustrated and have a short break outside the classroom, (perhaps by delivering a message to another member of staff)?	Yes / No	1 2 3 4 5
9.	If the child misbehaved did you move them to a quiet area (either inside or outside the classroom) where they could calm down?	Yes / No	1 2 3 4 5
10.	Did you make a point of immediately praising any and all good behaviour displayed by the child?	Yes / No	1 2 3 4 5

11.	Did you give frequent and immediate rewards for good behaviour?	Yes / No	1 2 3 4 5
12.	Did you offer rewards for good behaviour which were to be given at a later time? (e.g. Allowing a choice of activity in the afternoon if the child worked well during the morning.)	Yes / No	1 2 3 4 5
13.	Did you use a reward system for behaviour such as a star chart?	Yes / No	1 2 3 4 5

Appendix 3

Further Analysis From Chapter 9

'Results 1 – Distribution of Scores from the End Of Reception Behaviour Rating Scale'

Group D

The distribution of scores from the behaviour rating scale for the all the pupils in Group D are reported in the tables and which follow:

Table 18 Group D Frequencies of subjects

	Count	Percent
Boys	24251	51.1
Girls	23228	48.9
Total	47479	100

Table 19 Group D Frequencies of full behaviour rating scale scores (Total Scores and by Sex)

Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	7824	32.3	11764	50.6	19588	41.3
1	2420	10.0	2561	11.0	4981	10.5
2	2120	8.7	1974	8.5	4094	8.6
3	1911	7.9	1497	6.4	3408	7.2
4	1643	6.8	1147	4.9	2790	5.9
5	1415	5.8	968	4.2	2383	5.0
6	1235	5.1	765	3.3	2000	4.2
7	1044	4.3	572	2.5	1616	3.4
8	874	3.6	468	2.0	1342	2.8
9	797	3.3	385	1.7	1182	2.5
10	629	2.6	281	1.2	910	1.9
11	577	2.4	227	1.0	804	1.7
12	448	1.8	170	0.7	618	1.3
13	343	1.4	134	0.6	477	1.0
14	279	1.2	104	0.4	383	0.8
15	222	0.9	69	0.3	291	0.6
16	179	0.7	38	0.2	217	0.5
17	144	0.6	40	0.2	184	0.4
18	147	0.6	64	0.3	211	0.4

Table 20 Group D Frequencies of the distribution of scores of criteria relating to inattention (Total scores and by Sex)

Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	9257	38.2	13144	56.6	22401	47.2
1	3026	12.5	2941	12.7	5967	12.6
2	2739	11.3	2041	8.8	4780	10.1
3	2357	9.7	1512	6.5	3869	8.1
4	1847	7.6	1176	5.1	3023	6.4
5	1628	6.7	861	3.7	2489	5.2
6	1174	4.8	631	2.7	1805	3.8
7	973	4.0	414	1.8	1387	2.9
8	617	2.5	257	1.1	874	1.8
9	633	2.6	251	1.1	884	1.9

Table 21 Group D Frequencies from the behaviour rating scale of scores of criteria relating to hyperactivity/impulsivity (Total scores and by Sex)

Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	13035	53.8	16229	69.9	29264	61.6
1	3260	13.4	2709	11.7	5969	12.6
2	2167	8.9	1525	6.6	3692	7.8
3	1525	6.3	923	4.0	2448	5.2
4	1205	5.0	647	2.8	1852	3.9
5	959	4.0	421	1.8	1380	2.9
6	715	2.9	315	1.4	1030	2.2
7	585	2.4	235	1.0	820	1.7
8	380	1.6	88	0.4	468	1.0
9	420	1.7	136	0.6	556	1.2

Table 22 shows the number and proportion of pupils in Group D meeting criteria relating to Combined sub-type of ADHD.

Table 22 Frequency of pupils in Group D meeting the number of criteria from the behaviour rating scale relating to the Combined sub-type of ADHD

	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
Pupils who did not meet sufficient criteria for Combined sub-type of ADHD	23083	95.2	22833	98.3	45916	96.7
Pupils who met sufficient criteria for Combined sub-type of ADHD	1168	4.8	395	1.7	1563	3.3

Group E

The distribution of scores from the behaviour rating scale for the all the pupils in Group E are reported in the tables and which follow:

Table 23 Group E Frequencies of subjects

	Count	Percent
Boys	32319	50.5
Girls	31647	49.5
Total	63966	100

Table 24 Group E Frequencies of behaviour rating scale scores (Total Scores and by Sex)

Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	13238	41.0	18106	57.2	31344	49.0
1	2868	8.9	3090	9.8	5958	9.3
2	2530	7.8	2341	7.4	4871	7.6
3	2137	6.6	1757	5.6	3894	6.1
4	1919	5.9	1369	4.3	3288	5.1
5	1612	5.0	1095	3.5	2707	4.2
6	1503	4.7	902	2.9	2405	3.8
7	1166	3.6	679	2.1	1845	2.9
8	1051	3.3	586	1.9	1637	2.6
9	944	2.9	480	1.5	1424	2.2
10	730	2.3	301	1.0	1031	1.6
11	642	2.0	268	0.8	910	1.4
12	500	1.5	178	0.6	678	1.1
13	422	1.3	155	0.5	577	0.9
14	296	0.9	104	0.3	400	0.6
15	253	0.8	89	0.3	342	0.5
16	195	0.6	58	0.2	253	0.4
17	148	0.5	41	0.1	189	0.3
18	165	0.5	48	0.2	213	0.3

Table 25 Group E Frequencies of the distribution of scores of criteria relating to inattention (Total scores and by Sex)

Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	15116	46.8	19920	62.9	35036	54.8
1	3537	10.9	3314	10.5	6851	10.7
2	3142	9.7	2483	7.8	5625	8.8
3	2655	8.2	1807	5.7	4462	7.0
4	2208	6.8	1369	4.3	3577	5.6
5	1784	5.5	983	3.1	2767	4.3
6	1386	4.3	678	2.1	2064	3.2
7	989	3.1	492	1.6	1481	2.3
8	724	2.2	357	1.1	1081	1.7
9	778	2.4	244	0.8	1022	1.6

Table 26 Group E Frequencies from the behaviour rating scale of scores of criteria relating to hyperactivity/Impulsivity (Total scores and by Sex)

Behaviour Score	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
0	19184	59.4	23402	73.9	42586	66.6
1	3871	12.0	3269	10.3	7140	11.2
2	2474	7.7	1741	5.5	4215	6.6
3	1870	5.8	1074	3.4	2944	4.6
4	1405	4.3	731	2.3	2136	3.3
5	1084	3.4	494	1.6	1578	2.5
6	872	2.7	418	1.3	1290	2.0
7	652	2.0	245	0.8	897	1.4
8	447	1.4	147	0.5	594	0.9
9	460	1.4	126	0.4	586	0.9

Table 27 shows the number and proportion of pupils in Group E meeting criteria relating to Combined sub-type of ADHD.

Table 27 Frequency of pupils in Group E meeting the number of criteria from the behaviour rating scale relating to the Combined sub-type of ADHD

	Boys		Girls		Total	
	Count	Percent	Count	Percent	Count	Percent
Pupils who did not meet sufficient criteria for Combined sub-type of ADHD	31021	96.0	31205	98.6	62226	97.3
Pupils who met sufficient criteria for Combined sub-type of ADHD	1298	4.0	442	1.4	1740	2.7

Age and Behaviour

One-Way Analysis of Variance from Group D data

```
Analysis of Variance for Behaviour
Source     DF        SS        MS        F        P
Month      11    4052.3     368.4    24.69    0.000
Error   42349  631944.6      14.9
Total   42360  635996.9

                                    Individual 95% CIs For Mean
                                    Based on Pooled StDev
Level       N      Mean     StDev  -+---------+---------+---------+-----
 1       4031     2.486     3.629  (--*--)
 2       4048     2.585     3.762     (--*--)
 3       3643     2.652     3.741      (--*--)
 4       3787     2.826     3.839           (--*--)
 5       3537     2.733     3.745        (--*---)
 6       3241     2.893     3.887            (--*---)
 7       3512     3.003     3.884               (--*--)
 8       3259     3.033     3.896               (---*--)
 9       3361     3.052     3.834                (--*---)
10       3380     3.262     4.017                     (---*--)
11       3301     3.306     4.011                      (---*--)
12       3261     3.579     4.177                              (--*---)
                                   -+---------+---------+---------+-----
Pooled StDev =    3.863          2.40      2.80      3.20      3.60
```

One-Way Analysis of Variance from Group E data

```
Analysis of Variance for Behaviour
Source     DF        SS        MS        F        P
Month      11    5801.6     527.4    38.04    0.000
Error   56401  781985.3      13.9
Total   56412  787786.8

                                    Individual 95% CIs For Mean
                                    Based on Pooled StDev
Level       N      Mean     StDev  ---+---------+---------+---------+---
 1       5514     2.109     3.410  (--*--)
 2       5268     2.263     3.614      (--*--)
 3       4827     2.244     3.511     (--*--)
 4       5157     2.353     3.627        (--*--)
 5       4630     2.446     3.685           (--*--)
 6       4236     2.450     3.645           (--*--)
 7       4638     2.563     3.693              (--*--)
 8       4465     2.668     3.790                 (--*--)
 9       4484     2.893     3.933                       (--*--)
10       4393     2.874     3.903                     (--*--)
11       4489     2.951     3.923                       (--*--)
12       4312     3.193     4.029                              (--*--)
                                   ---+---------+---------+---------+---
Pooled StDev =    3.724           2.10      2.45      2.80      3.15
```

Appendix 4

Further Analysis From Chapter 11

'Results 3 - Achievement and Progress in Reading and Mathematics'

Further Analysis of Developed Ability Scores

Based on analysis of data from Group C. A t-test showed a significant difference between the mean score of each behaviour sub-group and the group of children with zero scores on the behaviour rating scale ($p \leq 0.01$ for the Combined group, $p \leq 0.01$ for the Predominantly Inattentive group and $p \leq 0.05$ for the Predominantly Hyperactive/Impulsive group.)

The size of the difference between the developed ability of children from Group C with high scores and children with zero scores on the behaviour rating scale are expressed as Effect Sizes in Table 57.

Table 57 Effect Sizes For Developed Ability

Behaviour Group	Group C
Combined	-0.81
Predominantly Inattentive	-0.94
Predominantly Hyperactive/Impulsive	-0.18

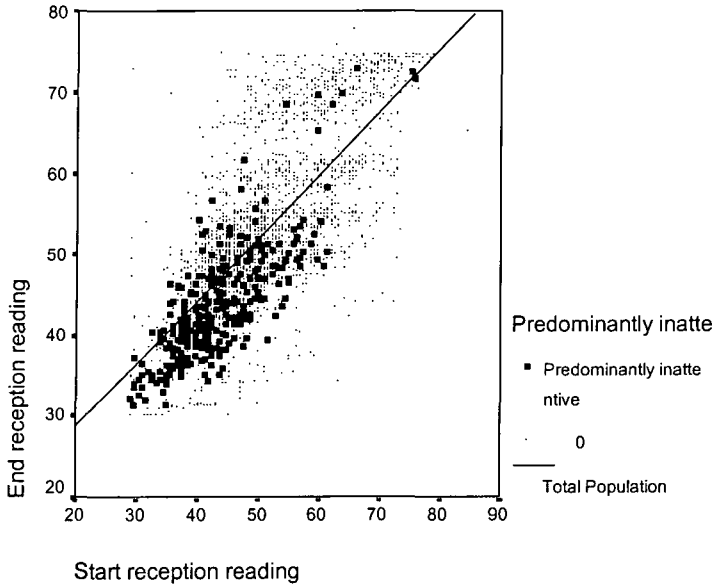
Scatterplots of Reading and Mathematics Residuals

The graphs below are plots of the z scores for reading and mathematics between the start of reception to the end of reception, and the end of reception to year 2, for children in Group C with high scores and zero scores on the Predominantly Inattentive and Predominantly Hyperactive/Impulsive sub-scales of the behaviour rating scale.

Reading and mathematics achievement (z scores) have also been plotted against developed ability (z scores). The line of best fit has been plotted on each graph and then the children with high scores on the behaviour rating scale have been highlighted against this line.

Reading - Predominantly Inattentive sub-scale

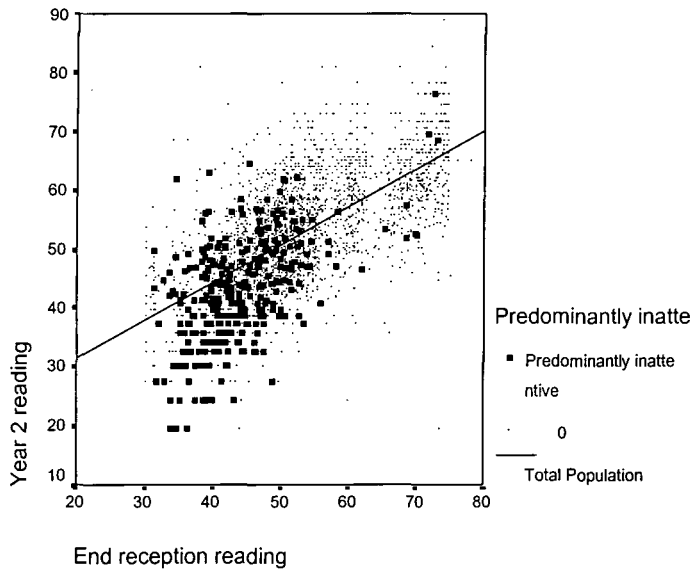
Graph 42 Start of reception reading (z score) against end of reception reading (z score) highlighting children with high scores on the Predominantly Inattentive sub-scale from Group C



Graph 42 demonstrates how many children with high scores on the Predominantly Inattentive sub-scale of the behaviour rating scale are not

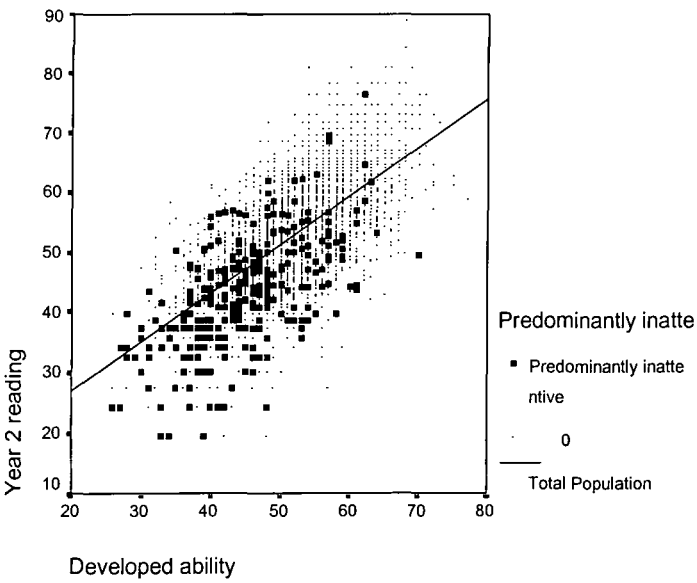
making as much progress in reading during the reception year as children with zero scores on the behaviour rating scale.

Graph 43 End of reception reading (z score) against Year 2 reading (z score) highlighting children with high scores on the Predominantly Inattentive sub-scale for Group C



Graph 43 shows many children with high scores on the Predominantly Inattentive sub-scale falling further behind their peers by Year 2 in terms of reading achievement.

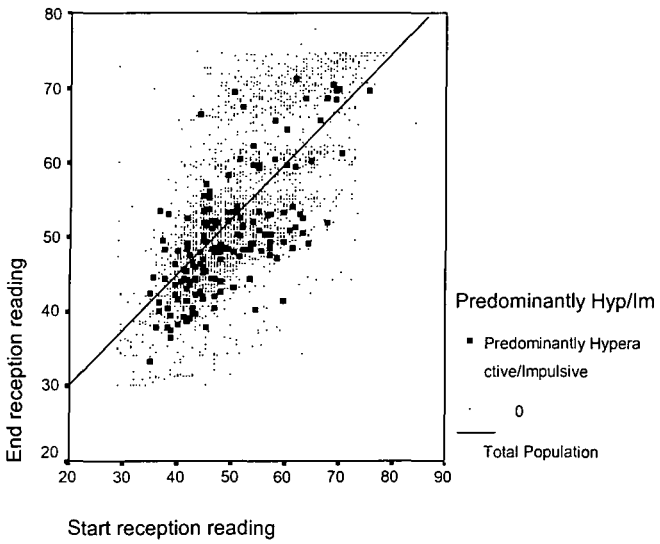
Graph 44 Year 2 reading (z score) against developed ability (z score) highlighting children with high scores on the Predominantly Inattentive sub-scale for Group C



Graph 44 demonstrates the extent to which many children with high scores on the Predominantly Inattentive sub-scale are underachieving in reading given their developed ability.

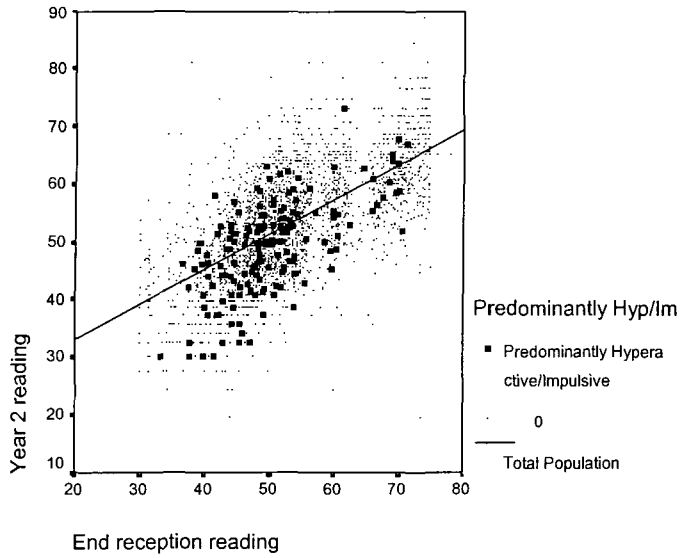
Reading – Predominantly Hyperactive/Impulsive sub-scale

Graph 45 Start of reception reading (z score) against end of reception reading (z score) highlighting children with high scores on the Predominantly Hyperactive/Impulsive sub-scale from Group C



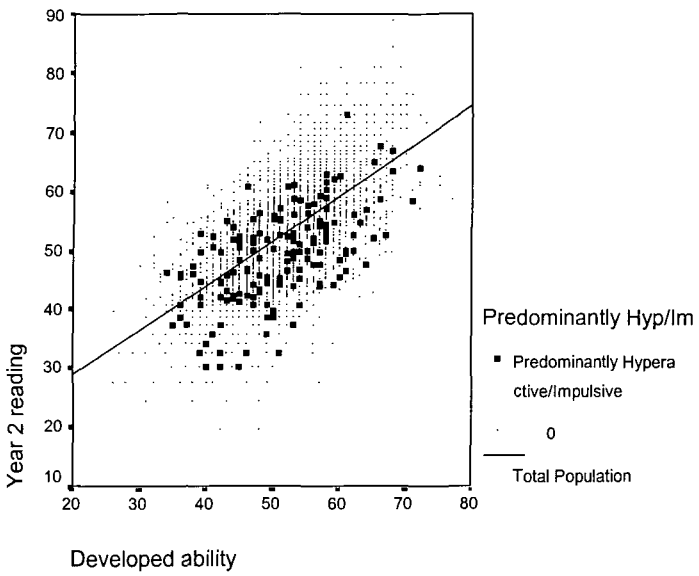
Compared to the reading achievement of children with high scores on the Combined and Predominantly Inattentive sub-scales, far fewer of the children with high scores on the Predominantly Hyperactive/Impulsive sub-scale were achieving lower reading scores than the children with zero scores at the end of reception.

Graph 46 End of reception reading (z score) against Year 2 reading (z score) highlighting children with high scores on the Predominantly Hyperactive/Impulsive sub-scale for Group C



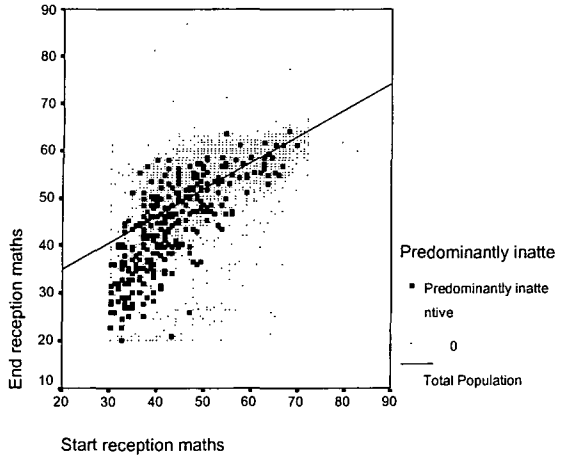
Again, by year 2 many of the children with high scores on the Predominantly Hyperactive/Impulsive sub-scale are achieving reading scores as good as or better than children with zero scores of the same ability at the end of reception.

Graph 47 Year 2 reading (z score) against developed ability (z score) highlighting children with high scores on the Predominantly Hyperactive/Impulsive sub-scale for Group C

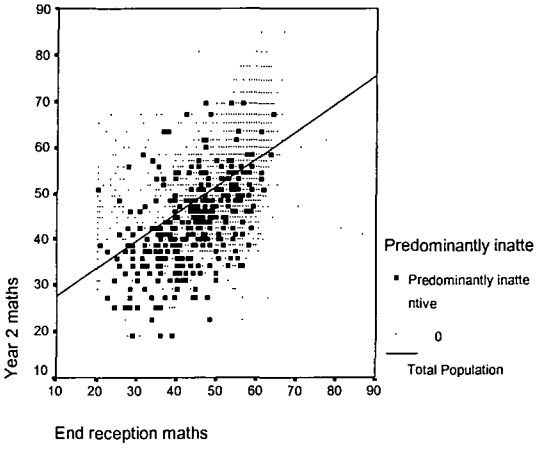


In terms of developed ability, many children with high scores on the Predominantly Hyperactive/Impulsive sub-scale were underachieving in reading at the end of year 2. Interestingly, very few of the children with high scores on the Predominantly Hyperactive/Impulsive sub-scale had low developed ability scores (i.e. more than one standard deviation below the mean) compared to children with high scores on the Combined and Predominantly Inattentive sub-scales.

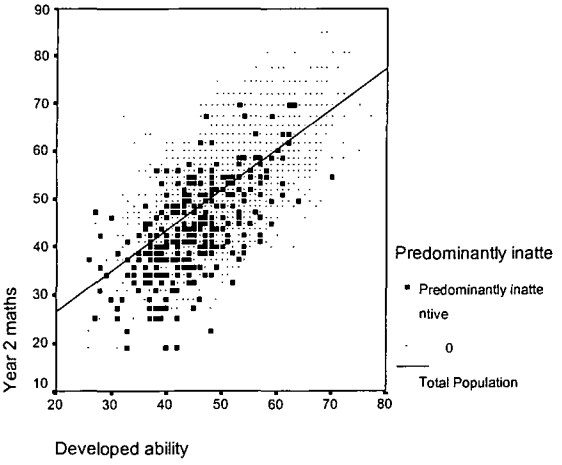
Graph 51 Start of reception maths (z score) against end of reception maths (z score) highlighting children with high scores on the Predominantly Inattentive sub-scale from Group C



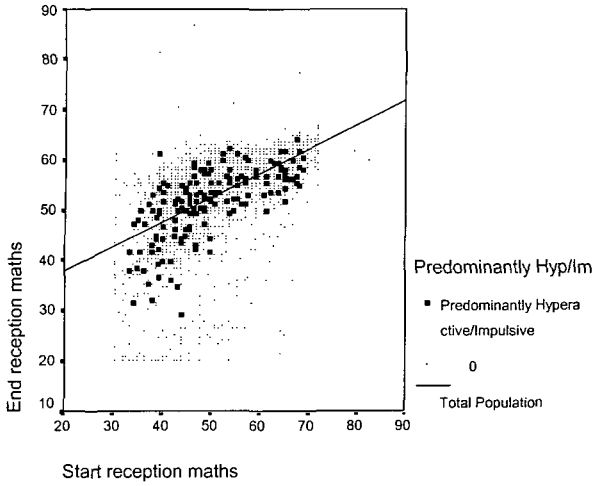
Graph 52 End of reception maths (z score) against Year 2 maths (z score) highlighting children with high scores on the Predominantly Inattentive sub-scale for Group C



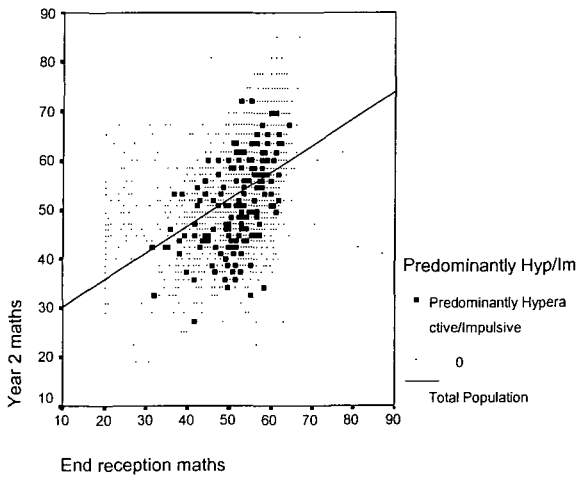
Graph 53 Year 2 maths (z score) against developed ability (z score) highlighting children with high scores on the Predominantly Inattentive sub-scale for Group C



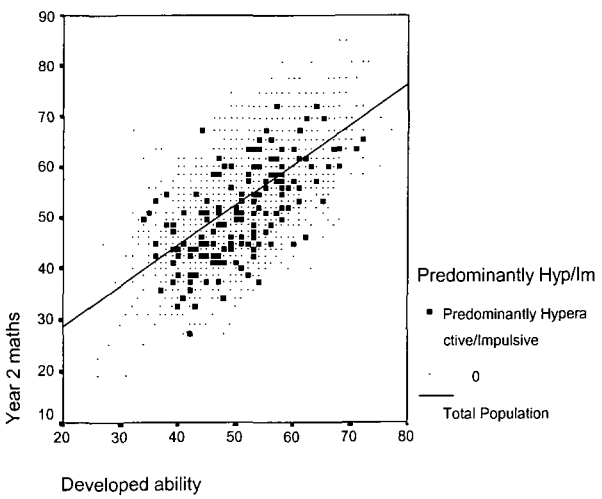
Graph 54 Start of reception maths (z score) against end of reception maths (z score) highlighting children with high scores on the Predominantly Hyperactive/Impulsive sub-scale from Group C



Graph 55 End of reception maths (z score) against Year 2 maths (z score) highlighting children with high scores on the Predominantly Hyperactive/Impulsive sub-scale for Group C



Graph 56 Year 2 maths (z score) against developed ability (z score) highlighting children with high scores on the Predominantly Hyperactive/Impulsive sub-scale for Group C



Appendix 5

Conners CPT variable descriptions

Conners CPT variable descriptions

Hits The number and percentage of correct responses to targets (all letters except X) responded to correctly.

Omissions The number and percentage of targets presented and not responded to. High omission errors therefore suggest poor attention to the task.

Commissions The number and percentage of times the space bar or mouse was pressed in response to non-targets (the letter X). A high number of commission errors suggest hyperactive and impulsive tendencies.

Hit RT The mean reaction time (milliseconds) for responses to target letters. High errors and reaction times indicate inattention. A very high T-score indicates fast response times which when considered alongside the other variables is often an indicator of hyperactivity and impulsivity.

Commission RT The mean time for responses to non-targets (letter X) in milli-seconds.

Hit RT Standard Error Measures the standard error for correct responses (hits). This shows the consistency of the response times. Inconsistent responses yield high T-scores which indicate inattention.

Attentiveness (d') This value indicates how well an individual can discriminate between targets and non-targets (their perceptual sensitivity).

Risk taking (β) Individuals who are cautious and choose not to respond very often will obtain high T-scores. High T-scores may also be a result of inattentive individuals who are easily distracted from the task. Risk taking, impulsive individuals will obtain low T-scores.

Hit RT block change The assessment is divided into six separate time blocks. The hit RT block change reports the slope of change over the six time blocks. A positive slope results from a slowing reaction time and indicates inattention. A negative slop results from a quicker reaction time as the test progresses.

Hit SE block change This is the slope of change in reaction time standard errors over the 6 time blocks. A positive slope means that the reaction time become less consistent as the test progresses, once again an indicator of inattention. A negative slope means that reaction times become more consistent as the test progresses.

Hit RT ISI change The targets are presented at three different time intervals (ISI's) – 1, 2 and 4 seconds. The hit RT ISI change is the slope of change in reaction times over the three ISI's. A positive slope means that the responses of an individual become slower as the interval between the targets increases. A negative slope means that the responses of an individual become more consistent as the test progresses.

Hit SE ISI change The slope of change in reaction time standard errors over the three ISI's. A positive slope means that reaction times become more erratic as the time between targets increases. A negative slope means that responses become increasingly consistent as the time between targets increases.

Overall Index This is a weighted sum of all the measures. A score greater than 8 indicates a good overall performance. Scores between 8 and 11 indicate a borderline performance. Scores greater than 11 indicate a poor performance and possible problems with attention.

Appendix 6

Tables of Scores from Section 2 of Survey 1

The number and percentage of scores for each item on the questionnaire are presented in the tables below:

Table 110 Survey 1 questionnaire results from teachers in relation to children with zero scores on the behaviour rating scale (Zero group).

Question	Rating					
	0	**1**	**2**	**3**	**4**	**5**
1	60.7% (n=17)	3.6% (n=1)	7.1% (n=2)	7.1% (n=2)	21.4% (n=6)	0%
2	60.7% (n=17)	3.6% (n=1)	7.1% (n=2)	3.6% (n=1)	10.7% (n=3)	14.3% (n=4)
3	71.4% (n=20)	0%	7.1% (n=2)	3.6% (n=1)	14.3% (n=4)	3.6% (n=1)
4	28.6% (n=8)	0%	0%	25.0% (n=7)	28.6% (n=8)	17.9% (n=5)
5	25.0% (n=7)	7.1% (n=2)	17.9% (n=5)	14.3% (n=4)	32.1% (n=9)	3.6% (n=1)
6	25.0% (n=7)	0%	25.0% (n=7)	21.4% (n=6)	21.4% (n=6)	7.1% (n=2)
7	71.4% (n=20)	3.6% (n=1)	3.6% (n=1)	10.7% (n=3)	3.6% (n=1)	7.1% (n=2)
8	85.7% (n=24)	0%	3.6% (n=1)	3.6% (n=1)	0%	7.1% (n=2)
9	75.0% (n=21)	0%	3.6% (n=1)	0%	14.3% (n=4)	7.1% (n=2)
10	35.7% (n=10)	3.6% (n=1)	7.1% (n=2)	3.6% (n=1)	21.4% (n=6)	28.6% (n=8)
11	39.3% (n=11)	3.6% (n=1)	0%	10.7% (n=3)	10.7% (n=3)	35.7% (n=10)
12	50.0% (n=14)	3.6% (n=1)	0%	14.3% (n=4)	7.1% (n=2)	25.0% (n=7)
13	35.7% (n=10)	3.6% (n=1)	3.6% (n=1)	17.9% (n=5)	10.7% (n=3)	28.6% (n=8)

Table 111 Survey 1 questionnaire results from teachers of children with high scores on both subscales of the behaviour rating scale (Combined group).

Question	Rating					
	0	1	2	3	4	5
1	18.0% (n=16)	7.9% (n=7)	32.6% (n=29)	22.5% (n=20)	15.7% (n=14)	3.4% (n=3)
2	13.5% (n=12)	1.1% (n=1)	21.3% (n=19)	30.3% (n=27)	23.6% (n=21)	10.1% (n=9)
3	40.4% (n=36)	6.7% (n=6)	14.6% (n=13)	22.5% (n=20)	13.5% (n=12)	2.2% (n=2)
4	12.4% (n=11)	9.0% (n=8)	23.6% (n=21)	20.2% (n=18)	24.7% (n=22)	10.1% (n=9)
5	4.4% (n=4)	35.7% (n=30)	29.2% (n=26)	20.2% (n=18)	12.4% (n=11)	0%
6	9.0% (n=8)	16.9% (n=15)	38.2% (n=34)	21.3% (n=19)	12.4% (n=11)	2.2% (n=2)
7	49.4% (n=44)	6.7% (n=6)	20.2% (n=18)	11.2% (n=10)	9.0% (n=8)	3.4% (n=3)
8	62.9% (n=56)	3.4% (n=3)	15.7% (n=14)	10.1% (n=9)	6.7% (n=6)	1.1% (n=1)
9	27.0% (n=24)	4.5% (n=4)	14.6% (n=13)	25.8% (n=23)	24.7% (n=22)	3.4% (n=3)
10	6.7% (n=6)	1.1% (n=1)	19.1% (n=17)	21.3% (n=19)	31.5% (n=28)	20.2% (n=18)
11	19.1% (n=17)	1.1% (n=1)	15.7% (n=14)	22.5% (n=20)	22.5% (n=20)	19.1% (n=17)
12	24.7% (n=22)	3.4% (n=3)	25.8% (n=23)	21.3% (n=19)	16.9% (n=15)	7.9% (n=7)
13	29.2% (n=26)	6.7% (n=6)	14.6% (n=13)	15.7% (n=14)	23.6% (n=21)	10.1% (n=9)

Table 112 Survey 1 questionnaire results from teachers of children with high scores on the predominantly inattentive subscale of the behaviour rating scale (Predominantly Inattentive group).

Question	Rating					
	0	1	2	3	4	5
1	39.5% (n=17)	11.6% (n=5)	23.3% (n=10)	18.6% (n=8)	4.7% (n=2)	2.3% (n=1)
2	23.3% (n=10)	4.7% (n=2)	16.3% (n=7)	20.9% (n=9)	23.3% (n=10)	11.6% (n=5)
3	46.5% (n=20)	2.3% (n=1)	18.6% (n=8)	20.0% (n=9)	9.3% (n=4)	2.3% (n=1)
4	18.6% (n=8)	7.0% (n=3)	16.3% (n=7)	25.6% (n=11)	30.2% (n=13)	2.3% (n=1)
5	11.6% (n=5)	11.5% (n=5)	20.9% (n=9)	30.2% (n=13)	20.9% (n=9)	4.7% (n=2)
6	16.3% (n=7)	4.7% (n=2)	27.9% (n=12)	32.6% (n=14)	14.0% (n=6)	4.7% (n=2)
7	53.5% (n=23)	9.3% (n=4)	16.3% (n=7)	7.0% (n=3)	9.3% (n=4)	4.7% (n=2)
8	69.8% (n=30)	2.3% (n=1)	9.3% (n=4)	7.0% (n=3)	9.3% (n=4)	2.3% (n=1)
9	48.8% (n=21)	4.7% (n=2)	7.0% (n=3)	16.3% (n=7)	18.6% (n=8)	4.7% (n=2)
10	11.6% (n=5)	0%	4.7% (n=2)	25.6% (n=11)	32.6% (n=14)	25.6% (n=11)
11	16.3% (n=7)	2.3% (n=1)	9.3% (n=4)	20.9% (n=9)	30.2% (n=13)	20.9% (n=9)
12	32.6% (n=14)	4.7% (n=2)	7.0% (n=3)	20.9% (n=9)	23.3% (n=10)	11.6% (n=5)
13	32.6% (n=14)	2.3% (n=1)	7.0% (n=3)	14.0% (n=6)	25.6% (n=11)	18.6% (n=8)

Table 113 Survey 1 questionnaire results from teachers of children with high scores on the predominantly inattentive/hyperactive subscale of the behaviour rating scale (Predominantly Hyperactive/Impulsive group).

Question	Rating					
	0	1	2	3	4	5
1	21.9% (n=7)	6.3% (n=2)	25.0% (n=8)	12.5% (n=4)	28.1% (n=9)	6.3% (n=2)
2	25.0% (n=8)	0%	18.8% (n=6)	18.8% (n=6)	25.0% (n=8)	12.5% (n=4)
3	43.8% (n=14)	3.1% (n=1)	15.6% (n=5)	15.6% (n=5)	15.6% (n=5)	6.3% (n=2)
4	12.5% (n=4)	3.1% (n=1)	15.6% (n=5)	25.0% (n=8)	25.0% (n=8)	18.6% (n=6)
5	9.4% (n=3)	9.4% (n=3)	28.1% (n=9)	28.1% (n=9)	21.9% (n=7)	3.1% (n=1)
6	15.6% (n=5)	6.3% (n=2)	18.8% (n=6)	18.8% (n=6)	34.4% (n=11)	6.3% (n=2)
7	59.4% (n=19)	3.1% (n=1)	9.4% (n=3)	9.4% (n=3)	18.8% (n=6)	0%
8	62.5% (n=20)	0%	9.4% (n=3)	12.5% (n=4)	9.4% (n=3)	6.3% (n=2)
9	21.9% (n=7)	0%	15.6% (n=5)	18.8% (n=6)	31.3% (n=10)	12.5% (n=4)
10	9.4% (n=3)	6.3% (n=2)	3.1% (n=1)	21.9% (n=7)	40.6% (n=13)	18.8% (n=6)
11	9.4% (n=3)	6.3% (n=2)	9.4% (n=3)	18.8% (n=6)	31.3 (n=10)	25.0% (n=8)
12	25.0% (n=8)	9.4% (n=3)	3.1% (n=1)	37.5% (n=12)	15.6% (n=5)	9.4% (n=3)
13	31.3% (n=10)	0%	15.6% (n=5)	18.8% (n=6)	21.9% (n=7)	12.5% (n=4)