

**INVESTIGATING THE IMPACT OF A WHOLE SCHOOL
INTERVENTION ON CHILDREN'S EXECUTIVE FUNCTION
AND ATTENTION SKILLS**

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ACRONYMS

ADHD	Attention Deficit Hyperactivity Disorder
ASD	Autism Spectrum Disorder
DfEE	Department for Education and Employment
DfES	Department for Education and Skills
EMBASE	Excerpta Medical Database
EP	Educational Psychologist
ERIC	Education Resource Information Centre
fMRI	Functional Magnetic Resonance Imaging
INSET	In-Service Education and Training
MEDLINE	Medical Literature Analysis and Retrieval System Online
NEPSY	Neuropsychological Assessment
NEPSY-II	Neuropsychological Assessment (Second Edition)
NICE	National Institute of Clinical Excellence
PET	Positron Emission Topography
PFC	Pre-frontal Cortex
SEAL	Social and Emotional Aspects of Learning
SEF	Self Evaluation Form
SENCO	Special Educational Needs Co-ordinator
TEA-Ch	Test of Attention for Children
TEP	Trainee Educational Psychologist
WCST	Wisconsin Card Sorting Task

ABSTRACT

Educational Psychologists (EPs) are often asked to see children that may have difficulties with attention or children with impairments in executive function. Research suggests that there is a link between attention and executive function. There is research evidence linking Attention Deficit Hyperactivity Disorder (ADHD) with executive function difficulties. It is proposed that there will be a link between primary school children's attention and executive function skills as measured by standardised assessment.

The present study involved assessing 31 participants on subtests of the Test of Everyday Attention in Children (TEA-Ch) (to gain a measure of attention) and the Neuropsychological Assessment (Second Edition) (NEPSY-II) (to gain a measure of executive function). Participants were aged between 6;01 and 10;08 (mean 8;06) when they were assessed at the pre-intervention stage. Participants were all from one primary school in the North West of England. Significant correlations between participants' performance on the TEA-Ch and NEPSY-II were found.

There is some research evidence that executive function interventions can improve children's executive functions, but this is at the individual case level. There were no studies identified that looked at whole school executive function interventions. Executive function staff training was developed and delivered to teachers and teaching assistants in the primary school. A supporting pack of written materials was produced to help staff. Evaluation questionnaires and staff interviews identified useful aspects of the training. It is proposed that the consultation model of training delivery was particularly important. Staff interviews indicated that interventions had been carried out at the whole school and class level.

Participants were reassessed at the post-intervention stage using the TEA-Ch and the NEPSY-II. Results indicated significant improvements in both attention and executive function skills for participants overall. Wilcoxon Signed Rank tests identified that there were significant increases in participants' mean TEA-Ch and mean NEPSY scores following the whole school intervention. The results suggest the intervention may have been most successful in improving children's selective attention, response inhibition, flexibility and task initiation skills.

DECLARATION

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DEDICATION

Firstly thank you to the children and the staff for taking part.

Thank you to Kevin Woods for his guidance and support throughout the course, particularly during the planning, and writing up of the present study. Thank you also to the rest of the Doctorate in Educational and Child Psychology course members for all their support.

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THE AUTHOR

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CHAPTER 1: INTRODUCTION

1.1 Aims of the study

This study aims to look at the link between executive function and general attention difficulties, using the Neuropsychological Assessment (Second Edition) (NEPSY-II) and the Test of Attention in Children (TEA-Ch); develop and deliver a whole school executive function intervention through staff training; and look at the impact on children's attention and executive functions following intervention.

1.2 Key research questions

1. What is the link between primary school children's attention skills and executive function skills as measured by standardised assessment?
2. What is useful about executive function staff training sessions?
3. What impact do executive function staff training sessions have on primary school children's attention skills and executive function skills as measured by standardised assessment?

1.3 Rationale

1.3.1 Why executive function and attention are important concepts for EPs

Executive function and attention difficulties are important concepts for Educational Psychologists (EPs). EPs are often asked to see children or carry out consultations involving children who have some level of attention difficulties. There is an important role for EPs to play in advising schools on how to manage attention difficulties and in suggesting interventions that may help to improve children's attention. Previous research carried out by a Trainee Educational Psychologist (TEP), (Hedges, unpublished) looked at the role of the EP in working with children with Attention Deficit Hyperactivity Disorder (ADHD). This research involved asking EPs in one local authority their views about their role in relation to ADHD. The results suggested that EPs feel they have a role to play in working with schools, children and families in relation to ADHD. The EPs that took part in the research saw a role for themselves in assessment, intervention, consultation and training. One of the interesting results of this research was that EPs felt that the individual child's needs were far more important than the label given to their difficulties. The study revealed that EPs would use similar interventions for children referred to them with attention difficulties, whether or not

that child had a diagnosis of ADHD. Given the number of children referred to educational psychology services with attention difficulties, looking at interventions that may be helpful for children with general attention difficulties is potentially very important.

When considering the importance of executive functions for the EP profession it is useful to look at the role that Neuropsychology, as a whole, should play in EP practice. Mackay (2005) examined the relationship between applied educational psychology and clinical neuropsychology. He argues that neuropsychology should be seen as an integral part of EP practice rather than a 'bolt-on' area. He identified several reasons why neuropsychology is becoming increasingly important for EPs. Firstly, the developments in technology, such as positron emission topography (PET) scans and functional magnetic resonance imaging (fMRI), have led to a new way to study brain-behaviour relationships. Secondly, there is an increased awareness of the role neuropsychology plays in areas within which EPs increasingly work such as reading and spelling difficulties, language and memory problems and autism. Thirdly, the new information available means that neuropsychology can increasingly inform EP practice. Neuropsychology has played a role in the development of psychological theories such as the theory of mind, central coherence and executive function. Due to advances in medical technology, children and babies that would have previously died due to disorders, injuries, or illnesses are now surviving but with special educational and health needs. Mackay believes that we should view neuropsychology as '*an essential and shared knowledge and practice base for educational psychology*' (p15). He concludes '*It is not so much a question for EPs of 'can we use Neuropsychology in our practice?' as 'are we fully competent to practise without it?'*' (p15).

Gioia and Isquith (2004) highlight the importance of executive functions for children:

'The executive functions are a critically important area of neuropsychological function in the developing child. These neuropsychological mechanisms of regulatory control play fundamental roles in the child's cognitive, behavioural, and social-emotional development. The level of executive functions, whether intact or impaired, has substantial implications for everyday social and academic function' (p136).

Impairments in executive function have been found in children with spina bifida and hydrocephalus (Burmeister, Hannay, Copeland, Fletcher, Boudousquie and Dennis, 2005), schizophrenia (Goldberg, Egan, Gscheidle, Cappola, Weickert and Kolachana, 2003), autism spectrum disorders (Ozonoff and Jensen, 1999), traumatic brain injury (Hanten, Bartha and Levin, 2000), foetal alcohol syndrome (Connor, Sampson, Bookstein, Barr and Streissguth, 2000), meningitis (Taylor, Schatschneider, Petrill, Barry and Owens, 1996), epilepsy (Stores, 1978), phenylketonuria (Welsh, Pennington, Ozonoff, Rouse and McCabe, 1990), malignancies (Brouwers and Poplack, 1990), very low birth weight (Taylor, Hack, Klein and

Schatschneider, 1995), heavy lead burden (Needleman, 1992), and ADHD (Barkley, Grodzinsky and DuPaul, 1992). EPs may be asked to see children with any number of these conditions, which makes learning about executive functions potentially very important for the profession.

EPs may often be asked to see children with attention difficulties or children with impairments in executive function. Learning about these concepts and interventions that may be useful in helping children to develop their skills in these areas is therefore both relevant and important for EPs.

1.4 Origins of the study

The researcher's interest in exploring the link between attention and executive function developed following a piece of casework with a Year 3 child who did not have a diagnosis of ADHD but did have significant difficulties with both attention and executive function which were impacting on her school experience.

During a planning meeting at a primary school in the authority in which the researcher is currently based as a TEP, the Special Educational Needs Co-ordinator (SENCO) discussed concerns that there were a high number of children in the school who appeared to have some difficulties with attention. The study started to evolve following initial consultations about how the school and the researcher could work together to help children across the school develop their attention skills.

1.5 Distinctive Contribution

There is research evidence that links difficulties in executive functions with ADHD, which will be discussed in more detail in chapter two (e.g. Pennington and Ozonoff, 1996; Seidman, Biederman, Monuteaux, Valera, Doyle and Farone, 2005). An extensive literature search identified two studies that looked at general attention and executive functions in children (rather than looking at links in children with an ADHD diagnosis). Hrabok, Kearns and Müller (2006) assessed the vigilance, orienting and executive attention networks in 4 year old children. Klenberg, Korkman and Lahti-Nuutila (2001) looked at the developmental sequences of attention and executive functions in 3 to 12 year old Finnish children. No studies were located that looked at the executive functioning skills of primary school children with general attention difficulties, without a diagnosis of ADHD. The first research question aims to fill this gap by exploring links between primary school children's attention skills and their executive function skills

Although there is some literature that discusses executive function interventions in children, the majority of these interventions are carried out with individual children and are highlighted as case studies. There were no studies located that looked at whole school executive function interventions. The second and third research questions aim to fill this gap by developing, delivering and evaluating the effect of whole staff executive function training.

1.6 Epistemological position

The epistemological position taken throughout this research is a post-positivist one. Muijs (2004) suggest that the epistemology traditionally underlying quantitative research was '*realist*' or '*positivist*' (p4). The positivist view is that there is an existing reality which can be uncovered by research. Langdrige and Hagger-Johnson (2009) state that '*the goal for positivists is to provide objective knowledge about the world (or people living in the world)*' (p363). Post-positivists do not take as extreme a world view as positivists. Muijs (2004) states that post-positivists '*believe that we should try and approximate reality as best we can, whilst realising our own subjectivity is shaping that reality*' (p5). The current study is predominately quantitative with standardised assessments being used to measure attention and executive function.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter aims to critically evaluate literature in two areas. Firstly literature relating to possible links between executive function and attention skills and secondly literature relating to executive function interventions.

In order to conduct the literature review, several searches were made across a number of databases. The databases used were Excerpta Medical Database (EMBASE), Medical Literature Analysis and Retrieval System Online (MEDLINE), Psychinfo, Web of Science, Cochrane Library, Science Direct, Australian Education Index, British Education Index, Education: A Sage Full-text Collection and Education Resource Information Centre (ERIC). Searches used included 'Executive Functions', 'Executive Functions and Attention', 'Executive Dysfunction', 'Executive Functions and children', 'Executive Function and ADHD' and 'Executive Function Interventions'. Searches were also carried out using these terms within some journals such as Developmental Neuropsychology, Educational Psychology in Practice and Child Neuropsychology. A search was also made on 'Google Scholar' using the same terms. A search for books was made on the University of Manchester library catalogue and also on Amazon. This identified several key texts which have also been used to form part of the literature review.

This chapter begins by exploring definitions (section 2.2) and proposed models of executive functions (section 2.3). A definition of attention is given in section 2.4 and the literature relating to the development of executive function and attention skills is explored in section 2.5. Current research exploring the relationship between ADHD and executive function difficulties is identified and discussed in section 2.6. This is followed by a discussion of the literature relating to the links between the concepts of attention and executive functions in section 2.7. Section 2.8 explores literature relating to the methodological problems in assessing attention and executive functions.

The chapter then moves on to discuss the current literature relating to executive function interventions. This section (2.9) starts by looking at literature relating to the importance of intervention for children with attention difficulties and for children with executive function difficulties. Studies that have identified executive function interventions are included and the impact of these interventions is discussed. This section finishes by looking at intervening through school staff training and the role of the EP in delivering this training is discussed. Finally, a summary of the literature review is provided in section 2.10

2.2 Executive function definitions

'Executive function' is a term now commonly used in neuropsychological literature. Most people involved in research into executive functions agree that neurological control of these functions emanates from the frontal lobes. Greene, Braet, Johnson and Bellgrove (2007) state the development of executive functions (in evolutionary terms) *'has in large part paralleled the development of the frontal lobe of the human brain'* (p30). McCloskey, Perkins and Van Divner (2009) recognise *'executive function capacities follow a development progression dependent on the maturation of the neural circuitry of the frontal lobes'* (p184). Studies using PET scans and fMRI have suggested a link between the frontal lobes and executive functions (Smith and Jonides, 1999). This has led to some using the term 'frontal lobe behaviours' and 'executive functions' interchangeably. Struss and Alexander (2000) have suggested that this interchangeable use of terms is a major problem, as the relationship between executive functions and the frontal lobe is not fully understood. For the purposes of this research the term executive function will be used throughout, as the focus is on executive functions at the behavioural level, rather than the anatomical level.

There are many different definitions of executive function proposed in the literature. Grattan and Eslinger (1992) describe executive functions as:

'cognitive and self-regulatory processes which include cognitive flexibility, impulse control, synthesis of multiple pieces of information across time and space, divergent production of ideas and alternatives, decision making, planning and regulation of goal directed activity' (p192).

Miyake, Friedman, Emerson, Witski, Howerter and Wager (2000) define executive functions as *'general-purpose mechanisms that modulate the operation of various cognitive sub processes and thereby regulate the dynamics of human cognition'* (p50). They recognise that there is not yet a comprehensive theory of executive functions. They investigated whether executive functions could be seen as a unitary concept. They looked at the separability of three executive functions; shifting, inhibition, and updating. They found that all three of these tasks had an underlying commonality and were moderately correlated, but could be seen as separable constructs. The results of the study suggest that different executive functions may contribute to a different extent depending on the task undertaken.

Synder, Maruff, Pietrzak, Cromer and Synder (2007) describe executive functions as an *'umbrella term'*. They talk about executive functions being about the effort that is made in situations where several cognitive processes are needed simultaneously. They suggest that the components of executive function include the organisation of attentional resources, inhibition and monitoring behaviour.

Marcovitch and Zelazo (2009) describe the term executive functions as '*self-regulatory behaviours necessary to sustain attention and guide behaviour within the context of goals and rules*' (p1).

Meltzer (2007) suggests that there is a general agreement that executive function is an '*umbrella term for the complex cognitive processes that serve ongoing, goal directed behaviours*' (p1). Meltzer claims most definitions include many of the following elements:

- Goal setting and planning;
- Organisation of behaviours over time;
- Flexibility;
- Attention and memory systems that guide these processes (e.g. working memory);
and
- Self-regulatory processes such as self-monitoring.

Dawson and Guare (2004) use the term '*executive skills*' when defining executive functions. They describe executive skills as something that helps us to regulate our behaviour. These skills include:

- Planning;
- Organisation;
- Time Management;
- Working Memory;
- Sustained Attention;
- Metacognition;
- Response Inhibition;
- Self-regulation of affect;
- Task initiation;
- Flexibility; and
- Goal-directed persistence.

The NEPSY-II has a domain of subtests for assessing attention and executive functions. The manual describes executive functions as '*activities necessary for achieving an objective, including strategic planning, flexibility, and the regulation of affect based on feedback from the environment*' (Korkman, Kirk and Kemp, 2007, p6). The key constructs measured by the NEPSY-II in the domain of executive functioning are inhibition, initiation, cognitive flexibility, planning, selective attention, sustained attention and distractibility.

The definition given by Dawson and Guare will be used throughout this study, as it includes the executive functions identified by the NEPSY-II, which will be used as an assessment tool and is linked to intervention ideas published by Dawson and Guare in their 2004 book; *Executive skills in children and adolescents: A practical guide to assessment and intervention* and their 2009 book; *Smart but Scattered*.

2.3 Models of Executive Function

Recently proposed models of executive function indicate that executive functions should not be seen as a unitary concept. Struss and Alexander (2000) carried out a study using patients with focal lesions of the frontal lobes. They carried out a number of different tasks with the patients designed to tap into memory, attention, verbal fluency and self-awareness. They compared performance on these tasks with the location of individual patient's lesions. They found that location of a patient's lesion was related to their performance on the tasks. This suggests that different executive processes are related to different regions within the frontal lobes. This adds weight to the argument that executive functions should not be seen as a unitary concept. Struss and Alexander's (2000) research suggests:

'the idea of a supervisory system is very applicable, if the emphasis is on a system constructed of multiple parts' (p291).

Struss and Alexander (2000) highlight the importance of the link between the frontal lobe and the limbic system. As noted previously, it is generally agreed that executive functions are located in the frontal lobes. The fact that the frontal lobes are very closely linked anatomically would suggest that the executive functions may also have a supervisory capacity in relation to emotion.

Barkley (1997) proposed a model of executive functions to account for the developmental sequence of executive function. The model contains five essential elements. The first of these to develop is behavioural inhibition, which involves the ability to inhibit a prepotent response, interrupt an ongoing sequence and interference control. The next to develop is nonverbal working memory. This is followed by self-regulation of affect, motivation and arousal. The next executive function to develop is the internalisation of speech. The final element is reconstitution, which enables us to solve novel problems. These five elements each contribute to directing our motor control system.

McCloskey, Perkins and Van Divner (2009) describe executive functions as:

'directive capacities that are responsible for a person's ability to engage in purposeful, organised, strategic, self-regulated, goal-directed processing of perceptions, emotions, thoughts and actions. As a collection of directive capacities, executive functions cue the use of other mental capacities such as reasoning, language and visuospatial representation' (p15).

If we accept that executive functions are independent but co-ordinated processes rather than a unitary concept, then it would follow that individuals could have very different profiles of executive function capabilities.

'..any person can have strengths and/or weaknesses in any one or more of the different executive functions, as well as variations in the integrity of the interconnections among various executive functions at any given point in time' (McCloskey, Perkins and Van Divner, 2009, p20).

An analogy used by Meltzer (2007) to explain executive function is:

'to put a cooked meal on the table, the cook needs both the ingredients and recipes for the component dishes. No meal is produced by simply setting out a bunch of ingredients; equally there is nothing to eat in a book or recitation of recipes. The "how and when" of EF is meaningless without reciprocal interaction with other cognitive and motor domains' (p16).

The NEPSY-II treats executive functions as separable constructs, giving individual scores for each of the subtests rather than an overall executive function score. This, together with the recent available literature suggests executive functions should be treated as separable from each other. The results of this research should give an indication of whether children can have varying profiles of executive function skills as measured by the NEPSY-II.

2.4 Attention Definitions

Theorists have been interested in the concept of attention since the 19th century. William James described attention in 1890:

'Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentrate, of consciousness are of its essence' (p403-404).

Attention, like executive functions, is considered to be a multi-dimensional rather than unitary concept. There are a number of different varieties of attention. Those suggested by Cohen (1993) include:

Focused or selective attention refers to directing our attention to a task or stimulus to the exclusion of other competing stimuli. An example of this type of attention would be the way we manage to hold a conversation with one person in a room where lots of people are talking to each other.

Divided attention refers to completing more than one attentional task at once. An example of this would be doing homework and watching the television at the same time. In the classroom this could be seen when a child holds a conversation with another child whilst continuing to write a story.

Sustained attention (sometimes known as vigilance) refers to sustaining focused attention to a task over a period of time. An example of this type of attention would be looking at a radar screen over a period of time in case there should be a signal of danger. In the classroom this type of attention might be employed when a child is focused on reading a book or completing a lengthy task.

Switching attention refers to the ability to switch attention back and forth between tasks. For example, children may be required to switch their attention from one activity to another in the classroom (Cohen, 1993, p4-5).

2.5 Development of Executive Function and Attention Skills

Both attention and executive function skills are thought to develop from a very early age (infancy) right through to adulthood.

The Sheridan (2008) developmental charts highlight the development of attention in children from birth to 5 years. Sustained/focused attention is thought to start developing as early as 3 months. During the first year there is a high level of distractibility towards dominant stimuli. In the second year children show rigid attention on a task of their choosing. They are resistant to interference. In the third year children develop single channelled attention. Their attention must be fully obtained in order for them to shift to a different task. In the fourth year children develop early integrated attention. They can control their own focus of attention. They need to look towards an adult in order to listen. In the fifth year children develop more mature integrated attention. They can perform an activity while listening to the adult who is giving directions. The next stage of development involves developing flexible and sustained attention.

'By 4 years of age, children are able to sustain their attention to learn, plan a sequence of actions, inhibit their impulse to respond to interesting but irrelevant attractions and manage their emotions to stay on task. They are now beginning to self-regulate their behaviour with gradually decreasing requirement for adults to guide and supervise their activities. Children mature in these abilities at different rates. Disruption in the development of self-regulation is one of the reasons for children to be disorganised, impulsive, defiant, easily frustrated and generally difficult' (Sheridan, 2008, p84).

Self-regulation and the development of attention skills are very important for success in the classroom. This information about the development of children's attention suggests that early interventions in school may be particularly important in supporting children's development of these essential skills.

Zelazo and Frye (1996) used a dimensional-change sorting card task to investigate the development of executive function skills in young children. This task involves sorting cards according to one rule and then to switch to sorting the cards according to another rule. They report that 3 year olds consistently perseverate using the first rule despite showing they have knowledge about how to use the second rule. According to their cognitive complexity and control theory, at 2 years old a child can only represent a single rule at a time. By 3 years old a child can consider two rules simultaneously but it is not until a child reaches 5 years old that he/she can represent a higher order rule that allows them to select the appropriate rule at the right time.

Klenberg et al (2001) studied the development of executive function and attention skills in 400 Finnish children aged between 3 and 12 years old. The children were assessed on age appropriate attentional and executive function subtests from the Finnish version of the NEPSY (first edition). These included measures of inhibition and control of motor responses, measures of auditory and visual attention, and measures of planning and fluency. They found a significant effect of age across all subtests. The age at which the different skills had developed was considered to be the age at which the scores levelled off so that the performance of a specific age group on specific skills did not differ from the performance of the older age groups. In the Statue subtest, which assesses the basic capacity to sustain a position and to inhibit impulses and motor responses, the levelling off occurred at 6 years old. In the Knock and Tap test, which measures self-regulation and inhibition, the levelling off occurred at 7 years old. Next was the Tower subtest which is designed to measure the executive functions of planning, monitoring, self-regulation and problem solving. Maturity was reached on this subtest at age 8. Maturity was reached on the 4 subtests designed to measure focused attention; Auditory Attention, Auditory Response Set, Visual Search and Visual Attention at the age of 10 years. The executive functions of fluency were the last to

develop. The Semantic Fluency subtest, which measures verbal fluency by assessing the ability to generate words from semantic categories, developed at age 10. The Phonemic Fluency subtest, which measures verbal fluency by assessing the ability to generate words from phonemic categories, and the Design Fluency subtest, which measures visuomotor fluency, developed at age 11. In the fluency subtests there was no levelling off in the oldest age groups which indicates that the development of these skills continues into adolescence.

The fact that this study identified inhibition as developing before auditory attention, visual attention, planning and fluency lends support to Barkley's (1997) model, in which he proposed inhibition is a prerequisite for more complex executive functions. This suggests that it will be important for any executive function intervention to include inhibition as part of the intervention process.

Dawson and Guare (2009) base their development sequence on Barkley's (1997) model and suggest that executive functions emerge in the following sequence:

1. Response Inhibition
2. Working Memory
3. Emotional Control
4. Sustained Attention
5. Task initiation
6. Planning/prioritisation
7. Organisation
8. Time management
9. Goal-directed persistence
10. Flexibility
11. Metacognition

Rebok, Smith, Pascualvaca, Mirsky, Anthony and Kellam (1997) looked at the development of attention skills in children between the ages of 8 and 13. They found that skills in focused and shifting attention increased significantly with age. The most rapid improvements were seen between the ages of 8 and 10.

The results of the Klenberg et al (2001) and the Rebok et al (1997) studies suggest that both attention and executive functions develop rapidly in middle childhood. This indicates that between the ages of 6 and 12, interventions related to executive functions and attentional skills may be particularly important. Best, Miller and Jones (2009) emphasise the importance of examining executive function throughout childhood.

McCloskey, Perkins and Van Divner (2009) suggest that although most children's executive functions develop over time, the developmental trajectory of each executive function varies between individuals. They liken the variation in the development of executive functions to the wide variation observable in children's physical development. They suggest that whilst children who differ in their physical development are not expected to perform the same in P.E classes, because executive function development is not observable physically, staff in schools may expect children of the same age to have developed the same executive functioning skills. It may therefore be important to make staff aware of the development of executive functions and the individual differences in children's development so that these differences can be accommodated for in the classroom setting.

2.6 Executive Function and ADHD

There is research evidence that suggests executive function deficits are a core part of Attention Deficit Hyperactivity Disorder (ADHD). As mentioned earlier, Barkley (1997) proposed a model linking working memory, self-regulation of affect, motivation, arousal, internalisation of speech and reconstitution with behavioural inhibition. This theory suggests that behavioural inhibition is a necessary prerequisite for those executive functions listed above. Barkley extended this model to ADHD and predicted that children with ADHD will have a deficit in behavioural inhibition, which will result in executive function difficulties.

Fuggetta (2006) assessed boys with ADHD and a control group using three executive function tasks; the dual task, shift task and spatial stimulus-response compatibility task paradigms. The results showed that the boys with ADHD were significantly impaired on all three measures of executive functioning when compared to the matched control group.

Synder, Maruff, Pietrzak, Cromer and Synder (2007) used the Groton Maze Learning Test to assess psychomotor speed, spatial memory and executive function in children with ADHD between the ages of 6 and 16 in comparison to a control group. This study also looked at differences between children with ADHD receiving stimulant medication and those who were not taking medication. They found that in comparison to the control group, unmedicated children with ADHD were moderately impaired in psychomotor speed, spatial memory and executive function. In comparison to the unmedicated children with ADHD, those children with ADHD taking stimulant medication had improved spatial memory. There were no significant differences between the executive function of the unmedicated and medicated children with ADHD.

Seidman, Biederman, Monuteaux, Valera, Doyle and Farone (2005) noted that a lot of the research into ADHD and EF deficits used samples of boys. They used a large sample of data taken from boys and girls with ADHD from two previous research samples. They found

that both boys and girls with ADHD showed significant executive dysfunctions when compared to controls. These differences were independent of psychiatric comorbidity or learning disability and were found in children between the ages of 9 and 17. There was no Sex x Diagnosis interaction in 85-90% of the variables tested, which indicated that girls and boys with ADHD, in their sample, had largely similar executive function impairments when compared with each other.

Biederman, Petty, Fried, Doyle, Spencer, Seidman, Gross, Poetzi and Faraone (2007) carried out a longitudinal follow-up study of males with ADHD. They found that the majority of participants continued to have executive function deficits into young adulthood. They emphasise the importance of early identification and intervention for executive function difficulties.

Pennington and Ozonoff (1996) reviewed the available literature relating to executive function deficits and ADHD. They located 18 studies that included a control group, explicitly tested the 'frontal hypothesis' of ADHD using cognitive tests and commonly accepted executive function measures. The 18 studies were all published in a referred journal. Of these 18 studies, 15 found that the ADHD group performed significantly worse on one or more executive function measure than the control group. In 67% of the executive function measures used across the 18 studies, the ADHD group performed significantly worse than the control group. There were no measures in which the ADHD group performed significantly better than the control group.

Wilcutt, Doyle, Nigg, Faraone and Pennington (2005) conducted a meta-analysis of 83 studies looking at executive function in children with and without ADHD. They found that groups with ADHD had significant impairments on all the executive function tasks. They state that the strongest and most consistent effects were seen in the measures of response inhibition, vigilance, working memory and planning.

There is then some evidence that executive function difficulties can be seen in both boys and girls with ADHD. The difficulties were found in children who were taking ADHD related medication as well as those children who were not receiving any medication. Executive function difficulties found were independent of psychiatric comorbidity and learning disability. Executive function difficulties have been found in those with ADHD between the ages of 6 and 17. There is some evidence that these difficulties persist, continuing into young adulthood.

2.7 Links between Executive Functions and Attention

As discussed previously, both executive functions and attention are considered to be multi-dimensional constructs. Fletcher (1998) highlights one of the conceptual issues involved in

identifying and measuring attention skills as the overlap between these concepts. Processes like inhibition are included in models of attention and executive functions.

The NEPSY-II groups executive function with attention into one domain. The manual explains that:

'Attention and executive functioning are multidimensional concepts that contain several related processes. Both concepts require self-regulatory skills and have some common sub processes; therefore, it is common to treat them together, or even to refer to both processes when talking about one or another' (Korkman, Kirk and Kemp, 2007, p6).

The TEA-Ch manual (Manly, Robertson, Anderson and Nimmo-Smith, 1999) describes a significant relationship between the 'Creature Counting' subtest (designed to measure attentional control/switching) and the Wisconsin Card Sorting Task (WCST) (used as a measure of executive function).

In the study by Klenberg et al (2001) a factor analysis was carried out using the data of the 7-12 year olds that participated. The purpose of this was to identify any independent factors that point towards the separability of attentional and executive functions. 4 factors were identified. Factor 1 represented fluency, factor 2 represented visual attention, factor 3 contained the auditory attention subtests and factor 4 represented inhibition. Klenberg et al (2001) comment that:

'The observed developmental stages, together with the results of the factor analysis, give support to both the multidimensional nature and to the overlap of attentional and EFs...Thus, though the functions are, to some extent, separable, they may be simultaneously be dependent on each other' (p425).

The literature does therefore suggest that executive function and attention are closely related. However, if we view executive functions as independent but related concepts and accept that executive functions are bidirectional in nature, then it is possible that although attention and executive function are considered to be independent but related concepts, and attention features in many definitions of executive function, an individual could have difficulties with some executive functions without having difficulties with attention. It therefore remains important to carry out research investigating the link between executive function capabilities and related concepts such as attention.

Hrabok, Kearns and Müller (2006) assessed the vigilance, orienting and executive attention networks in 4 year old children. These three attention systems were proposed by Posner and Petersen's (1990) model of attention. The operations that function in the executive attention

system are thought to resemble the construct of executive functions, including inhibition and goal-directed behaviour. As part of their study, Hrabok, Kearns and Müller (2006) looked at the relationship between performance on the lower forms of attention and the higher executive forms of attention. They found a significant correlation between the lower forms of attention proposed by Posner and Petersen (1990): vigilance and orienting. They also found significant links between the assessments used to measure the higher executive forms of attention. Although there were correlations between the lower and higher executive forms of attention, these did not reach significance at the .01 level.

This study had a number of limitations. The limited age range used in this study means it is difficult to generalise the results beyond the pre-school age. However, the study does support the suggestion that executive function skills are already beginning to develop in pre-school children. Importantly, the executive measures used to assess the children in this study were adapted from school age measures to make them suitable for the pre-school children. Hrabok et al (2006) comment that '*the executive attention measures used here were likely not pure measures of either working memory or inhibition, but instead likely recruited multiple skills, such as working memory, inhibition and problem solving*' (p418).

There is some evidence of a degree of interrelatedness between the concepts of attention and executive function. Although there has been research into the link between ADHD and executive function difficulties, there is little literature exploring the links between general attention and executive function. Hrabok, Kearns and Müller (2006) explored links between attention and executive attention in pre-school children. Klenberg et al (2001) looked at the development of executive function and attention in Finnish children between the ages of 3 and 12. No literature was identified that specifically investigated whether children with attention difficulties (without a diagnosis of ADHD) also have executive function difficulties. The first research question aims to address this gap in the literature by exploring the link between attention and executive function in children between the ages of 6 and 10. It is anticipated that there will be some correlation between children's attention and executive function skills, with children with attentional difficulties also having difficulties with executive function.

2.8 Methodological Problems in the Assessment of Attention and Executive Function

Pennington and Ozonoff (1996) highlight several difficulties in accurately measuring executive functions. As mentioned earlier, executive functions have been recently conceptualised as independent but co-ordinated processes. Tasks that have been used to measure executive functions therefore try to tap into many interacting component processes. Pennington and Ozonoff suggest that tasks such as the WCST or the Tower of Hanoi, which have been used in many research studies:

‘..appear to tap functions that are theoretically central to the prefrontal cortex (PFC). Unfortunately, they may tap multiple functions of the PFC, as well as non executive components that are unlikely to be specific to the PFC. Thus they may be poor at differentiating among different types of PFC deficits. They may also be poor at differentiating PFC deficits from non-PFC deficits’ (p56).

Other methodological problems of the WCST described include:

- differences in cognitive style or strategy potentially influencing the results, leading to potential difficulties in distinguishing between a person with intact and impaired executive functions;
- difficulties in discriminating between patients with different types of brain damage;
- difficulties in identifying people having problems at the behavioural level in everyday functioning who have been shown to perform within the normal range on the WCST; and
- ceiling problems and poor reliability in school-age populations.

Another methodological problem in the measurement of executive functioning is that many of the assessments used have been downwards extensions of tests that were designed for use in adult Neuropsychology. They may not be suitable for use with children and there is some evidence that they may not be sensitive to children’s executive functioning. (Kelly, Borrill, and Maddell, 1996). However, the NEPSY (Korkman, Kirk and Kemp, 1998) was developed specifically for use with children. A second edition of this battery of neuropsychological tests including a domain designed to assess attention and executive function was published in 2007.

Klenberg et al (2001) highlighted some difficulties in using the Tower subtest of the 1st edition of the NEPSY (Korkman, Kirk and Kemp, 1998). The Tower subtest is designed to measure the executive function of planning. However in order to complete the task, participants also need to use other attentional and executive function skills such as inhibition, working memory and visual spatial skills. The cognitive demands of the Tower task are thought to be dependent upon the strategy chosen by a participant. Differences in participants’ scores may be related to the development of cognitive functions as well as executive ones.

One of the aims of the revision of this assessment (the NEPSY-II) was *‘to improve the assessment of executive functioning, particularly with regards to inhibitory control’* (Korkman, Kirk and Kemp, 2007, p30). Subtests that were considered to have less clinical sensitivity

were removed from the second edition, including the Tower subtest. Three new executive functioning subtests have been added that were developed in the research phases of the NEPSY-II.

Another methodological problem in researching executive function and attention is that different researchers use multiple assessments to assess executive functioning and attention. It will be important for researchers in the future to use similar assessment tools so that when results are compared, researchers are clear that they are measuring the same concepts as one another. Using batteries of assessments specifically designed for use with children, that have standardised norms for children, such as the NEPSY-II and the TEA-Ch, is one way to address this methodological issue. The TEA-Ch and NEPSY-II will be used in this research study to gain a standardised measure of participants' attention and executive function.

2.9 Interventions

2.9.1 The importance of interventions for children with attention difficulties

Children with ADHD have been found to have difficulties in school. Barkley, Fischer, Edelbrock and Smallish (1990) conducted an 8 year follow up study. They found children in the hyperactive group were significantly more likely than the control group to have dropped a grade, been suspended or excluded, and to have dropped out of school early. Approximately a third of the hyperactive group received some additional support for a special educational need whilst at school.

The National Institute of Clinical Excellence (NICE) published guidelines in 2008 for the diagnosis and management of ADHD in children, young people and adults. The guidelines recognise the lack of impact current ADHD interventions are having on the educational achievement of children with the disorder.

'There is no evidence that psychological interventions for children with ADHD have positive effects on teacher ratings of ADHD symptoms or conduct related behaviours. Beneficial effects of psychological interventions for ADHD therefore do not appear to transfer to the classroom environment' (NICE, 2008, p179).

The NICE guidelines recognise that more needs to be done in relation to children with ADHD in school and that intervention needs to occur as early as possible.

As discussed earlier, EPs are often asked to see children who have difficulties with attention in the classroom. Often these are children who do not have a diagnosis of ADHD. Hedges (unpublished) found that EPs offered the same advice/interventions for children with attentional difficulties, regardless of whether they were labelled as having ADHD. There is some research evidence of children with attention difficulties who do not have a diagnosis of ADHD also experiencing difficulties in school. Merrell and Tymms (2001, 2005) found that difficulties with academic achievement extended to children without a diagnosis of ADHD. They found that children who were rated in Reception by their teachers as having severe ADHD symptoms continued to be behind their peers academically at age 11. They also found that the difficulties in academic achievement correlated with children being rated as inattentive, with the greater number of inattentive symptoms relating to greater impairment.

The current available literature suggests that it is important to intervene to help children with ADHD or general attention difficulties in an attempt to improve their educational outcomes. Given that links have been found between executive function and attention, carrying out interventions that address children's executive function difficulties may be one way to address attention difficulties in the classroom.

2.9.2 The importance of intervention for children with executive function difficulties

There have been several relevant books recently published around the topic of executive function education and possible interventions. This indicates that the importance of school interventions for children with executive function difficulties is increasingly being recognised.

Meltzer and Krishan (2007) highlight a number of executive function processes that affect academic performance; planning and goal setting, organising, prioritising, memorising, shifting flexibly and self-monitoring/checking (p81). They note that many aspects of elementary education (particularly from the fourth grade onwards) require children to use executive function processes; reading comprehension, homework, note taking, long term projects, studying and test taking and state:

'Academic success in all these content areas is dependent upon students' ability to plan their time, organize and prioritize information, distinguish main ideas from details, monitor their progress, and reflect on their work' (p97).

Meltzer, Polloca and Barzillai (2007) feel that we don't currently teach children how to learn, we only focus on what is to be learnt. They suggest *'One of the most effective ways of addressing executive function difficulties is through strategy instruction'* (p166). They suggest we should teach strategies for a number of reasons. Teaching strategies can teach children how to learn, to focus on process and understanding, to encourage independent

learning, promote flexible thinking, and help bypass weaknesses. They highlight the importance of explicit teaching of several key executive functions.

Firstly, planning and goal setting. This is very important and is '*a prerequisite for reading, writing, and completing projects in content areas such as science and social studies*' (Meltzer, Polloca and Barzillai, 2007, p171). When planning and goal setting are not used, pupils may be unsure of what the next step is and become stuck. Planning and goal setting helps pupils '*understand the objectives of a particular task, organize time effectively and determine the resources needed to complete the task*' (Meltzer, Polloca and Barzillai, 2007, p171).

Secondly, organising and prioritising. These executive function processes are essential as they underlie '*most academic and life tasks*' (Meltzer, Polloca and Barzillai, 2007, p172).

Thirdly, shifting flexibly is considered to be important. This can be particularly difficult for children with attentional difficulties. Children need to be able to use cognitive flexibility in the classroom. When taking tests children need to shift between different topics and problem types. When writing, they need to '*shift between their own perspective and that of the reader and between the main ideas and supporting detail*' (p181). When we ask pupils to read text that contains complex/figurative language they need to be able to shift between '*the concrete and the abstract, between the literal and the symbolic, and between major themes and extraneous details*' (Meltzer, Polloca and Barzillai, 2007, p181).

Self-monitoring and self-checking is something pupils can find very difficult. Although teachers often remind pupils to check their work, pupils need to know how to check their work and what to check for.

Several other chapters in the book '*Executive Function in Education*' edited by Meltzer (2007) emphasise the importance of executive functions interventions for particular aspects of the curriculum such as reading comprehension (Gaskins, Satlow and Pressley), writing, (Graham, Harris and Olinghouse) and maths (Roditi and Steinberg).

McCloskey, Perkins and Van Divner (2009) also highlight the academic skill problems that can occur as a result of executive function difficulties. Like the authors writing in Meltzer's (2007) book, they identify problems with reading, writing and maths (p139-172).

2.9.3 The impact of executive function interventions

Although there is lots of literature relating to executive functions, very little has been written about the impact of executive function interventions, particularly in relation to children. A

search for titles containing 'executive function' and 'intervention' conducted on Web of Science, Elsevier Reference Works, MEDLINE, Psychinfo and EMBASE yielded only 2 results.

Debonis (1998) carried out an executive function intervention with 5 dyads of adolescents with ADHD and their parents. The intervention ran over the course of 5 weeks. The intervention was focused on developing goal-plan-do routines and encouraged parents to support their children in developing these. Following the intervention there was evidence that participants made improvements in getting homework done. An improvement in behaviour was also seen and this was verified by outside sources. There was mixed evidence with regard to improvement in executive functions with qualitative data suggesting an improvement, but with quantitative data indicating there was little or no change. The intervention was considered to have improved the ability of parents to support their children and positively influence their behaviour.

Turkstra and Flora (2002) conducted a case study intervention with a 49 year old male (AP) who had executive function impairments resulting from a traumatic brain injury sustained when he was 26 years old. Over the course of 10 weeks, 21 therapeutic sessions were carried out with AP. These involved teaching compensatory strategies and practising mock interviews with the aim of improving AP's report writing skills to enable him to gain employment in his chosen profession. Following the therapeutic sessions, there was a significant improvement in the number of facts reported correctly and a significant decrease in the number of errors. The intervention enabled AP to obtain and maintain competitive employment in his chosen profession.

The books relating to executive function interventions use case studies as examples to highlight the impact intervention can have. Dawson and Guare (2004) have written vignettes to highlight successful intervention for the following executive skills; response inhibition, working memory, self-regulation of affect, sustained attention, task initiation, planning, organisation, time management, goal-directed persistence, flexibility and metacognition (p47-66).

Similarly, McCloskey, Perkins and Van Divner (2009) use six case vignettes throughout their book to help readers understand executive function difficulties. They report on the varying outcomes of the individual interventions offered to these six pupils (p260-271). They also provide a more detailed case study (p275-304).

It is clear then that there is little literature relating to the impact of executive function interventions. The literature that is available is mainly at the individual case work level. The case study reports in Dawson and Guare's (2004) and McCloskey, Perkins and Van Divner's

(2009) book contain some qualitative description about improvements in executive functions but do not provide any quantitative data to highlight changes following intervention.

There was no literature identified that looked at the impact of a systemic executive function intervention in school, or that evaluated the impact of training school staff in relation to executive function. The second and third research questions aim to address this gap by devising, delivering and evaluating the impact of staff training in relation to executive function.

2.9.4 Why use staff training to intervene at the systemic level?

The executive function intervention taking place as part of this research project will involve running two staff training sessions for teachers and two staff training sessions for teaching assistants at one primary school. There will additionally be some drop-in support sessions at which staff can speak to the researcher about any difficulties they are experiencing in relation to the intervention.

Marlowe (2000) indicates that executive function interventions would be well placed in primary schools as literature on the development of executive functions indicates:

‘..children begin to develop planning skills and mental set maintenance within the first 2 years of life. There is considerable maturation that occurs between the ages of 3 and 12 years. By ages 10 to 12 years, many aspects of measured executive functions are at or near adult levels’ (p446).

The literature around the development of executive function and attention skills discussed in section 2.5 would support the use of an executive function intervention for children of primary school age.

Although both Dawson and Guare (2004) and McCloskey, Perkins and Van Divner (2009) highlight the benefits of assessing children on an individual basis and designing specific executive function interventions to meet their needs, this is not always a practical approach to take in the busy school environment.

Dawson and Guare (2004) recognise the difficulties teachers may have in finding the time to work with all the children in their class with executive function problems on an individual basis. They state that the question teachers most frequently ask when they talk with them about executive function interventions, is *‘where will I find the time?’* (p76). This is a problem often faced by EPs. When working closely with schools it is extremely important for EPs to

recognise the demands that delivering interventions can place on teachers' time. Dawson and Guare (2004) highlight the benefit they believe classroom-wide procedures and interventions may have in *'addressing multiple problems in many children simultaneously'* (p76).

McCloskey, Perkins and Van Divner (2009) suggest a number of ways that clinicians can apply their knowledge about executive functions to their work in the school setting. These include:

- *'Sharing knowledge to help parents and school staff understand the role of executive functions in children's behaviour and academic performance*
- *Helping guide the implementation and evaluation of interventions that incorporate knowledge to enhance assessment of academic problems and the development of interventions.*
- *Advocating for system level change in schools to improve student academic performance and behaviour by taking into account what is known about executive functions'* (p233).

Part of the role of the EP includes working with staff in schools. In 2000 a Department for Education and Employment (DfEE) working party conducted a report into the current role of the EP, good practice and future directions. This identified EPs working *'at the whole school level'* (p10). The report recognises that:

'support may be provided through the provision of INSET to a group of teachers and/or learning support assistants, or through the provision of a drop-in advisory service' (p10).

The report also identified that schools want more involvement from their educational psychology service in In-Service Education and Training (INSET) and more opportunities for school staff to discuss issues arising from observation and intervention.

The EP has a role to play in helping schools to improve outcomes for all children. Staff training is seen as one way to work at the whole school level.

2.9.5 What should be included in an executive function staff training session?

The literature on executive function interventions indicates some key areas that may be useful to include in a staff training session relating to executive functioning.

McCloskey, Perkins and Van Divner (2009) highlight the importance of increasing *'awareness of this important concept and its application to instruction, assessment and intervention activities'* (p234). They emphasise that the information given to staff should be

integrated and *'woven into existing knowledge and practices to enhance effectiveness'* (p234). It will be important for staff to have opportunities during the training to reflect on the demands placed upon children's executive functions in school and what they already do to promote children's executive function development.

Dawson and Guare (2004) describe the importance of two types of intervention. The first of these is to intervene at the level of the environment. They suggest this can include changing the physical or social environment to reduce problems. For example, considering where children with difficulties are placed in the classroom. Changing the nature of the task can also be helpful, such as making the steps of a task more explicit. Providing cues to prompt children with weak executive skills, such as giving verbal prompts or reminders e.g. *'Children coming to the maths group should bring with them their maths book, calculator, a pencil and a ruler'*, may be useful. (35-39). It will be important to spend part of the training session looking at possible environmental modifications staff can make.

Whilst Dawson and Guare advocate intervening at the level of environment it is also important to intervene at the level of the person to change children's capacity for using their own executive skills. Dawson and Guare suggest that children usually need to be taught executive skills (as opposed to needing to be motivated to use executive skills they already have but are unwilling to employ). Both approaches may need to be used however, as learning executive function skills can be hard for children and motivating children to practise these skills is important.

Meltzer and Krishan (2007) list a number of principles that should guide the teaching of strategies that address executive function difficulties. These principles are thought to be useful to use with all students, but may be especially helpful for pupils with learning disabilities. It may be helpful to look at some of these principles with staff such as:

- *'Strategies for planning, organizing, prioritizing, memorizing, shifting flexibly, and checking should be taught explicitly and systematically.*
- *Students should be taught how, when and why specific strategies can be successfully used for different academic tasks.*
- *Strategy instruction should be embedded in the curriculum.*
- *Students should be taught strategies for organizing their time, materials, ideas, deadlines, and completed work.*
- *Strategy instruction should be spiralled so that students practice different ways of applying strategies to different academic tasks'* (p98).

It will be important to look at classroom strategies for executive functions such as:

- Planning (e.g. provide planning templates, talk children through the planning process repeatedly);
- Organisation (e.g. the use of different coloured folders for work that is completed and work that is to be done, the use of a desk cleaning checklist);
- Time Management (give children a schedule to follow, give time reminders, use of cueing devices);
- Working Memory (e.g. using storage devices, use of visual cues);
- Sustained attention (e.g. using incentive systems);
- Metacognition (e.g. use of error-monitoring checklists);
- Response Inhibition (e.g. cueing children to control impulses, teaching the child a competing skill to replace the disinhibited response);
- Self-regulation of affect (e.g. giving children scripts to follow in target situations, or things they can say to themselves to manage their emotions);
- Task initiation (e.g. verbally cueing children to start the task, using visual cues to prompt beginning a task);
- Flexibility (e.g. cue children in advance of transitions); and
- Goal-directed persistence (e.g. make goals visible, use goals that are motivating) (Dawson and Guare, 2004, p47-66).

In designing the two staff training sessions, it will therefore be important to give staff information about the concept of executive functioning and how it relates to the school setting, as well as providing ideas of classroom/school strategies that could be used. Staff will need to be provided with written material that they can take away from the training sessions to use as an aide. Staff should be involved in discussions throughout the training about how they can help to promote the development of the executive functions of children in their school.

2.9.6 Why should this training be delivered by an educational psychologist?

In terms of delivering the executive function training, it is important for the person planning and delivering the training to have a good understanding of the school context. EPs have a better understanding of context than other professionals that may consider executive function research as falling into their area of expertise. Mackay (2005) notes that clinical psychologists, EPs and clinical neuropsychologists overlap considerably in terms of their practice base and knowledge, but differ considerably in terms of their principal emphases. Mackay (2005) notes that '*educational psychology strongly emphasises context*' (p14) whereas for clinical psychology context '*may be viewed as its weakest area*' (p14). Mackay (2005) notes that clinical psychologists '*have limited exposure to the day-to-day contexts such as school, home and community in which children operate*' (p14). Clinical psychologists

also *'tend to see a restricted sector of the child population (those expected to have more significant disorders and disturbances)'* (Mackay, 2005, p14). In relation to this study, the children being used as participants would not necessarily fall into this restricted sector of the child population that clinical psychologists tend to be involved with. Mackay (2005) highlights EPs *'in terms of background, their knowledge and experience of educational settings is unparalleled'* (p14).

Whilst cognitive neuroscience may not traditionally have been seen as being within the realms of educational psychology, Goswami (2004) feels the discipline offers *'various possibilities to education'* (p6). These include:

'early diagnosis of special educational needs, the monitoring and comparison of the effects of different kinds of educational input on learning, and an increased understanding of individual differences in learning and the best ways to suit input to the learner' (Goswami, 2004, p6).

The increasing importance of cognitive neuroscience for education and the fact that EPs have a good knowledge of the school context and experience of working collaboratively with teachers means they are well placed to carry out research and interventions like the one described here.

2.97 Considerations for the model of delivery of the training

Consultation is an approach that is increasingly being used by EPs. Leadbetter (2006) describes consultation as *'a term that is used in a variety of contexts and settings and has a multiplicity of meaning'* (p20). She suggests that the aim of a consultation meeting might be:

'to empower the problem-owner and seek solutions that can be implemented by the school staff to improve educational or developmental outcomes for a child or group of children.' (Leadbetter, 2006, p22).

Farouk (1999) questioned EPs about their consultations with teachers. It was found:

'EPs placed a substantial amount of emphasis on following a joint problem-solving approach as well as building on teachers' own strategies. EPs therefore greatly emphasised the need to work collaboratively with teachers' (Farouk, 1999, p7).

It was considered important that the training was delivered in a collaborative, consultative way. If staff were going to implement strategies in school it was important for them to have

some sense of ownership over them and to build on their existing practice. This links with the emphasis placed by McCloskey, Perkins and Van Divner (2009) on information given to staff being integrated and '*woven into existing knowledge and practices to enhance effectiveness*' (p234). Therefore a consultation model of training delivery was considered appropriate to use with school staff.

2.10 Summary of the literature review

This literature review first looked at definitions of 'executive function' (section 2.2). This highlighted that there are many definitions of the term but they broadly relate to cognitive processes involved in goal-directed and self regulated behaviours. Dawson and Guare (2004) incorporate eleven executive skills into their definition which are; planning, organisation, time management, working memory, metacognition, response inhibition, self-regulation of affect, task initiation, flexibility and goal directed persistence. This definition will be used throughout the research as it fits with the assessment tools that will be used and is linked to intervention ideas.

The review went on to look at models of executive function (section 2.3) with research evidence suggesting executive functions should be seen as separable constructs. Definitions of attention (section 2.4) were also discussed and it was highlighted that attention is also seen as a multi-dimensional, rather than unitary construct.

Attention and executive function skills are thought to develop from infancy through to adulthood. McCloskey, Perkins and Van Divner (2009) suggest that whilst executive functions develop over time, the developmental trajectory can vary between individuals. Evidence from studies carried out by Rebok et al in 1997 and Klenberg et al in 2001 suggests that attention and executive functions develop rapidly in middle childhood which indicates interventions may be well placed during the primary school years.

There is research evidence that suggests executive function difficulties may be a core part of ADHD (section 2.6). There is evidence of girls and boys with ADHD having executive function difficulties. These difficulties were found in children taking ADHD related medication as well as children not taking medication. Executive function difficulties in children with ADHD were found to be independent of psychiatric comorbidity and learning disability. Difficulties were found in children between the ages of 6 and 17 with some evidence that difficulties persist into adulthood.

Although there is research exploring the link between executive function difficulties and ADHD there was little literature exploring possible links between general attention and executive function. Hrabok et al (2006) looked at links between pre-school children's

attention and 'executive attention' skills. Klenberg et al (2001) explored the development of Finnish children's attention and executive functions skills. These studies suggest possible links between attention and executive skills. There is some evidence from the factor analysis carried out by Klenberg et al (2001) that attention and executive functions may be separable to an extent but may be simultaneously dependent on each other. Literature suggests that attention and executive functions may be independent but related concepts. However, this link is not yet clearly understood and there was no literature found that attempted to identify specifically whether children with general attention difficulties also have difficulties with executive function. The first research question is designed to address this gap in the literature through the assessment of children between the ages of 6 and 11 on a standardised measure of attention (TEA-Ch) and a standardised measure of executive function (NEPSY-II). These assessments have been chosen to try and tackle some of the methodological problems highlighted in the literature by Pennington and Ozonoff (1996) and Kelly et al (1996).

- The first research question is: What is the link between primary school children's attention skills and executive function skills as measured by standardised assessment?

The second part of the literature review involved looking at executive function interventions (section 2.9). The literature highlights the importance of intervening with children with attention difficulties (section 2.91) and also the importance of carrying out interventions for children with executive function difficulties (section 2.92). Given the proposed links between the concepts, carrying out executive function interventions may be beneficial in helping children to develop both executive function and attention skills. As executive function covers a wider range of skills, improving these may help children more overall than an intervention directed at improving attention skills. Also, carrying out training in the area of executive function is likely to be more interesting to staff and more palatable than training focusing purely on attention. If staff are more engaged, they are more likely to carry out changes as a result of the training session. There was little literature identified that investigated the impact of executive function interventions, particularly in relation to children. This makes carrying out research in this area very important. Most of the literature relating to executive function interventions with children in schools is focused at the individual case level with a lack of quantitative data available to evaluate the impact of intervention. There were no studies identified that evaluated the impact of carrying out staff training in the area of executive functions and no studies were found that evaluated the impact of systemic executive function interventions. The second and third research questions aim to fill this gap in the literature by evaluating the impact of using school staff training as a systemic executive function intervention.

- The second research question is: What is useful about executive function staff training sessions?
- The third research question is: What impact do executive function staff training sessions have on primary school children's attention skills and executive function skills as measured by standardised assessment?

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter aims to describe the process of the research and the methods used to collect and analyse the data. The chapter begins with a statement of the research questions. An overview of the procedure is given in tabular form in section 3.3. The design used in this research project is described in section 3.4. A description of the sampling and participant recruitment is given in section 3.5. The instrumentation used in the study is discussed in section 3.6. The chapter then goes on to look at the three stages of the research. Firstly the pre-intervention stage is explored in section 3.7. The data gathering methods and data analysis relating to the first research question are explored in this section. The intervention stage of the research project is described in section 3.8. This section looks at the development of the training package, the delivery of the training and the support given to staff following the training including the development of a written pack of materials. The data gathering and analysis methods related to the intervention stage are also explored. Section 3.9 looks at the post-intervention stage including data gathering and data analysis methods which explore research questions two and three. The chapter continues by looking at the risk analysis and ethical considerations in section 3.10 and a critique of the method in section 3.11. Finally the chapter is summarised in section 3.12

3.2 Research Questions

The literature review described in chapter two led to the following research questions:

1. What is the link between primary school children's attention skills and executive function skills as measured by standardised assessment?
2. What is useful about executive function staff training sessions?
3. What impact do executive function staff training sessions have on primary school children's attention skills and executive function skills as measured by standardised assessment?

3.3 Overview of the procedure

One primary school was involved in the study. The school is a one form entry primary school in a low socio-economic area located in a town in the North West of England.

Initial discussions were held with the SENCO and head teacher of the primary school between November 2008 and January 2009. The head teacher spoke to the staff and the school agreed to be involved in the research project. Once the school had been recruited staff were asked to rate the children in their class as 'low' or 'not low' for attention. They then met with the researcher and were asked to identify and rank the six children in their class with the best attention skills and the six children in their class with the worst attention skills. Children who were not going to be six by the date of assessment were excluded, as were children who had a diagnosis of ADHD. Consent letters were sent to the parents/carers of the children in May 2009. The researcher assessed each of the participants using subtests from the NEPSY-II and the TEA-Ch. Pre-intervention assessments were carried out between June and July 2009. Training was carried out with the staff between September and October 2009. The participants were re-assessed between January and February 2010. Semi-structured interviews were carried out with the staff in February 2010.

Table 3.1 Timeline of present study

Date/Time Period	Activity	Research Stage/ Question
March 2009	Teachers (working in years one-five) asked to rate the children in their classes as 'low' or 'not low' for attention.	Participant recruitment
April 2009	Researcher and teachers/teaching assistants (working in years one-five) met. Staff asked to rank the six children with the best attention skills and six children with the worst attention skills in their class.	Participant recruitment
	Researcher and the SENCO met to check that none of the selected participants had an ADHD diagnosis. Participants with ADHD diagnosis excluded.	Participant recruitment
May 2009	Letters sent out to parents to request parental permission.	Participant recruitment
June-July 2009	Participants assessed using the TEA-Ch and NEPSY-II.	Pre-intervention data collection RQ1
July 2009	Staff audit questionnaires collected	Pre-intervention data collection

Date/Time Period	Activity	Research Stage/ Question
August 2009	Staff training prepared.	Intervention
September 2009	Staff training sessions carried out with teachers. Training evaluation questionnaires collected using content analysis.	Intervention. RQ2
October 2009	Staff training sessions carried out with teaching assistants. Training evaluation questionnaires collected and analysed using content analysis.	Intervention. RQ2
	Pack of written materials produced for school staff.	Intervention
	Whole school ideas discussed with the head teacher.	Intervention
October 2009- January 2010	Fortnightly drop-in support sessions available for staff over lunchtime.	Intervention
November 2009	Written materials distributed to school staff. Head teacher given possible assembly ideas.	Intervention
January- February 2010	Children reassessed using TEA-Ch and NEPSY-II.	Post-intervention data collection RQ3
February 2010	Semi-structured interviews carried out with staff.	Post-intervention data collection RQ2 and RQ3
September 2010	Feedback given to school	

3.4 Design

A pre-experimental design was used in the present study across one setting (the primary school). A repeated measures (pre-test post-test) single group design was used. A control group was considered but it was decided not to use one due to time constraints and the potential difficulties posed by trying to match a control group. This decision is discussed further in section 3.11. As mentioned in section 1.6, a post-positivist approach has been

taken. This approach has influenced the design of the study with a mainly quantitative approach being used.

3.5 Sampling and participant recruitment

The study took place in a one form entry primary school that expressed an interest in taking part in the research project. The school is situated in a low socio-economic area in the North West of England. The school had concerns about a number of children with attention difficulties, who were discussed in a planning meeting held between the researcher and the SENCO. As discussed in section 1.4, the study evolved following consultations around how the researcher and school could work together to help these pupils.

Following several discussions with the head teacher, he discussed the project with the staff at the school, and the staff agreed to be involved.

In order to explore the link between attention and executive functions and to assess the impact of the school staff training most effectively, it was felt that it was important to include children from different classes (within the age ranges for which the assessments were standardised). Therefore the decision was made to recruit participants from years one-five. Reception children were not included as they were all under age six which was the minimum age that the assessments were standardised for. Children from year six were not included as they would have left the school by the time the intervention was taking place.

The teachers working in years one-five were asked to rate the children in their class as either 'low' or 'not low' for attention. A copy of the letter given to members of staff asking them to do this can be found in Appendix 1. The teachers were asked to rate all the children in the class in this way to allow the teachers to think about all the children in the class along one dimension. If the rating had not been done in this way first the teachers may have selected children who they felt were well behaved or 'bright' as opposed to purely looking at children in terms of their attention skills.

Once the teachers had rated the children in their class, they met individually with the researcher in April 2009. A detailed script that was used by the researcher during these meetings can be found in Appendix 2. The staff were asked to think about the children they had rated as 'low' for attention and choose the six children from this group who had the least good attention skills. They were asked to rank these six children (number one having the worst attention skills). The staff were then asked to think about the children they had rated as 'not low' for attention. They were asked to choose the six children from this group who had the best attention skills. They were then asked to rank these six children (number one having the best attention skills). Staff were asked to not to share the selection of children with other staff members so that the teachers who have the children in the next academic year would

not know which of them have been selected. This was so that the teachers would not intervene more with those children they knew to be involved in the research project as the children were being used as a sample to look at what difference it makes to individual children when intervention is carried out at the whole school level.

The decision to ask the teachers to rank the children in the way described, was made to avoid getting a group of children with similar attention skills (a group around the middle). It was hoped that by picking children from the extreme ends of each class it would give a sample of children with a range of attention skills which would allow the link between attention and executive function skills to be explored most effectively.

It was hoped that consent would be gained for a total of 30 participants. The teachers were asked to identify more children than would be needed as participants (60 children). This was because it was thought some children may need to be excluded due to having a diagnosis of ADHD or being under six years old. It also meant that should there be difficulties in recruiting the participants the researcher would have extra children for whom parental consent could be requested. This could be done without having to meet with the teachers again and ask them to rank more children in the class.

Once the staff had ranked the children the researcher met with the SENCO to check whether any of the children on the list of possible participants had a diagnosis of ADHD. There were two children on the list who had a diagnosis of ADHD. These children were taken off the list of possible participants. The children with ADHD were excluded for three reasons. Firstly, the gap in the literature addressed by research question one related to the fact that there were no studies identified that looked at the link between children with general attention difficulties and executive function. There was already literature that indicated children with ADHD also have difficulties with executive function. Secondly, it was felt that if children with ADHD were included there was a possibility that they might skew the sample. Thirdly, the whole school approach was designed to be universal and something that would be useful to all children, rather than being a specific intervention for children with ADHD.

Whilst looking at the list with the SENCO, one child was identified who was due to move out of the area soon. This child was also taken off the list. For the children in year one, two children were identified who would not have turned six by the time of assessment (June-July 2009). These children's names were also taken off the list.

For each class the children ranked one-four as having the lowest attention skills and the children ranked one-four as having the best attention skills were selected where available. Where children had been excluded then next available ranked child was used. 40 possible participants were identified (20 who had been ranked as having the least good attention

skills and 20 ranked as having the best attention skills). Following ethical considerations it was decided that the school administration staff would send out the parental consent letters on behalf of the researcher. (See section 3.10 for more details.) An anonymised version of the parental consent letter can be found in Appendix 3.

If parents/carers had not responded to the letter approximately two weeks after the letters were sent, school administration staff phoned parents/carers to ask permission for the researcher to contact them about the research project. Following the administrative staff phone calls/researcher phone calls several letters were resent to parent/carers that were interested in their children participating but who had lost the letter and consent form.

Parental consent forms were returned by parents/carers of 31 of the 40 children. The participants were aged between 6;01 and 10;08 (mean age 8;06). The sample consisted of 14 males and 17 females. There were six participants from year one (three male and three female), four participants from year two (one male, three female), seven participants from year three (five male and two female), eight participants from year four (three male and five female) and six participants from year five (two male and four female). Information about whether the children were on the Special Educational Needs Register, at what stage and whether they were receiving additional funding was obtained from the SENCO. 6 of the 31 participants were on the SEN register. Two were at the School Action stage for reading, spelling and numeracy. One participant received additional funding for reading and spelling. One participant was at the School Action Plus stage for poor recording skills, three participants had statements of special educational needs. One of these was due to having an Autism Spectrum Disorder (ASD) and two due to Speech, Language and Communication difficulties.

The 31 children were given the opportunity to participate. The script of the conversation explaining the project to the children and inviting them to take part can be found in Appendix 4. All 31 children agreed to participate.

3.6 Instrumentation

3.6.1 NEPSY-II

The Attention and Executive Functioning domain of the NEPSY-II was used in this study to gain a standardised measure of executive function for each of the participants. As mentioned in section 2.8, Korkman, Kirk and Kemp devised the NEPSY in 1998. This neuropsychological assessment was designed for use with children. This assessment was revised and a second edition published in 2007, NEPSY-II.

The scores on the NEPSY-II are divided into four categories. There are primary scores, process scores, contrast scores and process scores.

Primary scores *'represent the global aspects or key clinical variables of the subtest. They are typically expressed as scaled scores...Combined scores are total scores for a subtest that are made by combining two measures within the subtest'* (Korkman, Kirk and Kemp, 2007, p25). Only the primary scores (combined scores are also considered primary scores) from the NEPSY-II will be used in this study, as these will give the information needed for the study by looking at the key variables of the subtests.

For participants aged seven and above, five subtests of the Attention and Executive Functioning domain of the NEPSY-II were administered. For participants aged six, four of the subtests were administered. A description of each of the subtests can be found in the table below.

Table 3.2: Attention and Executive Functioning subtests of the NEPSY-II

Subtest	Age range	Description*
Animal Sorting	7 - 16	This subtest is designed to assess the ability to formulate basic concepts, to transfer those concepts into action (sort into categories), and to shift set from one concept to another. The child sorts cards into two groups of four cards each using various self-initiated sorting criteria.
Auditory Attention and Response Set	5-16 7-16	This subtest has two parts. Auditory Attention is designed to assess selective auditory attention and the ability to sustain it (vigilance). Response Set is designed to assess the ability to shift and maintain a new and complex set involving both inhibition of previously learned responses and correctly responding to matching or contrasting stimuli. The child listens to a series of words and touches the appropriate circle when he or she hears a target word.
Clocks	7-16	This subtest is designed to assess planning and organization, visuoperceptual and visuospatial skills, and the concept of time in relation to analog clocks. For each drawing item, the child draws the image of a clock and places the hands where the examiner indicates. For visual items, the child reads the time on clocks that either have or do not have numbers.
Design Fluency	5-12	This subtest is designed to assess the behavioural productivity in the child's ability to generate unique designs by connecting up to five dots, presented in two arrays: structured and random. The child draws as many designs as he or she can on each array within a specified time limit.
Inhibition	5-16	This timed subtest is designed to assess the ability to inhibit automatic responses in favor of novel responses and the ability to switch between response types. The child looks at a series of black and white shapes or arrows and names either the shape or direction or an alternate response, depending on the color of the shape or arrow.

*Reproduced from Korkman, Kirk and Kemp, 2007 (p21)

Korkman, Kirk, and Kemp (2007) state that *'the results of the reliability studies indicate that most of the NEPSY-II subtests have adequate to high internal consistency or stability'* (p53). Some of the subtests for some of the age groups used in this study had reliability coefficients that were less than 0.7. There were also some stability coefficients that were less than 0.7. Some of these difficulties with reliability may be explained by practice effects, especially given the short test-retest period used in the studies (mean 21 days). The current study's test-retest period is seven months, which may alleviate some of these possible difficulties. Consideration was given to the researcher potentially asking the children at post assessment whether they thought they had done better and why, to give an indication of whether improvements could have been due to practice effects. However, it was decided that this would involve the use of leading questions. It may have been difficult for some of the children to articulate their views. Also the focus of the research is not matching self-perceptions with standardised data. In fact, by asking the participants if they thought they had done better, the researcher may have drawn it to the participant's attention that they had completed this task before. The researcher was aware that some of the measures used were, to some extent, more unreliable than others. However, the researcher as a psychologist practitioner has experience in recognising when an assessment may not be reliable (e.g. if the child seemed confused or tired). If the post assessment showed big improvements, the researcher checked record notes to see if the initial assessment was considered to represent an underachievement by the participant. If this was the case, the results were interpreted with particular caution. Further details of the standardisation, reliability and validity relating to the NEPSY-II can be found in Appendix 5.

3.6.2. TEA-Ch

The TEA-Ch was devised by Manly, Robertson, Anderson and Nimmo-Smith (1999) to assess different attentional capacities. There are nine subtests but the manual states that *'a briefer screening with just four subtests provides an estimate of the three attentional capacities and dual task performance'* (Manly et al, 1999, p4). The first four subtests of the Test of Attention for Children (TEA-Ch) were used in this study to gain a standardised measure of attention. A description of the subtests used including what aspect of attention they are designed to measure can be found below.

Table 3.3: TEA-Ch Subtests

Subtest	Measuring	Description*
Sky Search	Selective/focused attention	This is a brief, timed subtest. Children have to find as many target spaceships as possible on a sheet filled with very similar distractor spaceships. In the second part of the task there are no distractors. Subtracting part 2 from part 1 gives a measure of the child's ability to make this selection that is relatively free from the influence of motor slowness.
Score!	Sustained attention	Children have to keep count of the number of 'scoring' sounds they hear on a tape, as if they were keeping score on a computer game.
Creature Counting	Attentional Control/switching	Here children have to repeatedly switch between the two relatively simple activities of counting upwards and counting downwards. They are asked to count aliens in their burrows, with occasional arrows telling them when to change the direction in which they are counting. Time taken and accuracy are scored in this subtest.
Sky Search DT	Sustained-divided attention.	Having previously completed the Sky Search subtest and the Score! subtest, children are asked to combine the two tasks of finding the spaceships and keeping count of scoring sounds. Some children, who may have completed each aspect of the task well, can show a substantial decrement under these dual task conditions.

*Reproduced from Manly et al, 1999, p6.

Details of the standardisation, reliability and validity relating to the TEA-Ch can be found in Appendix 6. The Creature Counting timing score had a test retest reliability coefficient of less than 0.7. Again, this may have been due to practice effects as the test retest period was between 5 and 20 days in the study used. The researcher used the same methods to try and overcome the possible difficulty with reliability as discussed in the previous section (3.6.1).

3.7 Pre-intervention stage

3.7.1 Data gathering methods

3.7.1.1 Standardised assessments

Each participant was assessed using the first four subtests of the TEA-Ch (to get a standardised measure of attention) and the Attention and Executive Functioning section of the NEPSY-II (to get a standardised measure of executive function).

The participants were assessed in two separate sessions at the pre intervention stage of the research. This was due to the length of the assessments. A pilot assessment indicated it would take approximately 30-40 minutes to administer the NEPSY-II subtests and approximately 30 minutes to administer the TEA-Ch subtests. It was felt that conducting the assessments in two separate sessions would be more likely to accurately reflect the participant's ability. The assessments were carried out approximately one week apart for each child. 16 participants were given the TEA-Ch first and the NEPSY-II in the second session. The other 15 participants were given the NEPSY-II first and then the TEA-Ch in the second session. The TEA-Ch has two parallel forms designed for test-retest purposes. 16 of the participants were given form A at the pre intervention stage and 15 participants were given form B.

3.7.1.2 Staff Audit Questionnaire

A staff audit questionnaire was devised in order to identify staff training needs in the area of executive function prior to developing a training package. This questionnaire was piloted on an Assistant Psychologist, a teacher and an EP before being given to the school staff. A copy of the staff audit questionnaire can be found in Appendix 7. The audit questionnaire was informed by the literature review, which indicated it would be important to include areas such as classroom strategies in the training. The questionnaire included areas that were likely to be included in the training and asked staff to rate the importance of covering each of the areas so that the training time could be divided up according to staff training needs. The audit questionnaire also asked questions to get an idea of the range of knowledge staff already had in the area of executive functions and to discover what things staff were already doing to help children develop their skills in this area. The questionnaire also gave staff the opportunity to identify anything else they would like to be covered in the training. It was felt that it was important to ask this question, as it was hoped the research project would be seen as joint, collaborative working.

3.7.2 Data analysis methods

3.7.2.1 Standardised assessment

The table below gives a description of the scores from the TEA-Ch used during statistical analysis. All scores used in the analysis are scaled scores:

Table 3.4: Description of TEA-Ch scores used in statistical analysis

Subtest	Score	How the score is calculated
Sky Search	Sky Search (number of correctly identified targets)	This score looks at the number of correctly identified pairs of spaceships the participant identifies from a sheet including distracter ships.
Sky Search	Sky Search (time per target)	This score looks at the length of time it took the participant (per pair of spaceships).
Sky Search	Sky Search Attention	This score looks at the length of time it took the participant (per pair of spaceships) taking into account motor control by subtracting the time (per pair of spaceships) it took the participant to circle the pairs of spaceships in a task with no distracter ships.
Score!	Score!	This score looks at the participant's accuracy in counting the number of scoring sounds they hear.
Creature Counting	Creature Counting Accuracy	This score looks at the participant's accuracy in counting creatures in their burrows when the participant is asked to switch between counting up a down.
Creature Counting	Creature Counting Timing Score	This scores looks at the time it took the participant to accurately count the creatures, taking into account the number of switches between counting and up and down that was required.
Sky Search Dual Task	Sky Search DT	This score looks at the decrement to a participant's performance when asked to carry out the Sky Search and Score subtests at the same time.

For each participant a mean TEA-Ch score was calculated in order to gain a general picture of the participant's attention skills. The TEA-Ch mean was derived using six scaled scores;

Sky Search (number of targets correctly identified), Sky Search Attention, Score!, Creature Counting Accuracy, Creature Counting Timing Score and Sky Search Dual Task Detriment.

It was felt that if both Sky Search (time per target) and Sky Search Attention scores were included in the mean there would be an element of double counting as both looked at the time per target. Sky Search Attention was included in the mean as it was felt this was a better measure of the construct the mean was hoping to represent. By taking account of motor control differences it was felt that the Sky Search attention score was likely to be more closely related to attention.

The table below gives a description of the NEPSY-II scores used in statistical analysis. All scores are scaled scores.

Table 3.5: Description of NEPSY-II scores used in statistical analysis

Subtest	Score	How the score is calculated
Animal Sorting	Animal Sorting	This score looks at the number of correct sorts the participant produces.
Animal Sorting	Animal Sorting Combined	This combined score takes into account both the number of correct sorts the participant produces and the number of errors they make.
Auditory Attention	Auditory Attention Total Correct	This score looks at the number of times the participant correctly touches the appropriate circle when hearing the matching word.
Auditory Attention	Auditory Attention Combined	This combined score takes into account both the number of correct responses the participant makes as well as the number of commission errors the participant makes.
Response Set	Response Set Total Correct	This score looks at the number of times the participant correctly touches the appropriate circle when hearing the matching word.
Response Set	Response Set Combined	This combined score takes into account both the number of correct responses the participant makes as well as the number of commission errors the participant makes.
Clocks	Clocks	This score looks at the participant's score on a number of different tasks related to the participant's clock drawing and clock reading abilities.

Subtest	Score	How the score is calculated
Design Fluency	Design Fluency	This score looks at the number of different novel designs the participant can generate in a specified time limit on both the structured unstructured arrays.
Inhibition	Inhibition Naming Total Completion Time	This score looks at the time it takes the participant to name the shapes and the direction of arrows.
Inhibition	Inhibition Naming Combined	This score takes into account both the time it takes the participant to complete the task as well as the number of errors the participant makes.
Inhibition	Inhibition Inhibition Total Completion Time	This score looks at the time it took the participant to name the shapes and the direction of arrows when they have to replace the logical response with a novel one.
Inhibition	Inhibition Inhibition Combined	This score takes into account both the time it takes the participant to complete the task as well as the number of errors the participant makes.
Inhibition	Inhibition Switching Total Completion Time	This score looks at the time it took the participant to name the shapes and the direction of the arrows when they have to change their response based on a stimulus feature.
Inhibition	Inhibition Switching Combined	This score takes into account both the time it takes the participant to complete the task as well as the number of errors the participant makes.

For each participant a mean NEPSY score was calculated in order to gain a general picture of the participant's executive function skills. The NEPSY mean was derived using eight scaled scores; Animal Sorting Combined Score, Auditory Attention Combined Score, Response Set Combined Score, Clocks, Design Fluency, Inhibition Naming Combined Score, Inhibition Inhibition Combined Score and Inhibition Switching Combined Score.

Only the combined scores were included in the mean for Animal Sorting, Auditory Attention, Response Set, Inhibition Naming, Inhibition Inhibition and Inhibition Switching. It was felt if

the accuracy/time taken scores were also included there would be an element of double counting. The combined scores were used as they accounted for errors as well as time taken or number of correct items.

Field (2000) states '*All parametric tests gave four basic assumptions that must be met for the test to be accurate*' (p37). Firstly, it is assumed that the data is normally distributed. Secondly, it is assumed that the variances should not change systematically throughout the data. Thirdly, the data should be measured at least at the interval data. Finally, it is assumed that the data from different subjects are independent, so the behaviour of one participant does not influence the behaviour of another.

The normality of distribution for each of the variables was assessed following the suggestions made by Field (2000). This involved creating histograms and eyeballing the data to see whether the data followed a normal curve of distribution. As suggested in Field (2000) the kurtosis and the skewedness of the sample were calculated. In addition to this the Kolmogorov-Smirnov test was carried out as an '*objective test to decide whether or not a distribution is normal*' (Field, 2000, p46). This produced a mixed picture of results with the majority of the variables failing at least one of the procedures designed to look at whether the data was normally distributed. Due to these results it was decided that non-parametric tests would be carried out throughout the data analysis process. It was felt that this would ensure more accurate results and would be less confusing to the reader than if a variety of parametric and non parametric tests were carried out. Field (2000) states '*Spearman's correlation coefficient is a non-parametric statistic that can be used when the data have violated parametric assumptions*' (p91).

In order to examine the relationship between attention and executive function, Spearman's correlation coefficients were calculated. These were calculated to look at the relationship between the TEA-Ch mean and the NEPSY mean. Spearman's correlation coefficients were also calculated at the subtest level to examine the relationship between each of the TEA-Ch variables with each of the NEPSY-II variables. Field (2005) states '*The correlation coefficient is a commonly used measure of the size of an effect : values of +/- 0.1 represent a small effect, +/- 0.3 represent a medium effect and +/-0.5 is a large effect*' (p112). Although there is some debate between statisticians about these this, the values reported by Field (which uses Cohen's benchmark) will be used throughout.

Although correlation coefficients cannot tell us about which variable causes the other variable to change, Field (2000) says we can find out about the '*amount of variability in one variable that is explained by the other*' (p90). In order to do this the correlation coefficient is squared and then converted into a percentage by multiplying by 100. This calculation was done for each of the correlation coefficients and is reported in section 4.2.

It was decided that statistical analysis would not be carried out to compare the performance of those children rated 'low' for attention by their teachers and those rated 'not low'. This was because the reason for selecting participants in this way was to avoid getting a group of children around the middle (in terms of attention skills), but to get a sample of children with a wide range of skills to most effectively explore the links between attention and executive function. Secondly, as the initial assessments were scored it became clear that the 'low' group and 'not low' group were not distinguishable as two separate groups as there were children in both groups who had similar scores. Also, looking at matching teacher perceptions with the results of standardised assessments, whilst an interesting question, was not the focus of this study.

3.7.2.2 Staff Audit Questionnaire

The staff audit questionnaires were analysed using descriptive statistics and content analysis. Neuendorf (2002) defines content analysis as '*a summarizing, quantitative analysis of messages that relies on the scientific method*' (p10). Although content analysis was originally used with mass media, Neuendorf (2002) states that '*So long as other pertinent characteristics apply (e.g. quantitative, summarizing), the study of any type of message set can be deemed a content analysis*' (p17). Content analysis could therefore be used on a message set such as the responses to questionnaires. Gillham (2000) suggests that sometimes all that is needed when carrying out content analysis is a count analysis to look at how many people said the same kind of thing. Content analysis at this level was considered sufficient for analysing the staff audit questionnaires. Content analysis is discussed further in section 3.9.2.2.

10 of the staff audit questionnaires were returned. The results of these questionnaires were used to help plan the development of the training materials. The questionnaire results indicated that staff did have training needs in the area of executive function.

Nine participants responded to question one which asked participants to rate on a scale of 1-10 (1 being not at all knowledgeable and 10 being extremely knowledgeable) how knowledgeable they felt about executive functions. The mean rating score for how knowledgeable staff felt they were about EF was 2.55. The mode response (5 participants) was 1 (not at all knowledgeable).

Responses to question two indicated that members of staff were able to identify some ways in which they were already helping children to develop executive functions. This included the following:

- Alternative curriculum
- Learning styles

- Target setting
- Variety of tasks
- Lots of practical activities
- Memory games
- Planning experiments
- Design Technology designs
- Learning styles
- Memory games
- Thinking time
- Talking partners
- Classroom management?
- Different teaching and learning opportunities
- Use of resources, support
- By reminding them of time left to complete a task
- Class rules
- Demonstration

As discussed in section 2.97, in order for staff to invest in the training being offered, it was important that they could recognise there were some things they were already doing in this area (rather than feeling they were having strategies imposed upon them).

Question three asked participants to rate the importance of including the areas listed in the training, on a scale of 1-10 (1 being not at all important and 10 being extremely important). One person was excluded when calculating means as it was unclear how they had answered. One person was excluded from last three areas as they hadn't answered these areas (on page two of the questionnaire. Two people put 10's on both pages once at the side of the areas and so their answers were assumed to be 10 for all parts of question three. The mean rated scores (calculated using the rest of the participants) for the importance of each area being covered in the training were as follows:

- Executive function definitions- 8.89
- Where executive functions are located in the brain- 6
- Impact of executive function difficulties on the curriculum- 8.11
- What other difficulties may occur with executive function difficulties- 8.375
- Classroom strategies- 9.125
- Whole school strategies- 9.625

The results of the audit questionnaire suggested that it was important to cover all of the areas listed as part of the training. The results suggest that it would be useful to cover the

location of executive functions in the brain, but this should be done briefly. The results indicate that a larger proportion of time should be spent looking at classroom and whole school strategies. There were no suggestions given by participants of any other areas that needed to be covered in the training.

3.8 Intervention Stage

3.8.1 Developing the training

As discussed in section 2.9.7, it was felt that a consultative approach to developing and delivering the training was important in order to help staff build on existing practice. Four staff training sessions took place. The PowerPoint slides for session one delivered to the teachers can be found in appendix 8. The PowerPoint slides for the second session delivered to the teachers can be found in appendix 9. The PowerPoint slides for the first session delivered to the teaching assistants can be found in appendix 10. The PowerPoint slides for the second session delivered to the teaching assistants can be found in appendix 11. The pack of written materials developed to support staff following the delivery of the executive function training can be found in appendix 12. A list of assembly ideas given to the head teacher can be found in appendix 13. All of the above appendices have been anonymised to protect confidentiality. The evaluation questionnaire given to teachers at the end of session one can be found in appendix 14. The evaluation questionnaire given to teachers at the end of session two can be found in appendix 15. The evaluation questionnaire given to teaching assistants at the end of session one can be found in appendix 16. The evaluation questionnaire given to teaching assistants at the end of session two can be found in appendix 17.

3.8.1.1 Audience and time

It was felt that in order to have the most impact it would be helpful for the training to be delivered to as many staff as possible. The head teacher was keen for both teachers and teaching assistants to have the opportunity to take part in the training and so suggested that the training sessions were carried out during school time (rather than as twilight sessions). This would allow the teaching assistants to attend the training. It was also felt by the head teacher and researcher that staff may be more receptive and better able to suggest possible strategies during the school day (rather than during a twilight session). The researcher felt that the training would be best delivered over two sessions. The head teacher was able to offer part of two afternoon sessions in September 2009. The head teacher intended to take all of the children in the school hall for one session (with another member of the senior leadership team taking the children for the other session) to allow all other staff members to attend both training sessions.

The training package was therefore developed to be delivered to both teachers and teaching assistants across two one and a half hour sessions.

3.8.1.2 Content

In terms of the content of the training package, section 2.9.5 identified from the literature, important things to include the staff training sessions. This included the need to link the concept of executive function to the school setting as well as looking at classroom/school strategies. The staff audit questionnaire indicated that it was important that the training covered areas such as executive function definitions, the impact of executive function on the curriculum, comorbidities, classroom strategies, and whole school strategies. The staff audit questionnaire also indicated it would be important to briefly cover executive function and the brain. As discussed in section 2.5, literature such as McCloskey, Perkins and Van Divner (2009) suggests that it is important for school staff to be aware of the variation of development of executive function in children. It was felt that as part of understanding the concept of executive function, it would be useful to include some information about the development of executive function. This was considered to be particularly important given that the training was going to be delivered to staff working with children from 4-11 years old.

There were then two broad areas to cover in the training; knowledge and strategies.

3.8.1.3 Definition and Models

The definition used to explain executive functioning to staff was the one proposed by Dawson and Guare (2004). This was used for a number of different reasons. As mentioned in section 2.2, this definition was chosen to be used throughout the study due to its inclusion of the executive functions identified by the NEPSY-II and its links to intervention strategies suggested by Dawson and Guare (2004, 2009). The two texts written by Dawson and Guare (2004 and 2009) were used extensively in the development of the training package. It was felt that it was important to use models and ideas that were most closely related and relevant to school staff and education. Dawson is a clinical school psychologist and Guare is a neuropsychologist. As well as being practitioners who have experience of working with children, both are also involved in carrying out research. They link scientific knowledge to practice which was considered particularly important and relevant to the development of the training package, in which the researcher needed to use scientific knowledge about executive functions whilst relating it to school and classroom practice.

3.8.1.4 Key texts that contributed to the development of the training package

As mentioned in section 2.9.2, there are some other texts that have been written in relation to executive function interventions in children. The Dawson and Guare definition was used and the intervention ideas used more extensively than those from McCloskey, Perkins, and Van Divner (2009) and those from Meltzer (2007) for several reasons. The Dawson and Guare definition looks at 11 skills which clearly relate to classroom practice whereas the model proposed by McCloskey, Perkins and Van Divner (2009) propose a model that incorporates five tiers of executive capacity which have a number of different levels. There are a lot of executive functions in the model including 23 directive capacities under the title of self control: self regulation. It was felt that the number of 'capacities' included in this model would be more complex and it would not be manageable for teachers to look at all of these during the training. Skills identified in the Meltzer (2007) definition of executive functioning were already covered by the definition proposed by Dawson and Guare. The book by Dawson and Guare 'Executive Skills in Children and Adolescents' was designed to be read by school staff (not just school psychologists and other professionals). The book 'Smart but Scattered' was specifically designed for parents. In practical terms this meant that Dawson and Guare's texts were more accessible and already used language and ideas that could be readily used with primary school staff. Dawson and Guare base their definition and ideas on Barkley's (1997) model. Given that Barkley's (1997) model gives an explanation for the link between executive functions and ADHD, it seemed particularly useful to use this definition with staff given that the research project is looking at the link between executive function and attention. It was decided therefore to use Dawson and Guare's texts to form the main structure of the training sessions in terms of the definitions and models used and to use other literature in other areas of the training, such as executive function and the curriculum.

3.8.1.5 Language and terminology

Although the term executive function is being used throughout this study a decision was made to use the term 'executive skills' in the staff training. Dawson and Guare use this term in both their books to describe executive functions to school staff, professionals, and parents. It was important to present the information to staff in a way that was most easy for them to understand. It was decided therefore to make an attempt not to use too many neuropsychological terms with staff. It was important that following the training staff felt that they could help children to develop their executive functions. It was felt that the term 'executive skills' would keep the training relevant to what school staff could practically do to help children develop 'skills', rather than make them feel detached from the concept.

Another consideration made in terms of the language used was to title the PowerPoint presentations 'Executive Skills Session One' etc rather than 'Executive Skills Training'. The reason for this was because it was hoped that the sessions would be a consultative

collaborative process. The researcher didn't want the staff to feel they were being 'trained' but rather that they were taking part in a learning process.

3.8.1.6 General Structure

As mentioned in section 3.8.1.2, two broad areas needed to be covered in the sessions; knowledge and strategies. It was decided that rather than have one session covering all the knowledge and one covering strategies it would be better to include some of both in each session. It was felt this would allow a good mix of information and practical activities, which would be more likely to sustain staff interest.

The researcher had previously done staff training with the teaching staff at the primary school taking part in the project, as part of her role as a TEP. This training was on dyscalculia and maths difficulties. As part of this training session the teachers were given opportunities to discuss strategies they were using in their classrooms with each other. Evaluation questionnaires completed by staff at the end of this training session indicated that they particularly valued the opportunity to talk to their colleagues about strategies they were using and to share ideas. The researcher decided that as this was a format that staff had previously found valuable it would be useful to make sure this was utilised in the executive skills sessions.

Thought was given to which skills to place together when getting staff to discuss the strategies in groups. The researcher looked at the skills with an Assistant Psychologist and decided not to put the skills that staff might have the most difficulty with together. The researcher was aware that skills such as flexibility and metacognition would possibly be more difficult to discuss, so ensured these were not given to the same group and also ensured she was on hand to give extra help when strategies for more complex skills were being discussed.

Literature discussed in section 2.9.5 (e.g. Dawson and Guare, 2004) indicated that it may be important to intervene at the level of the environment as well as at the level of the person with regard to developing executive function skills. It was felt that it was most beneficial in the sessions to concentrate more on strategies that focussed on changing things at the environmental or whole class/school level due to the systemic nature of the intervention and the recognition of practicalities (discussed in section 2.9.4). It was decided that information for teaching the skills to individual children would be mentioned, but that this would be included in more depth in a written pack of materials developed to support the training sessions.

3.8.1.7 Structure and content of session one

PowerPoint slides used in session one can be found in appendix 8. It was decided that it would be important to start with a brief overview of the research project. It was felt that this was important in including all staff fully in the training. As mentioned in section 3.5, teachers (and/ or teaching assistants) from years one-five had met with the researcher as part of the participant recruitment. Teachers from the reception and year six class did not do this for reasons stated in section 3.5. This meant that some staff may have had more details of the research project than others. As the intervention was designed to be a whole school intervention it was important for all staff at the training to feel included. The first part of the session looked at an overview of the project, what had been done so far, and what was going to happen next.

The next part of the session looked at knowledge. It was felt important to look at a general definition of executive function first. This was followed by an introduction to Dawson and Guare's (2004) model with the list of 11 executive skills. The skills were then grouped into those skills involving thinking and those involving doing (as classified by Dawson and Guare, 2004).

Before going into a detailed explanation of each of the skills a small section on brain development and executive skills was included. This was brief as the staff audit questionnaire had indicated it was important to cover this area, but in less depth than other areas of knowledge. Also as mentioned in section 2.2, the focus of this research is looking at executive function at the behavioural level, rather than the anatomical level. The main purpose of including this section was to aid staff in understanding the development of executive skills and to highlight the importance of giving children opportunities to practise their executive skills. This section linked to talking about the development of executive skills. An analogy from Mcloskey, Van Divner, and Perkins (2009) (p70) was used to emphasise the need to take account of individual differences in children's executive skills development. The analogy was about how we wouldn't expect children of different sizes to perform the same on physical tasks and how it can be more difficult to take account of executive skills development because we can't always physically see the differences. The executive skills were listed in the order in which they are thought to begin to develop. It was decided to go through each definition in developmental order, so that development could be discussed alongside definitions.

The definitions given by Dawson and Guare's (2004, 2009) for each skill were used. Alongside each definition an adult example was given. Some of these were personal to the researcher and other examples were used to relate to school staff. A child example was also given to help staff understand each skill. Some information about what a child with difficulties

might look like was also given to help staff start to think about children they work with, who may have executive function difficulties. Some information about the development of the skill was also given to help staff gain a good picture of each individual skill.

The second part of the session planned to look at strategies. As mentioned in section 3.8.1.6, it was considered particularly important for staff to have an opportunity to share strategies they were already using. Six of the strategies were selected to be discussed in session one. The idea was for the staff to split into two-three groups and look at one strategy each. Staff would discuss strategies they were already using before feeding back to the whole staff. Once staff ideas had been discussed, some ideas from the literature would be given. The ideas from the literature (for sessions one and two) were taken from the two Dawson and Guare books (2004, 2009). It was planned that the strategies from the literature would be given to staff in a separate handout at the end of each session so that they could make the most of the opportunity to discuss and come up with their own strategies (without looking ahead in the handouts).

It was felt that it would be useful to have some activities related to the strategies before staff starting discussing current strategies. There would not have been time to do an activity for each skill, so two activities were selected for session one. The first activity was taken from the Social and Emotional Aspects of Learning (SEAL) Materials 'Overcoming Obstacles to Success' (Department for Education and Skills, 2005, p19-20). This activity was selected to give staff ideas of examples of famous people who had showed goal-directed persistence that they might find helpful to use with children. It was also chosen as it was felt that some of the SEAL materials might link well to developing executive skills. Following the completion of this activity it was hoped staff would discuss strategies related to goal-directed persistence, time management and organisation. The second activity was linked to response inhibition. The activity was the Stroop task (Neuroscience for Kids, 2010). This activity involved saying the colour that each word was written in (rather than the word itself, which were all colour names). It was hoped that this task might help staff to empathise with children who have difficulty inhibiting responses. Following the completion of this activity it was hoped that strategies related to response inhibition and emotional control would be discussed.

At the end of the session it was planned for staff to think about a few points during the week between sessions; to consider the executive skills discussed today, to identify when they ask children to use executive skills and to consider whether children within the class show differences in their executive skills.

3.8.1.8 Structure and content of session two

The plan was for session two to begin with a discussion about the task from session one and a plan of session two. The knowledge content focused on executive skills and the curriculum, and other difficulties that co-occur with executive skills difficulties.

The information about the executive skills and the curriculum was drawn mainly from the book edited by Meltzer (2007), 'Executive Function in Education'. The content was adapted for working with primary school children. Information was selected that the researcher felt would be helpful for staff. The main purpose of this section was to make staff aware of how important executive skills are for the curriculum. The information looked at links with writing, reading, maths, study skills and test taking skills. Several useful strategies from Meltzer (2007) were given in relation to maths and writing.

A small section on other conditions that may co-occur with executive function difficulties was included. It was felt that it was important not to pathologise executive skills difficulties as the researcher didn't want staff to feel that the skills were only important for children with these other difficulties. The conditions that have been shown to co-occur with difficulties with executive function were considered together with the researcher's knowledge of the school population. This led to this section focussing on Autistic Spectrum Disorders (ASD) and ADHD. Learning difficulties were also mentioned as this linked to difficulties with the curriculum linked to the previous section. Staff were given the names of other conditions that have been shown to sometimes co-occur with executive function difficulties but it was made clear that children other than those with co-occurring disorders could also have difficulties with executive skills.

It was planned that the strategy section would follow the same format as session one. The first activity that was planned to be used was related to sustained attention. This was based on a task from the NEPSY-II in which the adults were asked to work in pairs. There was a piece of paper with four coloured squares on. One person had to touch the red circle every time the other said the word red. A long list was given to the reader, to read in a monotone voice for several minutes. Following this activity staff would discuss strategies related to sustained attention, task initiation and flexibility. The second activity was related to the skill of planning. Staff were going to complete The Tower of Hanoi using the Tower subtest from the NEPSY (1st edition). This was to be followed by discussions about the remaining skills; planning and prioritisation, working memory, and metacognition. At the end of the session it was planned that some general classroom intervention ideas would be given to staff.

3.8.2 Delivering the training

3.8.2.1 Practical issues

Prior to the training being delivered the head teacher of the school broke his ankle. This meant that it was not possible for him to supervise the children whilst the executive skills sessions were carried out with the whole staff during school time. This meant that the sessions had to be delivered as two twilight sessions slightly later than planned. This also meant that teaching assistants would not be able to attend the training (due to working hours). It was felt that the training would be particularly useful for teaching assistants and that they would benefit from the sessions. It was also felt that it was important for a whole school intervention to involve as many staff as possible. A number of the teaching assistants also worked in the school as midday supervisors. The head teacher was able to release the teaching assistants for approximately two one hour sessions during school time. These sessions were delivered at the beginning of October which was slightly later than planned. Information about how the materials were adapted to use with teaching assistants in a shorter time is discussed in section 3.8.2.4. Advantages and disadvantages of having separate sessions for the teachers and the teaching assistants will be discussed in section 3.11

3.8.2.2 Data gathering and analysis methods

A research diary was kept throughout the intervention phase. Robson (2002) suggests that one of the things that might be entered in a research diary is *'stocktaking of where you are in relation to each phase of the project; short interim reports of progress; problems and worries; suggestions of what might be done'* (p2). Winter and Munn-Giddings (2001) suggest keeping *'detailed descriptive reports of events and verbatim notes of conversations, your interpretative comments, other people's comments, quotations from your reading'* (p228). The purpose of the research diary was to record anything of note, from the process of developing the training to the actual delivery. Notes from conversations with staff both during and after the training sessions were recorded to help answer research question two; what is useful about executive functioning staff training sessions. Notes were also used to record information about what staff were doing in school following the training sessions to help answer research question three; what impact do executive function staff training sessions have on primary school children's attention and executive function skills as measured by standardised assessment. In addition to this notes from tutorials and worries and concerns were also recorded to allow the researcher to track the progress of the research project.

Staff were given grids with space to fill in strategy ideas for each of the executive skills. It was hoped that the researcher would be able to photocopy these grids as part of the data

collection and for staff to be able to keep them as a reminder of the strategies they thought were most useful.

Staff were asked to complete evaluation questionnaires at the end of each session. The evaluation questionnaires given to the teachers at the end of session one and at the end of session two can be found in Appendices 14 and 15 respectively. The evaluation questionnaire given to the teaching assistants at the end of session one and at the end of session two can be found in Appendices 16 and 17 respectively. As with the staff audit questionnaires (discussed in section 3.7.2.2), descriptive statistics and content analysis were used to analyse the evaluation questionnaires. Once again this was at the level of looking at how many people said a similar sort of thing. Further discussion about content analysis can be found in section 3.9.2.2).

3.8.2.3 Adapting the training

Following the delivery of session one to the teachers (appendix 8), several changes were made to the plan for session two (appendix 9). The first of these was related to time. With the session now being a twilight session it took quite a while to get everyone together before the session could begin. Due to the limited time in session one, there was not time to verbally give strategy ideas from the literature. The strategies section felt a bit rushed and one of the evaluation questionnaires mentioned that it would have been good to hear some of the ideas from the literature first. Due to the time limitations it was decided that in session two, the planned activities would be shown and demonstrated rather than having staff carry them out individually. A few ideas from the literature were given first before staff discussed the current strategies that they use. Rather than having small groups of staff discussing a couple of skills each, the staff were asked if they would prefer a short amount of time to discuss each of the five skills before feeding back to the whole group. Also using the grids had not worked that well, and staff had not brought them back for the second session. Each group was given a large grid to write down strategy ideas. These were collected by the researcher at the end of session two. Staff were still able to write on individual grids to keep if they wished to do so.

The sessions with the teaching assistants were shorter than the sessions completed with the teachers. This meant that a condensed version of the training was used. The structure of the sessions was changed as well. Whilst keeping a split between knowledge and strategies in each session, even more emphasis was given to the strategies than it had been in the teacher sessions. The sessions took place in quite an informal setting around a table in the staff room, as it was felt this would be least intimidating and would help staff to feel that the training was a collaborative process. A computer wasn't used due to the space and availability of rooms so the teaching assistants were given copies of the handout and the

session was run in a 'workshop' style. The first session involved giving an overview of the research project, a brief definition of executive skills and brief discussion about the brain. Rather than go through a definition of each of the 11 skills at the beginning, this was done skill by skill across the two sessions. The developmental progression of the skills was discussed and the skills were discussed in order of development. The first session looked at response inhibition, working memory, emotional control, sustained attention and task initiation. The Stroop task was used and the sustained attention activity was demonstrated. Strategies were discussed as a whole group rather than in small groups. The PowerPoint including the notes pages used with the teaching assistants in session one can be found in appendix 10.

The second session started with a recap of the 11 skills discussed in session one. This was followed by discussions about the remaining six skills; planning/prioritisation, organisation, time management, goal-directed persistence, flexibility and metacognition. The Tower of Hanoi activity was demonstrated and the teaching assistants completed the 'Overcoming Obstacles' activity related to goal-directed persistence. In the second part of the session we briefly discussed a condensed version of executive skills and the curriculum, other difficulties that might co-occur with executive skills difficulties, and some classroom interventions. The PowerPoint including the notes pages used with the teaching assistants in session two can be found in appendix 11.

3.8.2.4 Arrangements for staff unable to attend the training sessions

The majority of staff were able to attend both training sessions. Teachers from each of the year groups from Reception-Year 6 attended the teacher sessions as well as one of the higher level teaching assistants, two trainee teachers, the SENCO and the head teacher. There were 12 members of staff at the teacher sessions. The learning mentor was unable to attend as was one of the year three teachers (due to job sharing and not being in school on the days of the sessions). 10 teaching assistants attended session one of the teaching assistant training and 11 attended session two. There were two teaching assistants that were unable to attend either session. Staff that were unable to attend the sessions were given copies of the handouts together with copies of the activities from the sessions. They were asked to contact the researcher if they had any questions or wanted a separate session to be carried out. There was also the opportunity for staff to sign up for a drop in session where they had the opportunity to speak to the researcher.

3.8.3 Support for staff following the training

3.8.3.1 Drop in sessions

Fortnightly drop in sessions were offered to staff over lunchtime between October 2009 and January 2010. Staff were asked to sign up under one of the available dates (placed on the staff room notice board) if they wanted to discuss anything to do with executive skills with researcher. Staff were asked to sign up rather than the researcher being in school on the particular lunchtimes. This was partly due to the possibility that staff may have felt uncomfortable and pressurised into meeting with the researcher or into feeling that they had to carry out strategies from the training session. Another reason for asking staff to sign up was due to the researcher's time commitments. Getting staff to sign up for sessions meant the researcher avoided wasting time by driving to the school and then finding no one wanted to see her.

3.8.3.2 Written materials

A pack of written materials was developed to support the executive skills sessions that were delivered to staff. The pack of materials was developed after the training took place so that the strategies suggested by staff could be incorporated into the pack. A copy of the pack of materials can be found in Appendix 12. The written pack included everything used in the PowerPoint presentations given to staff during the training. Information that was given to the staff verbally (rather than written on the slides) was also included in the written materials.

The pack generally put information in the same order as it was delivered in the training sessions. It started by looking at what executive skills are. This was followed by information about brain development and executive skills. The developmental progression of the skills was presented.

The pack then looked at each of the skills in turn (following the developmental progression). Alongside the definition, examples of when the skill is used successfully, examples of what a child with difficulties with that skill may do and additional information about the development of that skill were included. Information from Dawson and Guare (2004, 2009) was included in tabular form, which looked at the age of the child and tasks they could be expected to form. The American grades were changed to years to make the tables easier to understand within the British school system.

A list of strategy ideas was given for each skill. This included the ideas from the literature as well as the ideas suggested by staff. Step by step instructions for teaching the skill

individually to children, taken from Dawson and Guare (2004), were included were appropriate. It was hoped that this information would help staff work with individual children where they felt this was useful and if they had the time to do so. The pack also included possible activities to use with children to demonstrate or help them develop the particular skill. Information from Fleetham's (2008) book 'How to create and develop a thinking classroom' was used in the strategy part of metacognition as it was felt that ideas such as Edward de Bono's six thinking hats (Fleetham, 2008, p28-30) and Bloom's taxonomy (Fleetham, 2008, p30-34) might be useful and fitted in with the skill of metacognition.

Once each of the skills had been presented, the pack gave information about executive skills and the curriculum followed by a list of other difficulties that can co-occur with executive skills difficulties. This was followed by general classroom strategies that could be used by staff.

Two e-books from the 'LearningWorks for Kids' website (2009) were included which explained executive functions to children and gave them tips on how to improve them. It was decided that this information was important to include as it would be useful to make children aware of the different executive functions they are practising when completing different tasks in school. It was hoped that this information would help staff explain executive skills to the pupils using child friendly language. Finally, at the end of the pack, a list of references and useful links were given.

The written material packs were delivered to the school in November 2009. Enough packs were produced so that each teacher and TA could have their own copy.

3.8.3.3 Discussing whole school ideas with the head teacher

Whole school ideas were discussed with the head teacher. The head teacher suggested doing some assemblies about executive skills and asking teachers to look for a particular skill in a particular week. He suggested that children could be sent to him for demonstrating the skill or an improvement in the skill. The head teacher wanted some child friendly ways to talk to the children about the skills and help in thinking about which skills to discuss with the children. Alongside the written materials a document was produced for the head teacher about assembly ideas which can be found in Appendix 13.

3.9 Post intervention stage

3.9.1 Data gathering methods

Consideration was given to meeting with school staff individually during November 2009 to discuss how they were getting on with the intervention, whether they had found the sessions useful and to discuss any changes noticed in the children. It was decided not to do this for a number of reasons. This was firstly due to the timings of training and the written materials being slightly later than planned. This meant staff would not have had the written materials for long by the time the meetings took place. Secondly, the researcher was aware of the fact that teachers might feel pressurised into using strategies, which would not have been the purpose of having these meetings. Drop-in sessions had been offered, so if staff wanted to discuss anything to do with the intervention there was already a mechanism in place for them doing so. Thirdly, it was felt that information gained from these meetings could be gained at staff interviews due to be held in February 2010 and the researcher did not want to take up more staff time than was necessary.

The 31 participants were reassessed using the first four subtests of the TEA-Ch. Those participants that had been given form A at the pre-intervention stage were given form B and vice versa. The participants were also reassessed using the Attention and Executive Function domain of the NEPSY-II.

Once the participants had been reassessed, interviews were carried out with their current class teachers. Where there was a teaching assistant who had been on the training who was working with any individual children involved in the project, they were also interviewed. These interviews were semi-structured. A copy of the script used can be found in Appendix 18. The purpose of the staff interview was an intervention fidelity check, to find out what (if anything) they had been doing in class following the training sessions. The second purpose of the staff interviews was to identify possible extraneous variables in relation to the individual participants (e.g. if something else had happened at home/school that could have contributed to any changes in the participant's scores between pre and post intervention). The head teacher was also interviewed to find out about what had been done at the whole school level and what his views were. The script used for this interview can be found in Appendix 19. Staff were asked if they were happy for the interviews to be recorded. It was explained to staff that the recordings would be destroyed following completion of the research project.

3.9.2 Data analysis methods

3.9.2.1 Standardised Assessments

As explained in section 3.7.2.1, non-parametric tests were used as the pre-intervention data violated parametric assumptions. As this stage of the analysis involved comparing pre and

post-intervention scores, it was necessary to use non-parametric tests again. The Wilcoxon Signed-Rank Test *'is used in situations where there are two sets of scores to compare, but these scores come from the same participants'* (Field, 2005, p534). This test allows us to look at the differences between the scores at pre and post intervention level. It ranks the scores and looks at whether the change is a positive, negative or stays the same (tied ranks). Although the size of the sample differs between statistical textbooks, Field (2005) advises using the exact test when you have a small sample. As the sample used varied for different variables due to missing data, the sample size varied from 20-31. Given this small sample size it was decided to use the exact test to gain more accurate results. Field (2005) describes how to calculate an effect size for the Wilcoxon Signed-Ranks Test. This involves dividing the z score by the square root of the number of observations. When reporting Wilcoxon test results Field (2005) advocates reporting the median score, z score, the significance value and effect size (p542). Once again the figures from Field (2005), using Cohen's benchmark, were used with values of +/- 0.1 representing a small effect, +/- 0.3 representing a medium effect and +/-0.5 representing a large effect. When calculating the effect size, Field (2005) reports values between +/-0.3 and +/-0.5 as a medium to large effect (p541). Values between these two values in the analysis have therefore been described as a medium to large effect. Values between +/-0.1 and +/-0.3 have been described as a small to medium effect.

As well as using inferential statistics to look at any significant differences in the participant's scores between pre and post-intervention, descriptive statistics were used to look at the number of scores that increased, decreased or showed no change for each of the variables. For individual participants descriptive statistics were used to report whether their scores had increased, decreased or showed no change.

3.9.2.2 Staff interviews

Content analysis was selected as the method of analysis to be carried out on the staff interview data. Neuendorf (2002) comments that content analysis *'by most definitions, it fits the positive paradigm of social research'* (p11). McQueen and Knuseen (2006) suggest that, *'Given the objective and the observable, content analysis is reliable, in that analysis is not dependent upon the interpretation of the analyst. In this way, it differs from other methods that draw upon phenomenology'*. (p343). This fits with the epistemological position of the current research which, as is mentioned in section 1.6, is a post-positivist one.

Neuendorf (2002) highlights that much of the literature on content analysis has concentrated on manifest content. She says that considering the latent content is an alternative. The latent content looks at the possible meaning behind the language being used. It was not felt

necessary to do this for the current study as the focus was not on the meaning behind the language used, rather on simply describing what had been said during the interviews in a meaningful way for the reader.

In terms of carrying out a content analysis, Gillham (2000) states it *'is about ordering the substantive content of the interview: the content that is of substance'* (p59). He highlights that there are *'two essential strands to the analysis'*. The first of these is *'identifying those key, substantive points'* and the second is *'putting them into categories'* (Gillham, 2000, p59). Gillham describes categories as *'simply headings'* in which *'the substance and meaning come with the use of direct quotations categorized in this way but displaying the range and character of the responses'* (Gillham, 2000, p59). Gillham (2000) highlights that *'the overall purpose of constructing categories is to be able to assign all the 'substantive' statements to them'* (p60). He suggests that categories should be exhaustive and exclusive.

Due to time restrictions, the staff interviews were not transcribed. Neuendorf (2002) states that *'a content analysis summarizes rather than reports all details concerning a message set'* (p15). It was felt that it was possible to do this without transcribing all of the data from the interviews. Gillham (2000) describes a short cut to transcription which is

'...to listen to the tape and note down the substantive statements as they float along the stream of consciousness. There is a good to-ing and fro-ing with the tape and, when you have abstracted the statement you need to run through the tape again, listening for anything you might have missed' (Gillham, 2000, p61).

The staff interviews were therefore listened to and substantive statements noted down for each interview. The interviews were listened to again in order to note down anything that might have been missed. Gillham (2000) recommends having somebody to peer review the substantive statements and categorisations. Neuendorf (2002) recommends coder training and having at least two coders. This was not possible in this study and was not deemed necessary given the analysis was concentrating on describing what was said in the staff interviews rather than a deeper analysis looking at the possible meaning of the language used.

In relation to research question three; what impact do executive function staff training sessions have on primary school children's attention skills and executive function skills as measured by standardised assessment, it was felt important to identify what types of things staff were doing in class to help children develop their executive skills. The purpose of this part of the analysis was to provide examples of what staff were doing to promote the development of children's executive functions. It was possible therefore to pre-determine the categories as the purpose of the analysis was to record any examples relating to the eleven

executive functions. The possible categories were therefore the executive functions themselves; response inhibition, working memory, emotional control, sustained attention, task initiation, planning/prioritisation, organisation, time management, goal-directed persistence, flexibility, and metacognition. As suggested by Gillham (2000) these were organised in tabular form by year group with quotes used to highlight examples of the executive functions that were identified during the analysis (see section 4.4.1.2.1).

One of the other purposes of carrying out the staff interviews which relates to research question three was to identify any possible extraneous variables that may have contributed to changes in the participant's scores between pre and post intervention. Substantive statements were recorded and then reduced to short statements that in effect simply listed the extraneous variable, which was then included in the table highlighting descriptive statistics by participant (see section 4.4.2.3).

Substantive statements that did not relate to specific examples of staff promoting executive function development or possible extraneous variables were used to form categories that related to research question two; what is useful about executive function staff training sessions. Where there was a quotation from more than one staff member the quotes were presented in a tabular form. Categories that were identified from the discussion with the head teacher were presented in narrative format using appropriate quotes. The categories were formed to be as exclusive and as exhaustive as possible (see section 4.3.2).

3.10 Risk analysis and ethical issues

Table 3.6: Risk analysis

Risk	Level	Contingency
Difficulties with participant recruitment (pupils)	Medium	Ask the class teachers to choose more children from their class to be involved with the research.
Difficulties with participant recruitment (teachers)	Low	Ask the teaching assistants if they would like to be involved.
Difficulties with participant recruitment (school)	Low	Ask other primary schools in the local authority if they would be interested in participating.
Key members of staff not available during the INSET session.	Low	Offer an alternative date. Consider doing two INSETS. Offer to deliver INSET to key members of staff on an individual basis.
Researcher illness	Low	Use contingency time. Reduce the numbers of participants. Request an extension.

Data collection takes longer than anticipated.	Medium	Use contingency time. Reduce the numbers of participants. Request an extension.
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This research study was designed to fulfil the requirements set out by the British Psychological Society Code of Ethics and Conduct (2006). Voluntary and informed consent was gained from the adult participants (school staff). Informed parental consent was gained from the parent/carers of participating children. A letter explaining the study was sent to parent/carers and they were asked to fill in a reply slip to confirm they gave their permission for the children to participate. The researcher did not have access to children's details before parental consent had been given. School administration staff sent out the letters to parents/carers. The study was also explained to participating children and they were made aware that participating in the project was voluntary.

Every effort was made to ensure confidentiality. The participant's assessment results were identified by age and gender only. The school and names of the staff members involved in the study will remain anonymous. Staff were asked for their permission to take part in filling in the audit and evaluation questionnaires and the staff interviews. Participants were asked for their permission to record the semi-structured interviews. Participants were made aware of their right to withdraw from the study at any point and of their right to refuse to allow their contributions to be used in the project.

In accordance with the Data Protection Act (1998) the data will be stored securely and destroyed when no longer needed. School staff will be informed of the outcomes of the project.

Ethical considerations also informed the decision to deliver training to staff on executive function (rather than attention) and to intervene at a systemic, rather than individual child level. Executive functions cover a wide range of skills and have been identified as important for everyday social life as well as academic progress (e.g. Gioia and Isquith, 2004) so may have a larger impact than working on attention alone. By working at a systemic level to help staff to help children develop their executive function skills it ensured no children that were excluded. As mentioned in section 2.10, it was thought that staff may have found training on executive function skills more interesting than attention and so may have been more engaged in carrying out strategies identified in the training.

Consideration was given to potential ethical issues regarding the interviews carried out with teachers and teaching assistants during the post intervention stage of the research. Consideration was given to asking staff about their views on individual children's progress in executive skills and attention. However, it was felt that in order to do this staff would have had to be given information about the changes between individual children's scores. Whilst

parental permission had been gained to discuss individual children's progress, they had been assured that no information would be kept on their child's file (see appendix 3). It was thought possible that staff may inadvertently retain information about children's scores (even if it was not in a written format). This could be potentially damaging for children where some of their scores had decreased between the pre and post intervention stage. It was decided therefore that information about individual children's scores would not be given to staff.

3.11 Critique of the method

As discussed in section 3.4, a possible limitation of this study is the fact that a pre-experimental design is being used, in particular the lack of a control group. The time constraints of the project determined the number of children that could be tested within the allocated time. 31 children were assessed in the primary school that took part in the project. It was not possible to test another 31 children to make up a control group in the given time. Also as the intervention was carried out with the whole staff, the control group would have to come from another school and pupils and teachers from both schools would need to be matched which would, in reality be very difficult to do. A repeated measures design is being used so that each participant will act as their own control.

Mitchell and Jolley (1996) suggest that there are six questions to ask when examining a pre-test post-test design. The first of these is whether any differences could be due to maturation. One possible limitation of this study is the fact that children would be expected to make some gains in executive function and attention skills, which may be reflected in the differences between the pre and post measures. However, as the instrumentation used is standardised it will be possible to look at the gains children have made over and above those that they would normally be expected to gain in the 6 months between pre and post testing.

Another area Mitchell and Jolley (1996) suggest as important when examining a pre-test post-test design is whether participants score differently at post-test as a result of practice effects. As mentioned in section 3.7.1.1, two versions of the TEA-Ch are being used to minimise any potential practice effects. As discussed in section 3.6, there are some issues with reliability of some of the measures being used. However, steps have been taken to address this where possible, e.g. leaving seven months between pre and post test and being aware of the subtests that may be more unreliable than others. Scores will be interpreted with due caution where necessary.

The other questions posed by Mitchell and Jolley (1996) have also been addressed in this study. The same instrumentation was used with the participants in the same way when measured at pre-test and post-test. Participants were not selected for their extreme pre-test scores, which Mitchell and Jolley (1996) suggest can lead to participant's getting less extreme scores when measured at post-test. Another issue identified by Mitchell and Jolley

is regarding drop out rates and whether the pre-test and post-test group were actually two different groups. In this study all 31 participants assessed at pre-test were also assessed at pos-test. Finally, Mitchell and Jolley highlight that other events in the participants' lives may have contributed to changes in scores. The study attempts to address this issue by identifying possible extraneous variables through the staff interview, as discussed in sections 3.91 and 4.4.4.

There is an acknowledged degree of interrelation between attention and executive function. However, this does not mean that it is not important to investigate the links between these two concepts. Whilst it could be argued that the NEPSY-II is not a pure enough measure of executive function, it is the only standardised assessment to the researcher's knowledge that is available for direct use with primary school children. As discussed in section 2.8, one of the methodological difficulties is different researchers using multiple assessments to assess executive function and attention. This study attempts to address some of the previous methodological issues by using standardised assessments that are specifically designed for use with children, and which have standardised norms for the age range of the children participating in this study.

The first 4 subtests of the TEA-Ch are being used rather than the full nine subtests. However, as discussed in section 3.6.2, the manual states that the first four subtests can be used to gain a briefer screening which provides an estimate of the three attention factors and a dual task performance. Carrying out the four subtests is therefore considered sufficient for the purposes of this study.

As discussed in section 3.7.2.1 the decision was made to use non parametric tests throughout the inferential statistical analysis. Whilst these have less power than parametric tests, due to much of the data not meeting the necessary assumptions of parametric data, the use of non parametric tests allowed a more accurate analysis of the data. The study used Spearman's correlation coefficients to investigate the link between attention and executive function. Although correlations cannot tell us about the direction of the link, they provide a good starting point for a pre-experimental design and allow knowledge to be gained about the strength of the links between attention and executive functions.

As discussed in section 3.8.2.1 the staff training sessions had to be carried out separately with the teachers and teaching assistants. The disadvantage of this was that the sessions could not be held for the teachers during the school day. Having a twilight session meant there was less time as it took a while to gather everyone together. Also people were tired from their day at work. However, having separate sessions for the teaching assistants worked quite well as it meant the sessions could be carried out at the right level. The researcher got the impression that working with the teaching assistants separately meant

that they contributed more ideas than they may have done if the sessions were delivered to the whole staff together.

Staff did not use the drop-in sessions. One possibility is that they felt confident enough from the training sessions and information from the written materials to carry out the intervention without the need for additional input. On reflection, the drop in sessions could have possibly been advertised more effectively. However, the researcher visited the school several times between pre and post-intervention as part of her work as a TEP. On these occasions the researcher made sure she spent some time in the staff room in case anyone wanted to ask anything about the intervention. By not imposing herself fortnightly on the staff, the researcher allowed the staff to use whatever parts of the training they found practically possible. This means the intervention was more authentic and true to the type of research/interventions EPs are able to carry out, as in the course of this work there would not normally be time to offer such drop in sessions.

The teachers were not asked to rate the children using standardised checklists for attention or executive function skills. This was partly due to time constraints but also due to the fact that involving teachers in the project in this way is looking at a different research question; whether or not teacher perceptions match the standardised assessment scores gained by children on measures of attention and executive functioning. Whilst this is an interesting question that looks at matching psychology and teacher perceptions, the focus of this thesis is looking at the link between children's executive functioning and attention skills as measured by standardised assessment and exploring the effect of training staff about executive functioning and possible classroom strategies. Also, it would not have been possible to get the class teacher to rate the children's skills pre and post assessment without them being made aware of which children were being assessed. As discussed in section 3.10, the decision was made not to triangulate the standardised assessment scores through teacher interviews. In addition to ethical considerations (discussed in section 3.10), it was considered that once again, attempts to triangulate the data in this way would be answering a different research question as discussed above.

One of the class teachers taught the same class at both pre and post-intervention stages which meant she was aware of the children included in the sample from her class. This could not be controlled by the researcher and so the researcher remained aware of it and looked at descriptive statistics on the data from that particular class alongside discussing it with the class teacher during the semi-structured interview to try to ascertain whether this had had any impact on the results (see section 4.4.2.1).

Classroom observations were not carried out for a number of reasons. As the teachers were aware of the TEP's role as researcher, the researcher's presence in the classroom may have

encouraged the teachers to use executive function strategies where they may not have done otherwise. It would have been difficult to get a true measure of how any strategies were being implemented by carrying out short observations. The researcher was aware that there would be differences between the class teachers. However, this is the case with any whole staff training that is carried out in schools.

Whilst this study will only look at a small sample of children within one primary school, it is the first study to look at whether general attention difficulties are linked to executive function deficits and to look at the effects of staff training in relation to executive function. If the intervention is successful, future research could investigate how the results may be generalised.

3.12 Summary of methodology

This chapter has described the methods used to answer the study's three research questions;

1. What is the link between primary school children's attention skills and executive function skills as measured by standardised assessment?
2. What is useful about executive function staff training sessions?
3. What impact do executive function staff training sessions have on children's attention skills and executive function skills as measured by standardised assessment?

The study used a pre-experimental design. This involved using a single group, repeated measures approach. The study involved one primary school based in the North West of England. 31 participants were selected from across five year groups. The procedures used to recruit the participants were discussed in section 3.5. The chapter went on to look at the instrumentation used in the study (section 3.6), which was the first four subtest of the TEA-Ch and the Attention and Executive Function domain of the NEPSY-II. Potential issues of reliability were discussed and it was concluded that the instrumentation were suitable for use in the study and that procedures had been put into place to take account of potential reliability issues.

The pre-intervention stage of the research was described in section 3.7. This involved assessing all 31 participants using the TEA-Ch and NEPSY-II in June and July 2009. A staff audit questionnaire was also carried out to inform the development of the executive function training sessions. As much of the data did not meet the necessary assumptions of parametricity the decision was made to use non parametric tests throughout the inferential statistical analysis. Participants' scores on the NEPSY-II and TEA-Ch were analysed using

Spearman's correlation coefficients. The staff audit questionnaires were analysed using content analysis.

The intervention stage of the research was discussed in section 3.8. Details were given about how the training was developed, including considerations that were made with regard to aspects such as audience, timing, content, structure, language and terminology. Dawson and Guare's (2004) definition of executive skills and their model of 11 separate skills were used in the staff training. Dawson and Guare's 2004 and 2009 texts were used extensively in the development of the training package due to the accessibility for staff, the links to intervention ideas, and the knowledge the authors had in terms of applying scientific knowledge to educational practice. The delivery of the training was discussed including practical issues which resulted in separate sessions being delivered to teachers and teaching assistants. Details about how the training was adapted during the intervention stage were given. Details were also given about the support provided for staff following the delivery of the executive skills sessions, which included the provision of fortnightly drop-in sessions and the production of a pack of written materials. Data was collected in this stage of the research through the use of a research diary and staff evaluation questionnaires. The questionnaires were analysed using content analysis.

The post-intervention stage of the study was described in section 3.9. This stage involved reassessing the 31 participants using the NEPSY-II and TEA-Ch. Staff interviews were carried out in order to find out what staff had been doing between pre and post-intervention to help children develop their executive function skills and to identify any possible extraneous variables that might have accounted to changes in individual participant's score between pre and post-intervention. Staff interviews were also used to discover information about what is useful about executive function staff training sessions. The staff interviews were analysed using content analysis. Descriptive statistics were used to look at the differences between classes, to look at the changes between pre and post intervention for each variable and the changes between post and pre-intervention for each individual participant.

The chapter looked at a risk analysis and ethical considerations in section 3.10. Finally a critique of the method was provided in section 3.11, where possible limitations of the method were acknowledged and discussed.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter will consider each of the research questions in turn.

1. What is the link between primary school children's attention skills and executive function skills as measured through standardised assessment?
2. What is useful about executive function staff training sessions?
3. What impact do executive function staff training sessions have on children's attention skills and executive function skills as measured by standardised assessment?

4.2. What is the link between primary school children's attentional skills and executive function skills as measured through standardised assessment?

As described in section 3.2.7.1, a mean score for each child was calculated for the TEA-Ch and the NEPSY-II. Whilst these are proxy measures, they are useful as a general measure of attention and a general measure of executive function. It was predicted that the scores from the TEA-Ch would correlate significantly with the TEA-Ch mean and that the scores from the NEPSY-II would correlate significantly with the NEPSY mean. As there was a specific relationship predicted, a one tailed test was selected. Spearman's correlation coefficients were calculated. This analysis showed that each of the TEA-Ch scores correlated significantly with the TEA-Ch mean with $p < .01$ for each of the correlations. This suggests that the TEA-CH mean is a good proxy measure to use as a general measure of attention. The analysis also showed that each of the NEPSY-II scores were significantly correlated with the NEPSY mean with $p < .05$ level for each of the correlations. This suggests that the NEPSY mean is a good proxy measure to use as a general measure of executive function.

4.2.1. TEA-Ch mean and NEPSY mean correlation

It was predicted that the TEA-Ch mean would correlate significantly with the NEPSY mean as literature suggests a close link between attention and executive function (section 2.7). There was a significant correlation between the TEA-Ch mean and the NEPSY mean, $\rho = 0.793$, $p < .01$, one-tailed. This was a high correlation in which 62.88% of the variance in the TEA-Ch mean can be accounted for by variance in the NEPSY mean. This suggests that

there is a significant correlation between a general measure of attention skills and a general measure of executive function skills.

4.2.2 Correlations at the subtest level

Having established that there was a high correlation between the proxy measures used to look at general attention and executive function skills, Spearman’s correlation coefficients were calculated at the subtest level between each of the TEA-Ch variables and each of the NEPSY-II variables. Two-tailed tests were carried out at the subtest level as there was not a specific prediction about the relationships between the different subtests. The table below gives a summary of the number of NEPSY-II variables that correlated significantly and the number of NEPSY-II variables, which did not correlate significantly with each of the TEA-Ch variables.

Table 4.1: Number of significant and non significant correlations between each TEA-Ch variables and the NEPSY-II variables

TEA-Ch variable	Number of variables on the NEPSY-II significantly correlated	Number of variables on the NEPSY-II which did not correlate significantly
Sky Search (number of correctly identified targets)	3	11
Sky Search (time per target)	7	7
Sky Search Attention Score	7	7
Score!	10	4
Creature Counting Accuracy	10	4
Creature Counting Timing Score	3	11
Sky Search DT	6	8
Total	46	52

Each of the TEA-Ch variables and the correlations with the NEPSY-II variables are discussed in turn. Additional explanations for the correlations are suggested where possible.

4.2.2.1 Sky Search (number of correctly identified targets)

There was a significant correlation between Sky Search (number of correctly identified targets) and Auditory Attention Total Correct, $\rho = 0.359$, $p = .047$. This was a medium correlation in which Sky Search (number of correctly identified targets) can account for 12.88% of the variance in Auditory Attention Total Correct¹. There was also a significant

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

correlation between Sky Search (number of correctly identified targets) and Auditory Attention Combined Score, $\rho = 0.425$, $p = .017$. This was a medium correlation in which the variance in Sky Search (number of correctly identified targets) can account for 18.06% of the variance in Auditory Attention Combined. One possible explanation for this correlation is that both subtests involve the use of selective attention.

There was a significant correlation between Sky Search (number of correctly identified targets) and Design Fluency¹, $\rho = 0.442$, $p = .013$. This was a medium correlation in which the variance in Sky Search (number of correctly identified targets) can account for 19.54% of the variance in Design Fluency¹. One possible explanation for this correlation is that both subtests may involve the need to use working memory to adhere to the rules of the task.

There were no significant correlations between Sky Search (number of correctly identified targets) and the following NEPSY-II variables; Animal Sorting, Animal Sorting Combined, Response Set Total Correct¹, Response Set Combined, Clocks¹, Inhibition Naming Total Completion Time¹, Inhibition Naming Combined¹, Inhibition Inhibition Total Completion Time¹, Inhibition Inhibition Combined Score, Inhibition Switching Total Completion Time and Inhibition Switching Combined Score.

4.2.2.2 Sky Search (time per target)

There was a significant correlation between Sky Search (time per target) and Design Fluency, $\rho = 0.555$, $p < .01$. This was a high correlation in which the variance in Sky Search (time per target) can account for 30.80% of the variance in Design Fluency¹. Possible explanations for this correlation are that both involve motor control and processing speed.

There was a significant correlation between Sky Search (time per target) and Inhibition Naming Total Completion Time, $\rho = 0.476$, $p < .01$. This was a medium correlation in which the variance in Sky Search (time per target) can account for 22.66% of the variance in Inhibition Naming Total Completion Time. Possible explanations for this correlation are that both subtests involve processing speed and the need to self-monitor.

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

There was a significant correlation between Sky Search (time per target) and Inhibition Naming Combined, $\rho = 0.497$, $p < .01$. This was a medium correlation in which the variance in Sky Search (time per target) can account for 24.7% of the variance in Inhibition Naming Combined¹. One possible explanation for this correlation is that both subtests involve a need to get a balance between speed and accuracy. Other possible explanations are that both subtests involve processing speed, and the need to self-monitor.

There was a significant correlation between Sky Search (time per target) and Inhibition Inhibition Total Completion Time, $\rho = 0.538$, $p < .01$. This was a high correlation in which the variance in Sky Search (time per target) can account for 28.94% of the variance in Inhibition Inhibition Total Completion Time¹. Possible explanations for this correlation are that both tasks involve processing speed and the need to self-monitor.

There was a significant correlation between Sky Search (time per target) and Inhibition Inhibition Combined, $\rho = 0.522$, $p < .01$. This was a high correlation in which the variance in Sky Search (time per target) can account for 27.25% of the variance Inhibition Inhibition Combined. One possible explanation for this correlation is that both subtests involve a need to get a balance between speed and accuracy. Other possible explanations are that both subtests involve processing speed, and the need to self-monitor.

There was a significant correlation between Sky Search (time per target) and Inhibition Switching Total Completion Time, $\rho = 0.674$, $p < .01$. This was a high correlation in which the variance in Sky Search (time per target) can account for 45.43% of the variance in Inhibition Switching Total Completion Time. Possible explanations for this correlation are that both tasks involve processing speed and the need to self-monitor.

There was a significant correlation between Sky Search (time per target) and Inhibition Switching Combined, $\rho = 0.582$, $p < .01$. This was a high correlation in which the variance in Sky Search (time per target) can account for 33.87% of the variance in Inhibition Switching Total Completion Time. One possible explanation for this correlation is that both subtests involve a need to get a balance between speed and accuracy. Other possible explanations are that both subtests involve processing speed, and the need to self-monitor.

There were no significant correlations between Sky Search (time per target) and the following NEPSY-II variables; Animal Sorting, Animal Sorting Combined, Auditory Attention Total Correct¹, Auditory Attention Combined, Response Set Total Correct¹, Response Set Combined and Clocks¹.

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

4.2.2.3 Sky Search Attention

There was a significant correlation between Sky Search Attention and Design Fluency, $\rho=0.454$, $p=.012$. This was a medium correlation in which the variance in Sky Search Attention can account for 20.61% of the variance in Design Fluency¹. Possible explanations for this correlation are that both subtests may involve the need to use working memory to adhere to the rules of the task, and both subtests involve processing speed.

There was a significant correlation between Sky Search Attention and Inhibition Naming Total Completion Time¹, $\rho=0.433$, $p=.017$. This was a medium correlation in which the variance Sky Search attention can account for 18.75% of the variance in Inhibition Naming Total Completion Time. Possible explanations for this correlation are that both subtests involve processing speed and the need to self-monitor.

There was a significant correlation between Sky Search Attention and Inhibition Naming Combined, $\rho=.473$, $p<.01$. This was a medium correlation in which the variance in Sky Search Attention can account for 22.37% of the variance in Inhibition Naming Combined¹. One possible explanation for this correlation is that both subtests involve a need to get a balance between speed and accuracy. Other possible explanations are that both subtests involve processing speed and the need to self-monitor.

There was a significant correlation between Sky Search Attention and Inhibition Inhibition Total Completion Time¹, $\rho=.605$, $p<.01$. This was a high correlation in which the variance in Sky Search Attention can account for 36.6% of the variance in Inhibition Inhibition Total Completion Time. Possible explanations for this correlation are that both subtests involve processing speed and the need to self-monitor.

There was a significant correlation between Sky Search Attention and Inhibition Inhibition Combined, $\rho=.510$, $p<.01$. This was a high correlation in which the variance in Sky Search Attention can account for 26.01% of the variance in Inhibition Inhibition Combined. One possible explanation for this correlation is that both subtests involve a need to get a balance between speed and accuracy. Other possible explanations are that both subtests involve processing speed, and the need to self-monitor.

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

There was a significant correlation between Sky Search Attention and Inhibition Switching Total Completion Time, $\rho = 0.721$, $p < .01$. This was a high correlation in which the variance in Sky Search Attention can account for 51.98% of the variance in Inhibition Switching Total Completion Time. Possible explanations for this correlation are that both subtests involve processing speed and the need to self-monitor.

There was a significant correlation between Sky Search Attention and Inhibition Switching Combined, $\rho = 0.532$, $p < .01$. This was a high correlation in which the variance in Sky Search Attention can account for 28.3% of the variance in Inhibition Switching Combined. One possible explanation for this correlation is that both subtests involve a need to get a balance between speed and accuracy. Other possible explanations are that both subtests involve processing speed, and the need to self-monitor.

There were no significant correlations between Sky Search Attention and the following NEPSY-II variables; Animal Sorting, Animal Sorting Combined, Auditory Attention Total Correct¹, Auditory Attention Combined, Response Set Total Correct¹, Response Set Combined and Clocks¹.

4.2.2.4 Score!

There was a significant correlation between Score! and Auditory Attention Total Correct, $\rho = 0.490$, $p < .01$. This was a medium correlation in which Score! can account for 24.01% of the variance in Auditory Attention Total Correct¹. There was also a significant correlation between Score! and Auditory Attention Combined, $\rho = 0.545$, $p < .01$. This was a high correlation in which the variance in Score! accounted for 29.7% of the variance in Auditory Attention Combined. One possible explanation for this correlation is that both subtests involve the need to sustain auditory attention.

There was a significant correlation between Score! and Response Set Total Correct, $\rho = 0.657$, $p < .01$. This was a high correlation in which the variance in Score! can account for 43.16% of the variance in Response Set Total Correct¹. There was also a significant correlation between Score! and Response Set Combined, $\rho = 0.543$, $p < .01$. This was a high correlation in which Score! can account for 29.48% of the variance in Response Set Combined. One possible explanation for this correlation is that both subtests involve the need to sustain auditory attention.

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

There was a significant correlation between Score! and Design Fluency, $\rho = 0.394$, $p = .028$. This was a medium correlation in which the variance in Score! can account for 15.52% of the variance in Design Fluency¹. The researcher is not able to provide any additional explanation for this relationship.

There was a significant correlation between Score! and Inhibition Naming Total Completion Time, $\rho = 0.645$, $p < .01$. This was a high correlation in which the variance in Score! can account for 29.03% of the variance in Inhibition Naming Total Completion Time¹. The researcher is not able to provide any additional explanation for this relationship.

There was a significant correlation between Score! and Inhibition Naming Combined, $\rho = 0.589$, $p < .01$. This was a high correlation in which the variance in Score! can account for 34.69% of the variance in Inhibition Naming Combined¹. The researcher is not able to provide any additional explanation for this relationship.

There was a significant correlation between Score! and Inhibition Inhibition Total Completion Time, $\rho = .365$, $p = .043$. This was a medium correlation in which the variance in Score! can account for 13.32% of the variance in Inhibition Inhibition Total Completion Time¹. The researcher is not able to provide any additional explanation for this relationship.

There was a significant correlation between Score! and Inhibition Inhibition Combined, $\rho = 0.594$, $p < .01$. This was a high correlation in which the variance in Score! can account for 35.28% of the variance in Inhibition Inhibition Combined. The researcher is not able to provide any additional explanation for this relationship.

There was a significant correlation between Score! and Inhibition Switching Combined, $\rho = 0.458$, $p = .024$. This was a medium correlation in which the variance in Score! accounted for 20.97% of the variance in Inhibition Switching Combined. The researcher is not able to provide any additional explanation for this relationship.

Score! was not significantly correlated with the following NEPSY-II variables; Animal Sorting, Animal Sorting Combined, Clocks¹ and Inhibition Switching Total Completion Time.

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

4.2.2.5 Creature Counting Accuracy

There was a significant correlation between Creature Counting Accuracy and Animal Sorting Combined, $\rho = 0.480$, $p = .021$. This was a medium correlation in which the variance in Creature Counting Accuracy can account for 23.04% of the variance in Animal Sorting Combined. One possible explanation for this correlation is that both subtests involve the need for sustained effort.

There was a significant correlation between Creature Counting Accuracy and Response Set Combined, $\rho = 0.417$, $p = .048$. This was a medium correlation in which the variance in Creature Counting Accuracy can account for 17.39% of the variance in Response Set Combined. One possible explanation for this correlation is that both subtests involve sustained auditory attention.

There was a significant correlation between Creature Counting Accuracy and Clocks, $\rho = 0.565$, $p < .01$. This was a high correlation in which the variance in Creature Counting Accuracy can account for 31.92% of the variance in Clocks¹. One possible explanation for this correlation is that both subtests involve the need for some level of mathematical ability.

There was a significant correlation between Creature Counting Accuracy and Design Fluency, $\rho = 0.451$, $p = .012$. This was a medium correlation in which the variance in Creature Counting Accuracy can account for 20.34% of the variance in Design Fluency¹. The researcher is not able to provide any additional explanation for this relationship.

There was a significant correlation between Creature Counting Accuracy and Inhibition Naming Total Completion Time, $\rho = 0.530$, $p < .01$. This was a high correlation in which the variance in Creature Counting Accuracy accounted for 28.09% of the variance in Inhibition Naming Total Completion Time¹. The researcher is not able to provide any additional explanation for this relationship.

There was a significant correlation between Creature Counting Accuracy and Inhibition Naming Combined, $\rho = .412$, $p = .024$. This was a medium correlation in which the variance in Creature Counting Accuracy can account for 16.97% of the variance in Inhibition Naming Combined¹. The researcher is not able to provide any additional explanation for this relationship.

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

There was a significant correlation between Creature Counting Accuracy and Inhibition Inhibition Total Completion Time, $\rho = 0.707$, $p < .01$. This was a high correlation in which the variance in Creature Counting Accuracy can account for 49.98% of the variance in Inhibition Inhibition Total Completion Time¹. There was also a significant correlation between Creature Counting Accuracy and Inhibition Inhibition Combined, $\rho = 0.494$, $p < .01$. This was a medium correlation in which Creature Counting Accuracy can account for 24.40% of the variance in Inhibition Inhibition Combined. One possible explanation for these correlations is that both subtests involve the need for some level of cognitive flexibility.

There was a significant correlation between Creature Counting Accuracy and Inhibition Switching Total Completion Time, $\rho = 0.438$, $p = .037$. This was a medium correlation in which the variance in Creature Counting Accuracy can account for 19.18% of the variance in Inhibition Switching Total Completion Time. There was also a significant correlation between Creature Counting Accuracy and Inhibition Switching Combined, $\rho = 0.578$, $p < .01$. This was a high correlation in which Creature Counting Accuracy can account for 33.41% of the variance in Inhibition Switching Combined. One possible explanation for these correlations is that both subtests involve switching between factors.

There were no significant correlations between Creature Counting Accuracy and the following NEPSY-II variables; Animal Sorting, Auditory Attention Total Correct¹, Auditory Attention Combined. Response Set Total Correct¹.

4.2.2.6 Creature Counting Timing¹

There was a significant correlation between Creature Counting Timing and Inhibition Naming Total Completion Time, $\rho = 0.562$, $p < .01$. This was a high correlation in which the variance in Creature Counting Timing can account for 31.58% of the variance in Inhibition Naming Total Completion Time. There was also a significant correlation between Creature Counting Timing and Inhibition Naming Combined, $\rho = 0.473$, $p = .023$. This was a medium correlation in which the variance in Creature Counting Timing can account for 22.37% of the variance in Inhibition Naming Combined. One possible explanation for this correlation is that both subtests involve processing speed and speed of giving an oral response.

There was a significant correlation between Creature Counting Timing and Inhibition Switching Combined, $\rho = 0.517$, $p = .028$. This was a high correlation in which the variance in Creature Counting Timing can account for 26.73% of the variance in Inhibition Switching

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

Combined. One possible explanation for this correlation is that both subtests involve processing speed and speed of giving an aural response. Another possible explanation is that both subtests involve the need to switch between two factors.

There were no significant correlations between Creature Counting Timing and the following NEPSY-II variables; Animal Sorting, Animal Sorting Combined, Auditory Attention Total Correct, Auditory Attention Combined, Response Set Total Correct, Response Set Combined, Clocks, Design Fluency, Inhibition Inhibition Total Completion Time, Inhibition Inhibition Combined, Inhibition Switching Total Completion Time.

4.2.2.7 Sky Search DT

There was a significant correlation between Sky Search DT and Animal Sorting, $\rho = 0.554$, $p < .01$. This was a high correlation in which the variance in Sky Search DT can account for 30.69% of the variance in Animal Sorting. There was also a significant correlation between Sky Search DT and Animal Sorting Combined, $\rho = 0.454$, $p = .030$. This was a medium correlation in which the variance in Sky Search DT can account for 20.61% of the variance in Animal Sorting Combined. One possible explanation for this correlation is that both subtests involve the need for sustained effort.

There was a significant correlation between Sky Search DT and Auditory Attention Total Correct, $\rho = 0.433$, $p = .017$. This was a medium correlation in which the variance in Sky Search DT can account for 18.75% of the variance in Auditory Attention Total Correct¹. There was also a significant correlation between Sky Search DT and Auditory Attention Combined, $\rho = 0.488$, $p < .01$. This was a medium correlation in which the variance in Sky Search DT can account for 23.81% of the variance in Auditory Attention Combined. One possible explanation for these correlations is that both subtests involve sustained auditory attention.

There was a significant correlation between Sky Search DT and Design Fluency, $\rho = 0.580$, $p < .01$. This was a high correlation in which the variance in Sky Search DT can account for 33.64% of the variance in Design Fluency¹. Possible explanations for this correlation are that both subtests may involve the need to use working memory to adhere to the rules of the task, both subtests involve processing speed and both subtests involve motor control.

There was a significant correlation between Sky Search DT and Inhibition Naming Total Completion Time, $\rho = 0.388$, $p = .034$. This was a medium correlation in which the variance

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

in Sky Search DT can account for 15.05% of the variance in Inhibition Naming Total Completion Time¹. Possible explanations for this correlation are that both subtests involve processing speed and the need to self-monitor.

There were no significant correlations between Sky Search DT and the following NEPSY-II variables; Response Set Total Correct¹, Response Set Combined, Clocks¹, Inhibition Naming Combined¹, Inhibition Inhibition Total Completion Time¹, Inhibition Inhibition Combined, Inhibition Switching Total Completion Time, Inhibition Switching Combined.

4.2.2.8 NEPSY variables that did not correlate significantly with TEA-Ch variables

Examination of the correlations at the subtest level highlights that there were particular NEPSY-II variables that often did not correlate significantly with the TEA-Ch variables.

Clocks did not correlate significantly with six out of seven of the TEA-Ch variables¹. One possible explanation for this is that the Clocks subtest involves the child to have specific knowledge of time in relation to analogue clocks. This knowledge is not required for any of the TEA-Ch subtests. It is also possible that the executive functions assessed by Clocks, such as planning and organisation are more separable from attention than those executive functions measured by other NEPSY-II subtests.

Animal Sorting did not correlate significantly with six out of seven of the TEA-Ch variables. Animal Sorting Combined did not correlate significantly with five out of seven of the TEA-Ch variables. One possible explanation for this is that well developed language skills may aid executive functioning on this task. It is also possible that the conceptual reasoning skills and semantic knowledge needed for this subtest are more separable from attention.

Response Set Total Correct did not correlate significantly with six out of seven of the TEA-Ch variables¹. Response Set Combined did not correlate significantly with five out of seven of the TEA-CH variables. The researcher is not able to provide any additional explanation for the lack of relationship between the Response Set variables and the TEA-Ch variables.

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

4.2.3 Summary of the link between primary school children's attention skills and executive function skills as measured through standardised assessment

The first research question was: What is the link between primary school children's attentional skills as measured through standardised assessment? In order to answer this question Spearman's correlation coefficients were calculated.

There was a significant, high correlation between the TEA-Ch mean and the NEPSY mean, $\rho = 0.793$, $p < 0.1$. 62.88% of the variance in the TEA-Ch mean could be accounted for by variance in the NEPSY mean. This suggests that there is a significant correlation between attention and executive function skills.

Spearman's correlations coefficients were then calculated at the subtest level to look at the correlations between the TEA-Ch and NEPSY-II variables. This analysis identified 46 significant correlations.

Significant, high correlations were identified between Sky Search (time per target) and the following NEPSY-II variables; Design Fluency, Inhibition Inhibition Total Completion Time, Inhibition Inhibition Combined, Inhibition Switching Total Completion Time and Inhibition Switching Combined.

Significant, high correlations were identified between Sky Search Attention and the following NEPSY-II variables; Inhibition Inhibition Total Completion Time, Inhibition Inhibition Combined, Inhibition Switching Total Completion Time and Inhibition Switching Combined.

Significant, high correlations were identified between Score! and the following NEPSY-II variables; Auditory Attention Combined, Response Set Total Correct, Response Set Combined, Design Fluency, Inhibition Naming Total Completion Time, Inhibition Naming Combined and Inhibition Inhibition Combined.

Significant, high correlations were identified between Creature Counting Accuracy and the following NEPSY-II variables; Clocks, Inhibition Naming Total Completion Time, Inhibition Inhibition Total Completion Time and Inhibition Switching Combined.

Significant, high correlations were identified between Creature Counting Timing and the following NEPSY-II variables; Inhibition Naming Total Completion Time, Inhibition Switching Combined.

Significant, high correlations were identified between Sky Search DT and the following NEPSY-II variables; Animal Sorting and Design Fluency.

Score! and Creature Counting Accuracy correlated significantly with the highest number of NEPSY-II variables, both correlating significantly with 10 of the 14 NEPSY variables. Sky Search (time per target) and Sky Search Attention both correlated significantly with seven of the 14 NEPSY-II variables. Sky Search DT correlated significantly with six of the 14 NEPSY-II variables. Sky Search (number of correctly identified targets) and Creature Counting Timing correlated significantly with three of the 14 NEPSY-II variables. This suggests that Sky Search (number of correctly identified targets) and Creature Counting Timing may be more separable from executive functions than the other TEA-Ch variables.

The analysis indicated that Design Fluency and variables from the Inhibition subtest correlated significantly with a large number of TEA-Ch variables. The variables from the Auditory Attention subtest both correlated significantly with four of seven of the TEA-Ch variables. Clocks did not correlate significantly with six out of seven of the TEA-Ch variables. Animal Sorting did not correlate significantly with six out of seven of the TEA-Ch variables. Animal Sorting Combined did not correlate significantly with five out of seven of the TEA-Ch variables. Response Set Total Correct did not correlate significantly with six out of seven of the TEA-Ch variables. Response Set Combined did not correlate significantly with five out of seven of the TEA-Ch variables. This suggests that the Clocks, Animal Sorting and Response Set subtests may be more separable from attention than other NEPSY-II variables.

4.3 What is useful about executive function staff training sessions?

In order to answer the second research question information was used from staff evaluation questionnaires and staff interviews. Where appropriate, information from the research diary has also been included.

4.3.1 Staff evaluation questionnaires

As discussed in section 3.8.2.3, evaluation questionnaires were used with staff at the end of each training session. The questionnaires were analysed using descriptive statistics and content analysis. Each set of questionnaires is discussed separately.

4.3.1.1 Teacher evaluation questionnaires at the end of session one

9 teachers completed the evaluation questionnaires at the end of session one.

The first question asked the teachers to rate how knowledgeable they felt about executive skills at the start of the session on a scale of 1-10 (1 being not at all knowledgeable and 10 being extremely knowledgeable). The mean score at the start of the session was 2.33.

The teachers were asked the same question at the end of session one. The mean score at the end of the session was 7.77. The mean change between the teachers' ratings at the beginning and end of the sessions was 5.33.

The third question asked what teachers found most helpful about the session. Responses were as follows:

- Looking at how the skills develop and the order they develop in
- The info about executive skills was helpful
- Discussions as a group-strategies
- Explanation of executive skills, discussion of existing strategies
- Sharing ideas and information
- Finding out the progression of executive skills
- Discussing strategies used in a different department
- Explanation of executive skills and discussion of examples
- Talking about how we help children to gain the executive skills, listing the executive skills

Five participants identified discussing strategies as the most helpful thing about session one. Four participants mentioned definitions as the most helpful thing about session one. Two participants mentioned the information about the development of executive skills as helpful.

Five participants responded to question four which asked what they would be changing as a result of session one.

- More focus on time management (self)
- More aware, time to stand back and assess
- Greater consideration of what new strategies can be used in my classroom
- Thought given to the way children behave and respond
- Reminds you that children don't naturally have these executive skills.

No one mentioned anything that they wanted to be included in session two that was not mentioned in the plan for session two.

In terms of what could have been done differently teacher responses were:

- Quite happy
- I would have found it helpful to have heard your ideas and strategies first given that it is just a staff meeting. We work closely as a team and are all aware of the strategies we all use. Would have preferred having new ideas-would have been more useful.
- Good session
- Nothing, I very much enjoyed the session.

The teacher evaluation questionnaires at the end of session one indicated that teachers felt more knowledgeable about executive skills at the end of the session than they had done at the beginning. Teachers commented that they found the definitions, information about the development of executive skills and the discussions about strategies as helpful. Five of the teachers were able to comment on what they would be doing differently as a result of the session. The positive feedback suggests that the session was useful.

Notes from the research diary state that '*staff seemed interested*'. One teacher asked for the website for the Stroop task as she felt the children would really enjoy that. Another teacher asked about specific ideas for using with a younger age group as she felt we should be '*intervening as early as possible*'.

4.3.1.2. Teacher evaluation questionnaires at the end of session two

11 teachers completed the evaluation questionnaire at the end of session two.

The first questions asked teachers to rate on a scale of 1-10 (1 being not at all knowledgeable and 10 being extremely knowledgeable) how knowledgeable they felt about how executive skills relate to the curriculum.

The mean rating at the start of the session was 5.55. The mean rating at the end of the session was 7.81. The mean change between the participants' ratings at the start and end of session two was 2.27. Two of the participants rated themselves to be at the same point of the scale before and after the session. The other nine participants rated themselves as being more knowledgeable about how executive skills relate to the curriculum at the end of the session than they had done at the beginning of the session.

10 of the participants responded to question three which asked what they found most helpful about the session.

- Talking through different strategies for each skill and think about what we do
- Talking in small groups and taking on new ideas/strategies

- Considering existing practices to ensure a variety are being used
- Good information
- Discussion about issues
- Discussing with colleagues other strategies that we can share
- Discussion of the issues
- Katie's examples
- Discussion with colleagues
- Classroom strategies relevant and easy to apply in classroom situations

Eight participants mentioned the strategies as being the most helpful part of the session. Six participants also mentioned the discussion part of the session as being helpful. Two participants found the information given by the researcher the most helpful part of the session.

10 of the participants responded to question four which asked what impact the session will have on your teaching practice and the way in which you work with the children in school.

- To think about the best way to help individual children
- A few ideas given
- Try out new strategies
- To think about the skills more and implement some ideas
- More ideas to work with specific children
- Trying new strategies to improve executive skills
- Think of different strategies
- More aware of the skills when planning. Target children who have difficulties with strategies
- To think more carefully about strategies for certain children
- Planning- I will think about checklists, coloured trays, timers, routine, allowing children to become independent

All 10 participants mentioned they would be thinking about or implementing new strategies. Four participants mentioned using these strategies to work with individual children.

Four participants responded to question five which asked if there was anything that could have been done differently. The responses were:

- No
- No
- It repeated the last session a little

- No, thank you very much for your practical advice

The teacher evaluation questionnaires at the end of session two indicated that the majority of teachers felt more knowledgeable about how executive skills relate to the curriculum at the end of the session than they did at the beginning. This change was not as large as the change in knowledge about executive skills in session one. This may have been due to the fact that from session one, teachers had already gained knowledge about how executive skills relate to the curriculum. The teachers mentioned the strategies, discussion with colleagues and information given as being helpful. All 10 teachers were able to highlight something they would change about their teaching practice following the session. The positive feedback suggested that the teachers had found the session helpful.

4.3.1.3 Teaching Assistant questionnaires at the end of session one

10 teaching assistants completed the evaluation questionnaire at the end of session one.

The first question asked the teaching assistants to rate how knowledgeable they felt about executive skills at the start of the session on a scale of 1-10 (1 being not at all knowledgeable and 10 being extremely knowledgeable). The mean rating score at the start of session one was 1.7. Participants were asked to rate their knowledge again at the end of the session. The mean rating score at the end of session one was 6.7. The mean change in participant's scores between the start and end of session one was 5. All participants rated their knowledge about executive skills as higher at the end of session one than they did at the start of the session.

All 10 participants responded to question three which asked what they had found most helpful about the session. The responses were:

- New strategies to try out
- New ideas
- Realising that the terms used are what I do a lot of the time
- All of the strategies to prompt desired effect used by other TA's
- Refreshed me-new ideas
- Group discussion
- The ideas to use in class from other TAs
- Ideas of strategies to use
- Sharing information
- Sharing other peoples views and strategies/ideas

Nine participants mentioned the strategies part of the session as being the most useful. Five participants specifically commented on the usefulness of sharing ideas with their colleagues. One participant mentioned the understanding of the definitions as most helpful.

Nine participants responded to question four which asked what you will be changing (if anything) as a result of today's session. Responses were as follows:

- Still thinking
- Not changing but adding to
- Being more aware of my skills and how to help children develop their skills
- Try and use the ideas to fit the children
- Trying some different approaches
- Possibly applying new/more strategies if applicable
- Trying out and using the ideas
- More ideas to use within class, different strategies to help with children
- Maybe use visual prompts

Seven participants mentioned that they would be using strategies from the session. One participant needed more time to consider what they would be changing and one participant mentioned adding to what they do already.

Two participants said there was something not mentioned in the plan for session two that they would like to be included. The responses were:

- I would like to know more about brain development and be able to make a correlation between the age of a child and their behaviour e.g. why children tantrum at two years etc
- Looking at how classrooms and tables are set out and the effect this has on children's concentration.

Eight participants gave responses to the question is there anything that could be done differently. Responses were as follows:

- No
- No
- No enjoyed the session
- More table space
- No very good
- Found session very beneficial
- Enjoyed the session

- Use larger room please

The teaching assistant questionnaires at the end of session one indicated that all the teaching assistants felt their knowledge about executive skills had increased at the end of the session. The teaching assistants highlighted strategies, discussion with colleagues and definitions as helpful parts of the session. Seven teaching assistants were able to highlight something they would be changing following the session. The positive feedback received indicated the teaching assistants had found the session useful.

4.3.1.4 Teaching Assistant questionnaires at the end of session two

11 teaching assistants completed evaluation questionnaires at the end of session two. The first question asked participants to rate how knowledgeable they felt about executive skills at the start of the session on a scale of 1-10 (1 being not at all knowledgeable and 10 being extremely knowledgeable).

The mean rating score at the start of session two was 4.73. The participants were asked to rate themselves again at the end of session two. The mean rating score at the end of the session was 7.81. One participant rated their knowledge as the same at the beginning and end of the session. The other 10 participants rated themselves as more knowledgeable at the end of the session than they had done at the beginning. The mean increase in rated knowledge was 2.81.

All 11 participants responded to the third question which asked about what they found most helpful about the session. The responses were as follows:

- Strategies. I knew a lot of them as I am doing my level 3. The sessions have helped to recap and improve
- Learning new ideas
- Learning the rest of the definitions and recognising what I do and what I could do
- Finding out how many executive skills there are and how we use them. Recognising this goes on through life
- Group discussion
- How executive skills relate to everyday activities
- New ideas and I think the pack Katie makes for us will be great and help a lot
- Using different strategies
- New ideas
- Group discussion
- Time management-suggestions for my own child

Nine participants mentioned that new ideas/strategies (including group discussion) were the most helpful part of the session. Two participants specifically mentioned the group discussion as the most helpful part of the session. Three participants mentioned part of the information given as being helpful.

All 11 participants responded to question four which asked what impact the session will have on the way they work with children in school. Responses were as follows:

- To be aware that children may not have gained the skills needed to be organised and that we need to put these strategies in place for them. Hopefully they will eventually become second nature.
- Made more aware of how children learn and how I can assist them in their progress
- To think more about implementing strategies in the classroom
- Help me to be more understanding and pre-empt problems
- To be aware of the children's own needs
- It will help with planning and activities to help children
- I will try out the new ideas and practice my executive skills
- Giving children more choices, independence and organisational skills
- Made aware of difficulties
- I got an insight into other/different strategies I can implement within the classroom
- I will try some of tactics suggested by colleagues as the child I support progresses

Eight participants mentioned that they would be implementing new strategies or ideas. Three participants mentioned that they had become more aware of children's difficulties.

Seven participants responded to question five which asked if anything could have been done differently. Responses were as follows:

- No
- More time as rushed at the end
- No
- More time
- No
- No
- Very good, useful information

The teaching assistant evaluation questionnaires completed at the end of session two indicated that 10 out of 11 teaching assistants felt they were more knowledgeable at the end of the session than they were at the beginning. One teaching assistants rated their knowledge as the same before and after the session. As for the teachers, the change in knowledge was not as large as it had been between the start and end of session one. This once again may have been due to the possibility that the teaching assistants felt they gained lots of knowledge from the first session, which was then built upon in session two. All 11 teaching assistants were able to highlight something they would be doing differently as a result of the session. The positive feedback from the evaluation questionnaires suggests that the teaching assistants had found the session useful.

4.3.2 Staff interviews

Information from the staff interviews was also used to identify what is useful about executive skills training sessions. As discussed in section 3.9.2.2, the staff interviews were analysed using content analysis. Several categories were identified from the interviews. Each category will be considered in turn with quotes from interviews used to demonstrate how the category was formed. For each category anything noteworthy from the research diary has also been included.

4.3.2.1 Recognising differences in the development of children’s executive skills within the class

The first category that was identified was staff recognising differences in the development of children’s executive skills within the class.

Table 4.2: Quotes demonstrating that staff were recognising differences in the development of children’s skills within the class.

Member of staff	Quotes
Year 3 class teacher	<i>“It’s obviously very different for different children”.</i>
Year 4 class teacher	<i>“Whereas now you go round consciously thinking they’re weak on that skill, they’re really advanced on that and that sort of thing”.</i>
Year 5 class teacher	<i>“Withandwe’ve started using an egg timer so that by the time 2 minutes is up you will have done what? This has worked really well”.</i>
Year 6 class teacher	<i>“Half the class brilliant. Half the class-empty pencil cases. Searching everywhere”.</i>

4.3.2.2 Recognising that children may need to be taught executive function skills

The second category that was identified was staff recognising that children may need to be taught executive function skills.

4.3: Quotes demonstrating staff recognising that children may need to be taught executive function skills

Member of staff	Quotes
Year 2 class teacher	<i>"You just presume sometimes that they do it, but if they're not taught how to do it at home then organising themselves in school. You take it for granted but it doesn't happen. You have to teach them how to be organised".</i>
Year 5 class teacher	<i>"I think, from your meeting, you expect, we do as teachers, expect them to know how to do all of this. And they don't, do they, you know it's a learning curve".</i>
Head teacher	<i>"Saying to children this is an actual thing that you need to practise. Whereas before it tends to be, you've forgotten it again, you know. It tended to be a bit more of a nag, whereas now it's, we're going to practice getting yourself organised. You might get a bit of cynicism in some schools because they might expect that the children did these things automatically and that's where the problem often lies and I think where children are often misunderstood because they are labelled as lazy, naughty, all those things but actually they're not any of those things it's just that some of these skills are not embedded".</i>

Notes from the research diary detailed a conversation with one of the trainee teachers when the researcher was in school doing some EP work. The trainee teacher commented that she *"had been thinking about what you said about use it or lose it and about the connections in the brain and so am going to try using conversations withabout my own children and difficulties they had with organisation to helpdevelop strategies"*.

4.3.2.3 Staff were already helping children develop their executive function skills

The third category that was identified was that staff were already (before the training sessions) helping children in school develop their executive function skills.

Table 4.4: Quotes demonstrating that staff were already helping children to develop their executive function skills

Member of staff	Quotes
Year 2 class teacher	<i>"I think a lot of it comes naturally".</i>
Year 3 class teacher	<i>"I just think the whole range of executive skills, is kind of as a teacher, it's the nuts and bolts of what you do".</i>
Year 4 class teacher	<i>"A lot of the things we went through I already did".</i>
Year 5 class teacher	<i>"That's something I've always done".</i>
Year 6 class teacher	<i>"I think it's something that we do a lot here".</i>
Head teacher	<i>"Obviously these are things that staff do regularly anyway and that was one of the overriding features really was that loads of staff said oh we do that the whole time".</i>

4.3.2.4 Increased awareness of executive function

The fourth category that was identified was staff having an increased awareness of executive function.

Table 4.5: Quotes demonstrating staff had an increased awareness of executive function

Member of staff	Quotes
Year 2 class teacher	<i>"I think now we've done it this way, I'm more aware of it. It's easier to pick up on the skills".</i>
Year 4 class teacher	<i>"So it made me a lot more aware of things I already did. It's helped me think about the children that need to develop those skills and do more of what I do with them. It makes you more aware, you go back into class and pick out the children and I suppose before you don't consciously make a point of noticing it".</i>
Year 6 class teacher	<i>"You're thinking in the back of your mind-that will help with this".</i>
Head teacher	<i>"I didn't know what executive skills were before you came, but I know what they are now".</i>

4.3.2.5 Usefulness of the written materials

The fifth category that was identified was staff finding the written materials useful.

Table 4.6: Quotes demonstrating staff finding the written materials useful

Member of staff	Quotes
Year 4 teaching assistant	<i>“But looking through the book and going through the strategies and even on sites you suggested to promote and to show you how to do it, I found that really helpful”.</i>
Head teacher	<i>“This stuff you’ve written gives me a really useful tool to look at because I just look and think oh I can do that and here’s how I can conduct the assembly, rather than start from scratch. It’s really good. This has been like my assembly book. I share it with staff what I’m going to do and I just plan the assemblies from here”.</i>

4.3.2.6 Identifying and understanding individual children’s needs

A factor identified by the head teacher during his interview was identifying and understanding individual children’s needs. He gave an example of a child whose name has been removed for confidentiality purposes. This child was not one of the participants assessed on the TEA-Ch and NEPSY-II.

“I can think of a particular child that I was talking to his mum about yesterday. Very, very bright boy but has a problem with task initiation and we talked about the fact that he hated writing and we looked into and what it was, was he knew he had 40 minutes when he wrote, when he was set a task and so for the first 35 minutes he sat there thinking about it and not really doing anything and then suddenly panicking and writing it all in the last 5 minutes and only doing a few sentences and then getting in trouble. He was getting a negative cycle so he’d become worried every time he had to write he thought he couldn’t do it, he didn’t like it and wouldn’t do it because he knew he was going to fail. In his head it had become really negative so already what we did, I spoke to Mum and I spoke to him today and said. We’ve got to do this and what you’ve got to do is do the racing car. When its go you go and in the first 10 minutes you’ve written 5 sentences and then you’re off to a better start. So the task is started you feel much better about it etc”.

“It’s a skill and also with that there is another one, he didn’t have any goals, because well the trouble was the goal was set for him because someone would say right, you’ve got to write a page in 40 minutes there was a goal but the trouble was it wasn’t broken down enough into separate bits so none said within the first 5 minutes I want you to write 4 sentences. So he was thinking, I’ll just sit here and he couldn’t reach the goal and that was just reinforcing his

negativity about it but once we actually broke it down and looked at the skills and realised he couldn't get started and we've given him the tools he seems to be away. Now we've got very, very quickly a real positive approach to it".

"I can think of that example, whole school basis is great but individual basis as well for children who can't get started".

4.3.2.7 Staff having a framework and the language to talk about executive skills

Another factor that was identified by the head teacher during his interview was that staff now had a framework and the language to talk about executive skills.

"I just think it's really helped us focus. You know when you do things but there's not a name for it. I'm now thinking- oh that's an executive skill. It's made people very aware that what they do second nature, it's made it explicit".

"I think there is an improvement because I just get a feeling that people are talking a lot more about these skills. Just about things, particularly about getting started, keeping going, having a direction, organisation so I really think its to keep it explicit".

4.3.2.8 Changing children's self perceptions

This language appeared to have been helpful in discussing difficulties with individual children such as the individual example identified by the head teacher.

"He went out a happy boy because I think at last somebody, he thought, yeah that's right that's what I can't do. He just didn't know why he couldn't do it before. Saying you're not a naughty boy, I know you're getting in trouble because of you're not getting it done and that's why we want to help you. So he seemed happy with that. His self esteem seemed to build as well".

"Already in one day he put his hand up this morning in assembly to take notes, he was the one who took notes in our assembly. So, you know he wrote something at home, the night before he wrote I hate school and then put something at home really positive about school. So just by tackling that explicitly we're not saying he's lazy, you know it's really worked. We'll have to keep going and we'll have to keep revisiting it and making sure he's not slipping but it's changing his perception of himself in relation to a skill".

4.3.3. Summary of what is useful about executive function staff training sessions

The second research question was: What is useful about executive function staff training sessions. In order to answer this question information from the staff evaluation questionnaires, staff interviews and research diary was analysed.

The staff evaluation questionnaires indicated that both the teachers and teaching assistants felt their knowledge about executive skills had increased following the training sessions. Teachers identified that they found information about executive skills definitions, information about the development of executive skills and discussing strategies helpful in session one. They identified strategies, discussion with colleagues and information given by the researcher as helpful in session two. Teaching assistants identified that they found strategies, sharing ideas with colleagues and information about definitions as helpful in session one. They identified strategies, group discussion and information given as helpful in session two. Teachers and teaching assistants identified that as a result of the training sessions they would be thinking about or implementing new strategies and that they were more aware of children's difficulties.

Data from the staff interviews yielded several categories that related to what staff found useful about executive function staff training sessions. The first was 'recognising differences in the development of children's skills within the class' (4.3.2.1). Secondly staff were 'recognising that children may need to be taught executive function skills'. Information from the research diary also linked to this category with a trainee teacher identifying a particular child that needed help to develop organisation (4.3.2.2). The third category that was identified was that 'staff were already helping children to develop their executive function skills' (4.3.2.3). The fourth category was that staff had an 'increased awareness of executive function skills' (4.3.2.4). The fifth category identified was the 'usefulness of the written materials' which were given to support staff following the training sessions (4.3.2.5). A further three categories were identified following the more in depth interview held with the head teacher. Firstly, 'identifying and understanding individual children's needs'. The head teacher gave an example of a particular child where this had taken place (4.3.2.6). Secondly, 'staff having a framework and the language to talk about executive function skills' (4.3.2.7). Finally, 'changing children's self perceptions' was identified. The head teacher, in using the same example of one child, identified that discussion about executive skills had helped the child to change his self perceptions.

4.4. What impact do executive function staff training sessions have on children's executive function and attentional skills as measured by standardised assessment?

In order to answer the above question it was first necessary to find out what staff had been doing in school following the executive function training sessions.

4.4.1 What was done in school following the executive function staff training sessions?

Semi-structured interviews were carried out with staff to discover what had been done at the whole school and class level following the executive function staff training sessions. Information from the research diary was also used to highlight things that were done in school following the training sessions.

4.4.1.1 Whole school level

The head teacher was interviewed in order to find out what had been done at the whole school level. Information from the research diary was also used.

4.4.1.1.2 Assemblies

The interview with the head teacher revealed that he had delivered a number of different assemblies to *"reinforce what the teachers have been doing"*. At the time of interview assemblies had been carried out on the following skills:

- Working Memory
- Goal-directed persistence
- Task initiation
- Response inhibition
- Organisation
- Time Management
- Emotional Control

The head teacher gave some examples of the content of assemblies that had been carried out.

"I did one this morning about goal-directed persistence. I told a story about two footballers. One didn't listen to advice and the other one did and kept persisting and had goals in his mind about winning. He practised and set himself targets. He succeeded and he was

obviously Wayne Rooney. The children asked what happened to the other guy. He didn't make it. I said we don't know what he's called because he's not famous. Then we got some children out and I said what do you want to achieve? They told me what they wanted to achieve. And how did they get there, and then we broke it down. How did they get there on a daily basis? So we're making it very meaningful for the children".

Whilst in school a teacher was heard talking to a child and referring to the assembly, asking the child whether he wanted to be like "Sean Wright-Phillips" and discussing how he was going to get there. (Research Diary, February 2010).

Another example the head teacher gave was his assembly on working memory. *"It's a really excellent one to do in an assembly format because it's really interesting. Things like they had to try and start by remembering a phone number. They couldn't do it. Then we played a game of you go to the shop and I want you to get me this, this and this and they couldn't remember and then I gave directions and they had to try and follow them. Then we played Kim's game and then what we talked about is, because some children are successful, so why are they successful? And then we talked about straight away children began to recognise things that they could do that really helped them improve their memory so like, I remember one child said straight away, I can repeat it to myself. The obviously, the children didn't know the technique of if they tried to remember lots of objects of going on an imaginary visit round your house and the door knocker is 10 and you go on the journey and you remember it so we tried that and that helped them".*

Once each assembly had been carried out *"what I've always done is ask the teachers to spot any children that they think are doing particularly well in that skill we've been talking about. Children get a certificate on Friday".*

The head teacher felt that the assemblies had been useful. *"It seemed to have an effect and it seems to make people much more conscious of it".*

The head teacher also mentioned that the assemblies were something he would be continuing with. *"I will do the others too. I will do them because they're a really good thing to focus on. I'll probably do this every year. Try and do different assemblies just to reinforce some of these skills".*

4.4.1.1.3 Commitment of the head teacher

An important factor identified from conversations with the head teacher and the interview that was held with him was how important he feels it is to develop children's executive skills.

"In many schools, and ours is one particularly, executive skills is something that many children don't really have. It's vital that they are doing it at all times".

"I absolutely think it would be useful in other schools. I think it's particularly useful at this school".

"You could develop this a lot because I honestly think this is at the root of children not learning. All of these skills, they cover just about everything. There is nothing in here that isn't involved in children's learning".

"When you see a really good teacher what they will be doing is most of these things. When you see not a good teacher I think I'd be able to spot which of these they weren't doing".

"When you do these things their attention does get better and their learning because it's underneath all of this".

"I could do a terms worth of assemblies about organisation skills and I might do sometime because I think it's really important. A terms worth and none of it would be wasted".

The head teacher also mentioned that he had put executive skills on the School's Self Evaluation Form. *"I've put it on the SEF".*

Reading of the research diary indicated that the head teacher had been committed from the beginning of the research project. Notes made during initial discussions included *'Head keen to be involved and glad to have some additional staff training'* (November 2008). *'Head very supportive'* (January 2009).

His commitment was also demonstrated in the dissemination of information to other staff. *'One of the TAs mentioned that the research had been discussed at the TA meeting'*. (March 2009).

During discussions with the head teacher following the staff training sessions he said they were *"really good"* and said it was *"really important for us to develop these skills in children"* as they are *"skills for life"*. (September 2009).

4.4.1.2 Class level

Each of the class teachers (current years two-six) were interviewed to find out what they had been doing in class to help children develop their executive function. Where there was a

teaching assistant who had attended the training and was working with any of the participants, they were also interviewed.

4.4.1.2.1 Executive functions and examples by class

The tables below highlight the executive functions that the staff talked about and examples of how they were helping children to develop their skills. Each class was looked at in turn.

Table 4.7: Executive functions and examples identified in Year 2

Executive Function	Examples
Time Management	<i>“Doing lots of activities timed for a minute. I’ve got a three minute timer. Knowing what they’ve got to do in a certain block of time”.</i>
Organisation	<i>“In the mornings they know they’ve got 15 minutes to hang up their coat, sort out their locker, change their reading book, and then bring everything to me and then you can go to the carpet. I have been rewarding them for organising themselves and getting their P.E kit ready”.</i>
Metacognition	<i>“Thinking skills activity on Monday morning. Half an hour slots. Work in small groups. Negative and positives about new school uniforms”.</i>
Goal-directed Persistence	<i>“Rewards for persisting with tasks”.</i>
Emotional Control	<i>“Go and stand outside and calm down and we’ll talk about it”.</i>

Table 4.8: Executive function and examples identified in Year 3

Executive Function	Examples
Time Management	<i>"You've got 5 minutes left. 2 minutes and you're coming back to the carpet, giving them control of their time".</i>
Sustained Attention	<i>"Children with attention problems I tend to try to predict when they are going to go and say just go and take that to the library you know try and direct them somewhere else to give them a break and then they come back to it".</i>
Organisation	<i>"In my class they have to be organised when they go swimming. Problems about finding it even though they have bought it in, remembering to say they've forgotten it so I can ring home but again its trying to predict the children who need reminding and getting them to say they've forgotten and talking about whose job it is".</i>
Working Memory	<i>"Lots of talking about learning and trying to be quite specific about what they've learnt rather than what they've done. Lots of repetition".</i>

Table 4.9: Executive functions and examples identified in Year 4

Executive Function	Examples
Metacognition	<i>"Lots of thinking skills- I usually start the day with a thinking skills or problem type solving exercise".</i>
Time Management	<i>"Putting into place times and introducing time. Using the clock. We've got so long and we need to do this in this amount of time".</i>

Table 4.10: Executive functions and examples identified in Year 5

Executive Function	Examples
Working Memory	<i>"In spellings we use a lot of mnemonics. I've started using a lot of mind maps as well which I find really helps'. 'What I tend to do in a lesson is when I'm explaining the task for the day and what they've got to do, I get a child to repeat it back to me".</i>
Organisation	<i>"For three of the children in my class who are constantly forgetting things, they got their own laptops and made their own checklists of things they are supposed to remember. Then we laminated it and that's for them to keep on their desk so they've got a record of what they are supposed to be bringing in".</i>
Time Management	<i>"Timers in class. I use this all the time. Same using just the clock. So they look at the clock and I say right, by the time it's ten to 2 I want you to have done this, this and this".</i>
Metacognition	<i>"I tend to use the success criteria so if we're writing a letter or a diary account. I ask the children, what do you think I'll be looking for? We write it down like a checklist that they're coming up with so that when they come to do independent writing like the big write, they know what they need to do".</i>
Sustained Attention	<i>"And then bringing them back to the carpet reviewing what they've done so far so there it breaks it down".</i>

Table 4.11: Executive functions and examples identified in Year 6

Executive Function	Examples
Working Memory	<i>"We've done a lot of games. Kim's game, the tray game and I went shopping. They've loved it and it's really helped them'. 'When I'm giving instructions to a task I'll say there are three instructions".</i>
Goal directed persistence	<i>"For our residential I've asked them to get 50 tokens/stamps, from before Christmas to April. They're all on about 20 now. That's really working. They're still motivated by that. Still want those stamps. And it's for all of them. That's working well".</i>
Time Management	<i>"We've used a lot of the time countdowns on the whiteboard. They've been really good. So I'll say you've got a minute. They watch it count down. They like that, especially the boys".</i>
Organisation	<i>"I've given them all a pencil case with their equipment so they are organised and that's theirs to look after".</i>

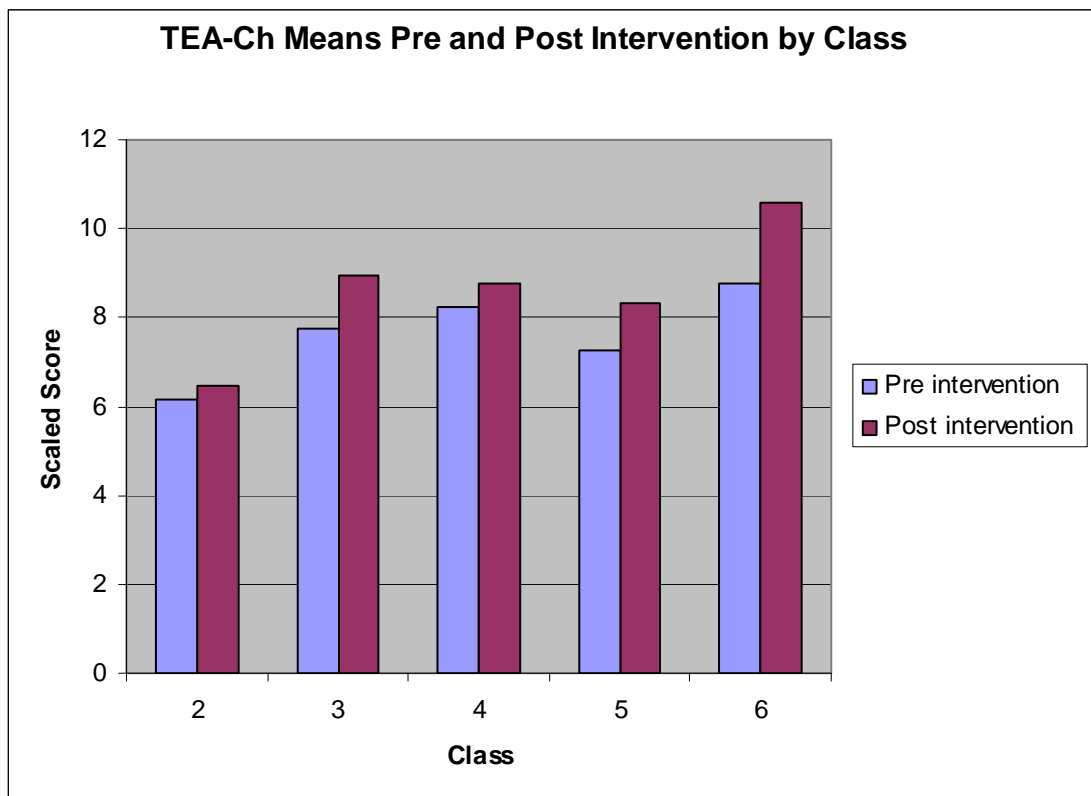
4.4.2 Descriptive Statistics

Descriptive statistics were carried out on the pre and post intervention data to compare differences between classes (4.4.2.1). Descriptive statistics were also carried out on the pre and post-intervention data for each variable (4.4.2.2) and for each individual (4.4.2.3).

4.4.2.1 Comparison of TEA-Ch and NEPSY scores at pre and post-intervention by class

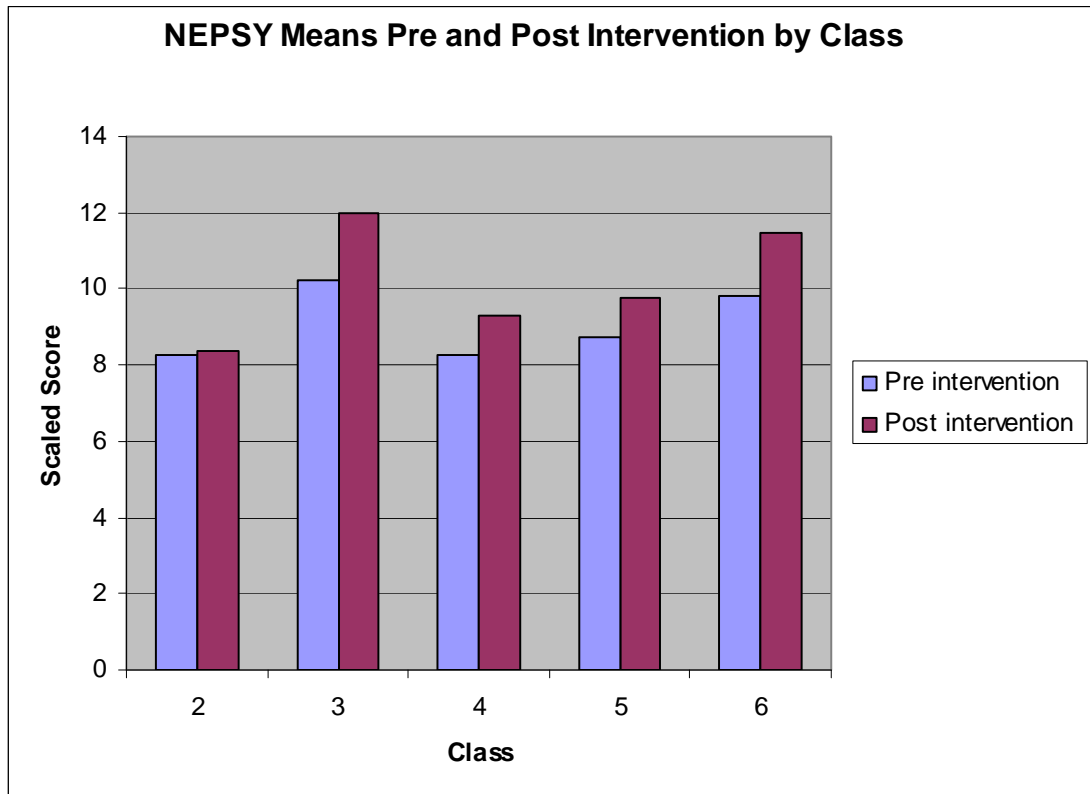
Descriptive statistics were carried out in order to look at the differences between the classes. The descriptive statistics are shown in the graphs below.

Figure 1: TEA-Ch Means Pre and Post-Intervention by Class



Class two's TEA-Ch mean increased by a scaled score of 0.34 from pre to post-intervention. Class three's TEA-Ch mean increased by a scaled score of 1.17 from pre to post-intervention. Class four's TEA-Ch mean increased by a scaled score of 0.54 from pre to post-intervention. Class five's TEA-Ch mean increased by a scaled score of 1.04 from pre to post-intervention. Class six's TEA-Ch mean increased by a scaled score of 1.27 from pre to post-intervention.

Figure 2: NEPSY Means Pre and Post-Intervention by Class



Class two's NEPSY mean increased by a scaled score of 0.08 from pre to post-intervention. Class three's NEPSY mean increased by a scaled score of 1.72 from pre to post-intervention. Class four's NEPSY mean increased by a scaled score of 1.02 from pre to post-intervention. Class five's NEPSY mean increased by a scaled score of 1.02 from pre to post-intervention. Class six's NEPSY mean increased by 1.68 from pre to post-intervention.

As mentioned in section 3.11, class six had the same teacher both at pre and post intervention which meant the teacher was aware of which children had participated in the research and so may have targeted intervention at those children. These descriptive statistics indicate that class six made similar progress to class three. Discussion with class six's teacher during the interview indicated that she did not feel she had done any extra individual intervention with the participant's identified in her class. Although she was aware of the participant's she said she had "*done the same with the whole class*". The descriptive statistics do not indicate that class six made gains significantly larger than for other classes. The participants in class two made the least progress. One possible explanation for this is that there was a lot of missing data from class two (as they were below seven and so could not be assessed on as many of the NEPSY-II assessments). This may have meant there was less opportunity for the class to show their progress. Another possible reason is that it may be easier to carry out the strategies with children who are older than the children in class two (e.g. classes three to six).

4.4.2.2 Pre and post intervention changes for each TEA-Ch and NEPSY variable

As mentioned in section 3.9.2.1, descriptive statistics were used to look at the number of participants whose scores increased, decreased or stayed the same between pre and post intervention. The table below looks at each variable in turn. The table also shows the mean score at pre and post intervention for each variable.

54.08% of the available attention scores (including the attention mean) showed an increase between pre and post intervention. 14.59% of the available attention scores (including the attention mean) showed no change between pre and post intervention. 31.33% of the available attention scores (including the attention mean) showed a decrease between pre and post intervention.

58.45% of the available executive function scores (including the executive function mean) showed an increase in scores between pre and post intervention. 16.43% of the available executive function scores (including the executive function mean) showed no change between pre and post intervention. 25.12% of the available executive function scores (including the executive function mean) showed a decrease between pre and post intervention.

Overall, 56.89% of the available scores showed an increase between pre and post intervention. 15.77% of the available scores showed no change between pre and post intervention. 27.36% of the available scores showed a decrease between pre and post intervention.

The descriptive statistics suggest that overall participants did show an improvement in both their attention and executive function scores when measured at the post-intervention stage.

Table 4.12: Means pre and post intervention and number of participants whose scores increased, decreased and stayed the same between pre and post intervention by variable

Score	Mean pre-intervention	Mean post-intervention	Number of participants showing improvement	Number of participants showing no change	Number of participants showing decrease
Attention Mean	7.63	8.48	22	0	9
NEPSY Mean	8.94	10.00	28	0	3
Sky Search (number of correctly identified targets)	8.58	8.42	12	5	14
Sky Search (time per target)	7.42	9.26	23	4	4
Sky Search Attention	7.43	9.58	22	6	2
Score!	8.19	7.97	12	6	13
Creature Counting (Accuracy)	8.97	9.43	12	5	13
Creature Counting(Timing)¹	9.35	10.27	11	2	7
Sky Search DT	5.1	6.72	12	6	11
Animal Sorting	6.96	8.96	17	1	5
Animal Sorting Combined	6.75	8.74	16	2	5

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

Score	Mean pre-intervention	Mean post-intervention	Number of participants showing improvement	Number of participants showing no change	Number of participants showing decrease
Auditory Attention Total Completion Time¹	9.10	9.77	12	12	7
Auditory Attention Combined	8.94	9.81	13	11	7
Response Set Total Completion Time¹	10.00	11.29	14	7	3
Response Set Combined	9.75	11.42	16	4	4
Clocks¹	9.29	10.17	12	5	7
Design Fluency¹	10.20	10.84	14	7	10
Inhibition Naming Total Completion Time¹	9.55	10.19	18	4	9
Inhibition Naming Combined¹	8.65	10.32	20	2	9
Inhibition Inhibition Total Completion Time¹	9.65	9.71	17	4	10
Inhibition Inhibition Combined	8.29	8.97	17	3	11

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

Score	Mean pre-intervention	Mean post-intervention	Number of participants showing improvement	Number of participants showing no change	Number of participants showing decrease
Inhibition Switching Total Completion Time	9.75	10.5	12	3	9
Inhibition Switching Combined	8.83	10.13	16	3	5
Total			368	102	177

4.4.2.3 Pre and post-intervention changes for each individual child

Having looked at the changes between pre and post measure for each variable, descriptive statistics were carried out by individual participant. If a participant showed big improvements, the researcher checked record notes to see if the initial assessment was considered to represent an underachievement by the participant. If this was the case, the results were interpreted with particular caution. Possible extraneous variables for each individual participant were identified from staff interviews. The purpose of this was two fold. Firstly, to identify whether there were any extraneous variables affecting a large number of participants. Secondly, to see whether there were any individual children who contributed disproportionately to any overall changes that could be strongly linked to extraneous variables. This information was discussed with another registered psychologist practitioner who is an experienced researcher, and a decision was made whether or not to remove the individual child from the overall analysis. Having, discussed the information the decision was made that there were no individual children that needed to be removed from the overall analysis.

Table 4.13 Number of missing data, increased scores, decreased scores, extraneous variables and information about removal from analysis by participant

P	Missing data-attention	Missing data-EF	Total missing	Increased scores-attention	Increased scores-EF	Total Increase	Scores remain same-attention	Scores remain same-EF	Total remain same	Decreased scores-attention	Decreased scores- EF	Total decrease	Extraneous Variables	Remove from analysis?
1	2	0	2	4	12	16	2	1	3	0	2	2	Has 9 hours of support from a TA who came on the training, Has started attending breakfast club. Family have had support from the children's centre. Learning has improved.	No
2	1	0	1	4	13	17	2	0	2	1	2	3	Has responded well to intervention. Has developed a good relationship with staff.	No
3	1	7	8	4	5	9	1	1	2	2	2	4	Behavioural issues. Good home-school liaison.	No

P	Missing data-attention	Missing data-EF	Total missing	Increased scores-attention	Increased scores-EF	Total Increase	Scores remain same-attention	Scores remain same-EF	Total remain same	Decreased scores-attention	Decreased scores- EF	Total decrease	Extraneous Variables	Remove from analysis?
4	1	0	1	0	8	8	3	4	7	4	3	7	Has a statement and full time support from a TA who came on the training. TA has taken a different approach with him which is perceived to be beneficial. Behaviour and learning improved at home and school. Speech and language and social skills improving. Spends more time in the class this year.	No

P	Missing data-attention	Missing data-EF	Total missing	Increased scores-attention	Increased scores-EF	Total Increase	Scores remain same-attention	Scores remain same-EF	Total remain same	Decreased scores-attention	Decreased scores- EF	Total decrease	Extraneous Variables	Remove from analysis?
5	4	2	6	2	8	10	0	2	2	2	3	5	Has a statement and full time support. Has been having extra intervention on developing social skills. School-home liaison is good.	No
6	1	7	8	5	4	9	2	2	4	0	2	2	Had support last year but does not have support this year. Family difficulties.	No
7	1	0	1	2	11	13	1	2	3	4	2	6	Behaviour and learning difficulties. Difficult 6 months. Been in trouble with police. Clashed with members of staff. Has responded well to intervention. Has had same teacher for 2 years.	No

P	Missing data-attention	Missing data-EF	Total missing	Increased scores-attention	Increased scores-EF	Total Increase	Scores remain same-attention	Scores remain same-EF	Total remain same	Decreased scores-attention	Decreased scores- EF	Total decrease	Extraneous Variables	Remove from analysis?
8	1	0	1	7	10	17	0	1	1	0	4	4	Has had the same teacher for 2 years. Responded well to intervention. Brother in same class has had a difficult 6 months. May have made her settle down more.	No
9	0	0	0	7	10	17	0	4	4	1	1	2	None identified.	No
10	1	7	8	2	5	7	2	0	2	3	3	6	A lot of disruption with both class teachers being off sick. Learning difficulties. Learning has improved a bit. Gets some support from general teaching assistant who attended the training. Toe by Toe intervention. Parent illness.	No

P	Missing data-attention	Missing data-EF	Total missing	Increased scores-attention	Increased scores-EF	Total Increase	Scores remain same-attention	Scores remain same-EF	Total remain same	Decreased scores-attention	Decreased scores- EF	Total decrease	Extraneous Variables	Remove from analysis?
11	0	0	0	5	9	14	2	0	2	1	6	7	None identified	No
12	0	0	0	6	8	14	0	1	1	2	6	8	Stated pupil who receives full time support from a TA who came on the training. Improvement in speech and language skills. Improvement in learning, particularly maths. Some parental difficulties at home.	No
13	0	0	0	3	6	9	3	3	6	2	6	8	Has started going to breakfast club. Family have had support from children's centre.	No
14	1	0	1	4	12	16	0	1	1	3	2	5	Changes in home circumstances with new parental relationship.	No

P	Missing data-attention	Missing data-EF	Total missing	Increased scores-attention	Increased scores-EF	Total Increase	Scores remain same-attention	Scores remain same-EF	Total remain same	Decreased scores-attention	Decreased scores- EF	Total decrease	Extraneous Variables	Remove from analysis?
15	0	7	7	2	0	2	0	1	1	6	7	13	None identified.	No
16	1	7	8	4	4	8	0	1	1	3	3	6	None identified.	No
17	0	0	0	6	11	17	1	2	3	1	2	3	Difficult time in school. Wanted to be the leader. Other children have got fed up of her and she has been upset by this.	No
18	0	0	0	5	8	13	1	2	3	2	5	7	None identified.	No
19	0	0	0	6	5	11	0	3	3	2	7	9	New sibling. Made progress with learning.	No
20	0	0	0	5	5	10	1	5	6	2	5	7	None identified	No
21	0	0	0	1	9	10	2	5	7	5	1	6	None identified	No
22	0	7	7	5	6	11	1	1	2	2	1	3	None identified	No
23	0	0	0	6	9	15	1	3	4	1	3	4	None identified	No
24	0	0	0	5	7	12	2	1	3	1	7	8	Has responded well to intervention. Spelling has improved.	No
25	0	7	7	1	1	2	1	3	4	6	4	10	Family bereavement	No

P	Missing data-attention	Missing data-EF	Total missing	Increased scores-attention	Increased scores-EF	Total Increase	Scores remain same-attention	Scores remain same-EF	Total remain same	Decreased scores-attention	Decreased scores- EF	Total decrease	Extraneous Variables	Remove from analysis?
26	0	0	0	3	14	17	1	1	2	4	0	4	Currently doing lots of looking after younger siblings. Mum expecting another baby.	No
27	0	0	0	6	4	10	0	7	7	2	4	6	None identified	No
28	0	0	0	2	7	9	0	4	4	6	4	10	Parental break up. Low motivation.	No
29	0	0	0	5	12	17	2	2	4	1	1	2	Some family issues.	No
30	0	0	0	4	11	15	3	2	5	1	2	3	None identified	No
31	0	0	0	5	18	13	0	3	3	3	4	7	None identified	No
Total	15	51	66	126	242	368	34	68	102	73	104	177		

4.4.3 Wilcoxon Signed-Rank Tests

As mentioned in section 3.9.2.1, Wilcoxon Signed-Ranks Tests were used to compare the pre and post measures of attention and executive functioning. This allowed a comparison of each of the variables as measured at the pre-intervention and post-intervention stages. Each variable will be described in turn.

There was a significant difference between the TEA-Ch mean at the pre and post intervention. Participants TEA-Ch mean was significantly higher at post-intervention ($Mdn = 9.00$) than at pre-intervention ($Mdn = 8.16$), $z = -2.91$, $p < .01$, $r = -.37$. This represents a medium to large change in scores between pre and post-intervention.

There was also a significant difference between the NEPSY-II mean at the pre and post intervention. Participants NEPSY-II mean was significantly higher at post intervention ($Mdn = 10.38$) than at pre-intervention ($Mdn = 9.50$), $z = -3.76$, $p < .01$, $r = -.48$. This represents a medium to large change in scores between pre and post-intervention.

This suggests that there was a general improvement in participants attention and executive functioning scores (as measured by standardised assessment) following the delivery of the executive skills training sessions. Having established that there was a general improvement in scores as measured by the proxy attention and executive function means, Wilcoxon Signed-Ranks test were carried out on each of the variables.

4.4.3.1 TEA-Ch Scores

There was no significant difference between participants' scores when measured at the pre and post-intervention stage on the Sky Search (number of correctly identified targets) variable.

There was a significant difference in participant's scores on Sky Search (time per target) variable between pre and post-intervention. Participants scores were significantly higher at post-intervention ($Mdn = 9.00$) than at pre-intervention ($Mdn = 8.00$), $z = -3.66$, $p < .01$, $r = -.46$. This represents a medium to large change in scores between pre and post-intervention.

There was a significant difference in participants' scores on Sky Search Attention variable between pre and post-intervention. Participants' scores were significantly higher at post-intervention

(*Mdn* = 9.00) than at pre-intervention (*Mdn* = 8.00), $z = -3.98$, $p < .01$, $r = -.51$. This represents a large change in scores between pre and post-intervention.

There was no significant difference between participants' scores on the Score! variable when measured at pre and post-intervention.

There was no significant difference between participants' scores on the Creature Counting Accuracy variable when measured at pre and post-intervention.

There was no significant difference between participants' scores on the Creature Counting Timing variable when measured at pre and post-intervention.

There was no significant difference between participants' scores on the Sky Search DT variable when measured at pre and post-intervention.

4.4.3.2 NEPSY-II scores

There was a significant difference between participants' scores on the Animal Sorting variable between pre and post intervention. Participants scores were significantly higher at post-intervention (*Mdn* = 9.00) than at pre intervention (*Mdn* = 7.00), $z = -2.27$, $p = .021$, $r = -.33$. This represents a medium to large change in scores between pre and post-intervention.

There was also a significant difference between participant's scores on the Animal Sorting Combined variable. Participants scores were significantly higher at post-intervention (*Mdn* = 9.00) than at pre-intervention (*Mdn* = 7.00), $z = -2.27$, $p = .022$, $r = -.34$. This represents a medium to large change in scores between pre and post intervention.

There was no significant difference between participants' scores on the Auditory Attention Total Time Completion variable when measured at pre and post-intervention¹. There was also no significant difference between participant's scores on the Auditory Attention Combined variable when measured at pre and post-intervention.

There was a significant difference between participant's scores on the Response Set Total Correct variable between pre and post-intervention. Participants scores were significantly higher at post-intervention (*Mdn* = 12.00) than at pre-intervention (*Mdn* = 11.00), $z = -2.66$, $p < .01$, $r = -.38$. This represents a medium to large change in scores from pre to post-intervention¹. There was also a significant difference between participants' scores on the Response Set Combined variable. Participants scores were significantly higher at post-

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

intervention (*Mdn* = 13.00) than at pre-intervention (*Mdn* = 10.00), $z = -2.78$, $p < .01$, $r = -.40$. This represents a medium to large change in scores.

There was no significant difference between participants' scores on the Clocks variable when measured at pre and post-intervention¹.

There was no significant difference between participants' scores on the Design Fluency variable when measured at pre and post-intervention¹.

There was no significant difference between participants' scores on the Inhibition Naming Total Completion Time variable when measured at pre and post-intervention¹.

There was a significant difference between participants' scores on the Inhibition Naming Combined variable between pre and post-intervention. Participants scores were significantly higher at post-intervention (*Mdn* = 11.00) than at pre-intervention (*Mdn* = 8.00), $z = -2.32$, $p = .019$, $r = -.30$. This represents a medium change in scores from pre to post-intervention¹.

There was no significant difference between participants' scores on the Inhibition Inhibition Total Completion Time variable when measured at pre and post intervention¹.

There was no significant difference between participants' scores on the Inhibition Inhibition Combined variable when measured at pre and post intervention.

There was no significant difference between participants' scores on the Inhibition Switching Total Completion Time variable when measured at pre and post-intervention.

There was a significant difference between participants' scores on the Inhibition Switching Combined variable when measured at pre and post-intervention. Participants scored significantly higher at post-intervention (*Mdn* = 9.50) than at pre-intervention (*Mdn* = 8.50), $z = -2.28$, $p = .022$, $r = -.34$. This represents a medium to large change in scores from pre to post-intervention.

One possible explanation for this pattern of results is that those variables which showed significant improvements were more susceptible to this particular type of whole school intervention.

¹ Results should be interpreted with caution due to reliability issues (see section 3.6).

4.4.4 Summary of the impact of executive function staff training sessions on children's attention skills and executive function skills as measured by standardised assessment

The third research question was: What impact do executive function staff training sessions have on children's attention skills and executive function skills as measured by standardised assessment. In order to answer this question it was necessary to get some idea of what had happened in school at the whole school and class level following the staff training sessions (4.4.1).

At the whole school level the interview with the head teacher revealed that a number of assemblies had been carried out covering seven of the executive function skills discussed in the training sessions. Following each assembly staff were asked to identify two children in their class who had shown that skill. The children were rewarded with a certificate in Friday's assembly (4.4.1.1.2). At the whole school level the commitment of the head teacher was identified as an important factor in what happened in school following the staff training sessions (4.4.1.1.3). At the class level, all teachers were able to give examples of how they were helping children to develop their executive skills in class (4.4.1.2). Descriptive statistics carried out between the classes indicated that all classes had made progress in both the TEA-Ch mean and the NEPSY mean. Although the teacher of class 6 had gone up with the class and therefore knew which children were participating in the research, descriptive statistics indicated class 6 made similar progress to class 3. Discussion with class 6's teacher indicated she did not feel she had treated the children participating in the research any differently from the rest of the class (4.4.2.1).

Descriptive statistics were carried out to look at the changes for each variable between pre and post intervention (4.4.2.2). This showed that of the available attention scores (including the attention mean) 54.08% showed an increase, 14.59% showed no change and 31.33% showed a decrease between pre and post-intervention. This showed that of the available executive function scores 58.45% showed an increase, 16.43% showed no change, and 25.12% showed a decrease between pre and post-intervention. Overall 56.89% of the available scores showed an increase, 15.77% showed no change and 27.36% showed a decrease between pre and post intervention. The descriptive statistics suggest that overall participants did show an improvement in both their attention and executive function scores when measured at the post-intervention stage.

Descriptive statistics were also carried out at the individual participant level. Possible extraneous variables were identified from the staff interviews. The decision was made that there were no participants that needed to be removed from the overall analysis (4.4.2.3).

Wilcoxon Signed-Ranks tests were carried out on the pre and post TEA-Ch and NEPSY-II data (4.4.3). Participants TEA-Ch mean was significantly higher at post-intervention than at pre-intervention. Participants' NEPSY mean was also significantly higher at post-intervention than at pre-intervention. This suggests that following the delivery of the executive skills staff training sessions there was a general improvement in participants' attention and executive function skills as measured by standardised assessment.

Wilcoxon Signed-Ranks test also revealed significant improvements in participant's scores on the following TEA-CH variables; Sky Search (time per target) and Sky Search Attention. There were also significant improvements in participants' scores on the following NEPSY-II variables; Animal Sorting, Animal Sorting Combined, Response Set Total Correct, Response Set Combined, Inhibition Naming Combined and Inhibition Switching Combined.

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter will begin with a summary of the results in section 5.2. Each research question will then be considered in turn with reference to the reviewed literature (sections 5.3-5.5). A summary of the present study will be given in section 5.6. The chapter will then go on to consider strengths and weaknesses of the present study (section 5.7) followed by implications for professional practice (section 5.8). Finally the chapter will conclude with an overall summary of the study and priorities for future research (section 5.9).

5.2 Summary of results

The present study explored the link between primary school children's attention skills and executive function skills through the use of standardised assessment. Following consideration of the literature it was proposed that there would be a link between primary school children's attention skills and their executive function skills. The present study found that there was a link between the participants' attention skills and executive function skills. There was a significant, high correlation between participants' mean TEA-Ch score and mean NEPSY-II score ($\rho = 0.793$, $p < 0.1$). 62.88% of the variance in the TEA-Ch mean could be accounted for by variance in the NEPSY mean which suggested a significant correlation between attention skills and executive function skills.

Spearman's correlation coefficients also identified a number of significant correlations between the TEA-Ch and NEPSY-II variables. The following significant, high correlations were found:

Table 5.1: Subtests with significant high correlations

TEA-Ch subtest	NEPSY-II subtests high correlations
Sky Search (time per target)	Design Fluency Inhibition Inhibition Total Completion Time Inhibition Inhibition Combined Inhibition Switching Total Completion Time Inhibition Switching Combined
Sky Search Attention	Inhibition Inhibition Total Completion Time Inhibition Inhibition Combined Inhibition Switching Total Completion Time Inhibition Switching Combined
Score	Response Set Total Correct Response Set Combined Inhibition Naming Total Completion Time Inhibition Naming Combined Inhibition Inhibition Combined
Creature Counting Accuracy	Clocks Inhibition Naming Total Completion Time Inhibition Inhibition Total Completion Time Inhibition Switching Combined
Creature Counting Timing	Inhibition Naming Total Completion Time Inhibition Switching Combined
Sky Search DT	Animal Sorting Design Fluency

The following medium significant correlations were found:

Table 5.2: Subtests with significant medium correlations

TEA-Ch subtest	NEPSY subtests medium correlations
Sky Search (number of correctly identified targets)	Auditory Attention Total Correct Auditory Attention Combined Design Fluency
Sky Search (time per target)	Inhibition Naming Total Completion Time Inhibition Naming Combined.
Sky Search Attention	Design Fluency Inhibition Naming Total Completion Time Inhibition Naming Combined
Score	Auditory Attention Total Correct Auditory Attention Combined Design Fluency Inhibition Inhibition Total Completion Time Inhibition Switching Total Completion Time.
Creature Counting Accuracy	Animal Sorting Combined Response Set Combined Design Fluency Inhibition Naming Combined Inhibition Inhibition Combined Inhibition Switching Total Completion Time
Creature Counting Timing	Inhibition Naming Combined
Sky Search DT	Animal Sorting Combined Auditory Attention Total Correct Auditory Attention Combined Inhibition Naming Total Completion Time

Possible explanations for this pattern of results are discussed in section 5.3.

The study also investigated what is useful about executive function staff training sessions. The teachers and teaching assistants reported an increase in knowledge about executive skills following the staff training sessions. In the staff evaluation questionnaires, areas that staff identified as most helpful included executive skills definitions, information about executive skills and their development. A large number of participants commented that they had found sharing ideas and discussing strategies useful. Feedback from the training sessions was positive and indicated that teachers and teaching assistants found the training sessions beneficial.

Staff interview data yielded several factors relating to the usefulness of the executive function staff training sessions. These were:

- Recognising differences in children's executive function skills development within the class.
- Recognising children may need to be taught executive function skills.
- Staff were already helping children to develop executive function skills.
- Increased awareness of executive function skills.
- Usefulness of the written materials.
- Identifying and understanding individual children's needs.
- Staff having a framework and the language to talk about executive function skills.
- Changing children's self perceptions.

Finally the study looked at the impact of the staff training sessions on the participants' attention skills and executive function skills as measured by standardised assessment. Staff interviews indicated that interventions had been carried out at the class and whole school level. All class teachers involved in the study were able to give examples of ways in which they were helping children in their class to develop executive function skills. At the whole school level a number of assemblies were carried out relating to the executive function skills. Children were rewarded weekly for their development of these skills.

Descriptive statistics comparing the classes showed an improvement for the children in all classes for both the TEA-Ch and NEPSY-II means from pre to post-intervention. Descriptive statistics indicated improvements in attention and executive function. 54.08% of the attention scores increased from pre to post-intervention. 58.45% of the available executive function scores increased from pre to post-intervention. Overall 56.89% of the available scores increased from pre to post-intervention.

Discussion with teachers about individual participants highlighted some possible extraneous variables. However, it was decided there was no need to remove any participants from the overall analysis.

Wilcoxon Signed Rank tests revealed participants' TEA-Ch mean was significantly higher at post intervention than it was at pre intervention. This was a medium to large change in scores. Participants' NEPSY-II mean was also significantly higher at post-intervention than at pre-intervention. This also represented a medium to large change in scores. At the subtest level, several significant differences were revealed. There were significant increases from pre- to post-intervention for the following variables; Sky Search (time per target), Sky Search Attention, Animal Sorting, Animal Sorting Combined, Response Set Total Correct, Response Set Combined, Inhibition Naming Combined and Inhibition Switching Combined.

5.3 What is the link between primary school children's attention skills and executive function skills as measured by standardised assessment?

The present study proposed that there would be a link between primary school children's attention skills and executive function skills as measured by standardised assessment. There is research evidence that executive function deficits are a core part of ADHD. Barkley (1997) predicted that children with ADHD would have a deficit in behavioural inhibition, leading to executive function difficulties. Wilcutt et al (2005) carried out a meta-analysis of 83 studies looking at executive function in children with and without ADHD and found the groups with ADHD had significant impairments on all of the executive function tasks. There is evidence that both boys and girls with ADHD experience executive function difficulties. These were found in children taking ADHD related medication and in those not taking medication and were found to be independent of psychiatric comorbidity and learning disability (see section 2.6).

There is literature suggesting that attention and executive function are more generally related. Fletcher (1998) highlights that one of the conceptual issues in this area is that processes such as inhibition are included in models of attention and executive function. Klenberg et al (2001) carried out a factor analysis to try and identify any independent factors that point towards the separability of attention and executive function. Their results supported '*the multidimensional nature and the overlap of attentional and executive functions*' (Klenberg et al, 2001, p425).

The findings of the study support this overlap between attention and executive function skills. The present study excluded any participants who had a diagnosis of ADHD. There was a significant high correlation between participants' TEA-Ch mean and executive function mean. This indicates that the concepts of attention and executive function are more generally linked and do not only apply to children with a diagnosis of ADHD. The fact that the concepts were related in a range of children suggests that children with general attention difficulties are likely to also have difficulties with executive functions.

Hrabok et al (2006) found correlations between lower forms of attention (vigilance and orientating) and higher executive forms of attention (inhibition and goal directed behaviour) in four year old children. However, these correlations did not reach significance. In the present study however, significant correlations were found between a number of attention variables and executive function variables. One possible explanation for this is that the links between attention and executive function may become more evident as a child grows older. A more likely possibility however, is that the measures used in the present study may have been

more sensitive and may have been better representative of executive functions. Hrabok et al (2006) used measures adapted from school age measures which the authors suggest '*were likely not pure measures...but instead recruited multiple skills*' (p418).

The present study showed a number of significant correlations. The attention variables that correlated most often with the executive function variables were Score, Creature Counting Accuracy, Sky Search (time per target) and Sky Search Attention. The NEPSY-II variables that correlated most often with the attention variables were those in the subtests Auditory Attention, Design Fluency and Inhibition. One possibility for this pattern of results is that the concepts measured by these variables have a greater degree of interrelatedness than those variables that do not show many significant correlations. This would mean that sustained and selective attention is linked more closely to executive functions whilst switching and divided attention are more separable from executive functions. The results suggest that inhibition may be closely related to attention. This lends support to Fletcher's (1998) suggestion that inhibition is included in definitions of both attention and executive function. The findings also lend support to Barkley's (1997) model in which he suggests that behavioural inhibition may be a necessary prerequisite for other executive functions and that behavioural inhibition is related to ADHD. The findings suggest that executive functions such as planning and organisation and concepts such as semantic knowledge and conceptual reasoning may be more separable from attention than other executive functions.

Whilst there were a number of significant correlations between the attention and executive function variables in the present study, it is important to note that not all of the variables correlated significantly with each other. It is also important to note that there were no perfect correlations and so not all of the variance in one variable could be explained by the variance in another variable. This suggests that attention and executive function should not be seen as the same thing but rather should be seen as related concepts.

Research question one was an important starting point of the research process. As the research initially developed from school's concerns about the number of children with attention difficulties it was important to know whether attention and executive function were linked before carrying out an executive function intervention. If there had been no clear links between attention and executive function, there would have been little point in carrying out an executive function intervention in order to try and improve attention skills. As the results of research question one showed a number of significant correlations between attention and executive function it meant that it was logical to continue the research as planned and carry out the executive function training in school. Research question one therefore provided the theoretical basis for delivering executive function training to try and improve attention skills. Research questions two and three also link back to research question one, as the executive function intervention was successful in improving children's attention skills (research

question three), which provides further support for the link between attention and executive function. As the results of the research further support this link it was important to know what was useful about the executive function staff training (research question two) as this will help others in designing executive function interventions to help children develop their attention skills.

5.4 What is useful about executive function staff training sessions?

The second research question aimed to fill the gap in the literature around executive function staff training. There was no literature located that looked at executive function staff training. Therefore, it was felt necessary to carry out some evaluation to find out what is useful about carrying out executive function training sessions with primary school staff.

McCloskey, Perkins and Van Divner (2009) suggested that clinicians should share knowledge to '*help parents and school staff understand the role of executive functions in children's behaviour and academic performance*' (p233). The staff evaluation questionnaires suggested that the training sessions were successful in increasing staff knowledge about executive functions. The mean change in teachers' scores (scale 1-10) on how knowledgeable they felt about executive functions, was an increase of 5.33 after the first session. The mean change in teaching assistants' scores after the first session was an increase of 5 and an increase of 2.81 after the second session. The teachers' ratings for how knowledgeable they felt about how executive functions relate to the curriculum increased by a mean of 2.77 after the second session. One of the categories identified from the staff interviews was that staff had an increased awareness about executive functions. Another category was changing children's self perceptions. By helping staff to develop their understanding of executive functions, it meant that they could pass on this knowledge to children and help to change perceptions about their difficulties.

McCloskey, Perkins and Van Divner (2009) also highlight the role that clinicians have in '*helping guide the implementation and evaluation of interventions that incorporate knowledge to enhance assessment of academic problems and the development of interventions*' (p233). Discussion with staff indicated that they had found the written materials (used to support the development of interventions) useful. Other categories from the staff interview suggest the training helped to enhance the assessment of academic problems such as 'identifying and understanding individual children's needs'.

Meltzer and Krishan (2007) emphasise the importance of teaching strategies to address executive function difficulties. Meltzer, Polloca and Barzillai (2007) suggests that executive

functions need to be taught, as they can show children how to learn, to focus on process and understanding, to encourage independent learning, promote flexible thinking and help bypass weakness. One of the categories identified from the staff interviews was that staff were recognising that children may need to be taught executive function skills.

McCloskey, Perkins and Van Divner (2009) emphasise the importance of understanding differences in children's development of executive function skills. This was another outcome of the staff training. One of the categories identified from the staff interviews was that staff were recognising the difference in the development of children's executive function skills within their class.

Section 2.97 considered literature which suggested carrying out a consultation model of training would be useful. Leadbetter (2006) suggests that consultation aims *'to empower the problem-owner and seek solutions that can be implemented by the school staff to improve educational or developmental outcomes for children or a group of children'* (p22). McCloskey, Perkins and Van Divner (2009) suggest that information given to staff should be *'woven into existing knowledge and practices to enhance effectiveness'* (p233). Information gathered during the evaluation process suggested that carrying out a consultation model of training was particularly useful in the present study. Many members of staff identified discussing strategies and sharing ideas with their colleagues as the most useful thing about the training sessions. One of the categories identified from staff interviews was that staff were already helping children to develop their executive function skills. This allowed staff to build on current practice and to recognise what they were doing that was working well, and so they were able to do more of this. It appeared that one of the most useful things about the training was that it gave staff a framework and the language to talk about executive function skills which meant they were able to recognise and verbalise things they could (and had already) put in place for children to help them to develop executive function skills.

5.5 What impact do executive function staff training sessions have on primary school children's attention skills and executive function skills as measured by standardised assessment?

Staff interviews indicated that the training had been successful in helping teachers to use strategies in the classroom to encourage children to develop their executive function skills. All the teachers interviewed were able to give examples of things they were doing in the classroom to help promote executive function development.

McCloskey, Perkins and Van Divner (2009) suggest that clinicians can *'advocate for systems level change in schools'* (p233). The training prompted a number of assemblies to be carried out at the whole school level. The fact that the head teacher was so committed to the development of executive function skills meant a greater chance of there being a systems

level change. During the interview with the head teacher, he mentioned that the development of executive function skills had been added to the school's self evaluation form. This indicates that the interventions are considered important at the whole school level. Discussion with the head teacher indicated that there is a possibility of lasting change at the whole school level with the head teacher making the decision to carry out assemblies on executive function skills every year.

Descriptive statistics indicated improvements were made in attention and executive function skills by participants in all classes. The results of the studies carried out by Klenberg et al (2001) and Rebok et al (1997) suggested that middle childhood is a period of time when executive functions develop rapidly and therefore is a good time to carry out interventions designed to help executive functions develop. The results of the current study suggest that interventions carried out during middle childhood are effective in improving both attention and executive function skills. The fact that the participants in class two (six to seven year olds) made the least progress lends support to the study carried out by Rebok et al (1997) who found the most rapid improvements in executive functions occurred between the ages of eight and ten. This is the age of the children in classes three to six, where greater improvements were made than in class two.

Descriptive statistics indicated a general improvement in attention skills and executive function skills following the staff training session. 54.08% of the attention scores increased from pre to post-intervention. 58.45% of the available executive function scores increased from pre to post-intervention. Overall 56.89% of the available scores increased from pre to post-intervention.

Although some extraneous variables were identified for some of the participants, none of these were considered significant enough to remove an individual participant from the overall analysis.

Wilcoxon Signed Rank tests were carried out on the data to look at the differences between pre and post-intervention scores. There was a significant improvement in participants' TEA-Ch mean at the post-intervention stage. There was also a significant improvement in participants' NEPSY-II mean at the post-intervention stage. This indicates that generally there was a significant improvement in participants' attention and executive function skills (as measured by standardised assessment) following the executive function staff training sessions. The fact that attention scores improved following staff training on executive function gives further support to the close link between attention and executive functions in primary school children. This lends support to Struss and Alexander's (2000) suggestion that the executive functions are part of a supervisory system. The results of the present study indicate that attention may be an output of executive functions. The results suggest that

intervening to improve executive functions in primary school children may also improve their attention skills.

At the subtest level, several significant differences were revealed. There were significant increases from pre to post-intervention for the following TEA-Ch variables; Sky Search (time per target) and Sky Search Attention. This suggests that the intervention may have been more successful in helping children to develop selective/focused attention skills than sustained, switching or divided attention. It is surprising that significant changes were not found in the subtests designed to measure sustained attention given that sustained attention was included as part of Dawson and Guare's (2004) executive function definition, and was therefore included in the staff training sessions. One possible explanation is that selective attention skills may be more susceptible to intervention changes than the other areas of attention. The fact that Creature Counting Timing and Sky Search DT did not significantly improve following intervention may be explained by the fact that they did not correlate with a large number of NEPSY-II variables and therefore may be more separable from executive functions.

There were significant increases in the following NEPSY-II variables; Animal Sorting, Animal Sorting Combined, Response Set Total Correct, Response Set Combined, Inhibition Naming Combined and Inhibition Switching Combined. The fact that there were significant increases in these subtests suggests that there was an improvement in participant's task initiation, flexibility and response inhibition. One possible explanation for this is that these executive functions may be more susceptible to intervention. Another possibility is that staff may have used more strategies in relation to these executive functions.

5.6 Summary of the present study

The present study investigated the link between attention and executive function in primary school children. 31 participants from one primary school in the North West of England were assessed using subtests of the TEA-Ch and NEPSY-II.

The present study found a significant, high correlation between participants' mean TEA-Ch and mean NEPSY-II scores, indicating that there is a link between attention skills and executive function skills. There were several significant correlations between the TEA-Ch and NEPSY variables. The researcher suggests primary school children's attention skills and executive functions should not be seen as the same thing but should be viewed as related concepts. The results of the present study indicate that sustained and selective attention are linked more closely to executive functions, whilst switching and divided attention are more separable from executive functions. The present study's results also suggest that inhibition is closely related to attention.

The present study involved using current literature to develop executive function staff training sessions. A supporting pack of written materials was also prepared to help and support staff in carrying out a whole school executive function intervention. Staff evaluation questionnaires indicated that staff knowledge about executive functions improved following the training sessions. Staff identified the following as helpful; information about executive skills definitions, information about the development of executive skills, discussing strategies and sharing ideas with colleagues. Teachers and teaching assistants identified that as a result of the training sessions they would be thinking about or implementing new strategies and that they were more aware of children's difficulties.

Data from the staff interviews yielded several categories that related to what staff found useful about executive function staff training sessions. These were:

- Recognising differences in the development of children's skills within the class
- Recognising that children may need to be taught executive function skills.
- Staff were already helping children to develop their executive function skills.
- Increased awareness of executive function skills.
- Usefulness of the written materials' which were given to support staff following the training sessions.
- Identifying and understanding individual children's needs.
- Staff having a framework and the language to talk about executive function skills.
- Changing children's self perceptions.

The positive feedback from the sessions indicates that staff found the executive function training sessions useful. The researcher proposes that the consultation model of delivering the training was particularly important.

Finally the present study looked at the impact of executive function staff training sessions on primary school children's attention skills and executive function skills, as measured by standardised assessment.

Descriptive statistics indicated that participants in all the classes made progress in attention skills and executive function skills. Wilcoxon Signed Rank tests showed significant improvements in participants' mean TEA-Ch and NEPSY-II scores at post- intervention suggesting a general improvement in attention skills and executive function skills. The author proposes that primary school aged children are able to benefit from executive function interventions. The results of the present study suggest that attention may be an output of executive functions and that carrying out executive function interventions can have a beneficial effect on primary school children's attention skills.

There were significant improvements in some of the scores at the subtest level. There were significant improvements at the post-intervention stage in the following TEA-Ch variables; Sky Search (time per target) and Sky Search Attention. The researcher proposes that the intervention may have been more successful in helping children to develop selective/focused attention skills than sustained, switching or divided attention. There were significant increases in the following NEPSY-II variables; Animal Sorting, Animal Sorting Combined, Response Set Total Correct, Response Set Combined, Inhibition Naming Combined and Inhibition Switching Combined. The author proposes that the intervention may have been more successful at improving the executive functions measured by these variables, e.g. task initiation, flexibility and response inhibition.

5.7 Strengths and limitations of the present study

The fact that all 31 participants were able to be reassessed at the post intervention stage is considered a strength of the present study. The sample consisted of males and females, both with and without identified special educational needs, who spanned a wide age range. This was a good representative sample of the primary school population from ages six to ten years old. The strength of this sample is that it suggests that the link between attention and executive function spans both male and female, with and without special educational needs across a wide age range. It was possible to interview all the teachers of the children involved. It was also possible to interview all the teaching assistants working with any of the participants. This allowed a complete data set to be gathered.

Another strength of the present study is the number of staff members that attended the executive function training sessions. All the teachers attended the training sessions alongside the head teacher, one higher level teaching assistant and two trainee teachers. 10 out of 13 teaching assistants attended the first training session and 11 out of 13 attended the second session. This enabled a whole school approach to developing children's executive function skills to be implemented. The fact that the head teacher showed such commitment to the development of executive skills is also considered a strength of the present study. The present researcher proposes that this helped interventions to be carried out across the school. When interviewed, all teachers were able to give examples of ways in which they were helping children to develop their executive function skills.

The fact that standardised assessments designed for use with primary school aged children were used is considered a strength of the study. As discussed in section 2.8 there are several methodological issues in assessing attention and executive function skills. Pennington and Ozonoff (1996) highlighted that many of the assessment tools designed to look at executive functions tap many interacting component processes. Another issue is that

many assessment tools are downwards extension of tests designed for use in adult Neuropsychology and may therefore not be sensitive to children's executive functions. The NEPSY-II has been specifically designed for use with children, as has the TEA-Ch. The use of standardised assessments such as these should help researchers to be able to link and compare studies. This has been difficult previously with researchers using multiple assessment tools. Although the use of standardised assessments is considered a strength of the present study, a number of reliability and test-retest coefficients were below the recommended 0.7 and so caution is needed when interpreting those results.

One of the limitations of the current study is that the data arising from the content analysis of the semi-structured interviews with staff was analysed only by the researcher. The risks of the analysis being conducted by the researcher alone include the fact that the researcher may have unintentionally had a confirmatory bias and picked out the positives from the staff interviews. Had there been an additional coder, they may have highlighted substantive content and quotes that gave a more balanced viewpoint. Another risk is that because there was only one interpreter it may be more difficult to replicate the analysis, thus making the results less transferable. The data was analysed by the researcher alone for a number of reasons. Firstly, it was not practical within the time limitations to get somebody else to analyse the data. Secondly, part of the data used pre-conceived categories (the executive functions themselves) to highlight examples of where staff were helping children to develop their executive function skills. This meant that the risks to data were lower than they would have otherwise been. There was a larger threat to the researcher analysing the data alone where categories were derived to discover what was useful about executive function staff training (research question two). However, as the content analysis did not analyse the latent content it was decided that it was possible for the researcher to analyse the data alone. Had there been an interest in the meaning behind the language used, rather than a description of what was actually said by staff, then an additional coder of the data would have been necessary.

The main limitation of the current study is the lack of control group. As explained in section 3.11 it was not practical or realistic to use a control group in the present study. As the executive function intervention was designed to be a universal, whole school approach, it was not possible to have a control group within the school in which the research was carried out. Consideration was given to using a control group in another school, however it would have been very difficult to match the children, teachers and school setting in order to have a relevant control group elsewhere and time limitations meant that this process was not possible. Also, the current study used a pre-experimental design as this type of intervention had not been carried out before. It was felt it was useful to first discover whether the training was worthwhile before investing additional time in conducting a piece of research using an

experimental design with a control group. The use of a control or comparison group is something that could be considered a direction for future research.

5.8 Implications for professional practice

There are several implications for professional practice identified from the present study. Firstly, this study has implications for how researchers and clinicians look at the concepts of attention and executive function. The results of the present study suggest that there is a link between primary school children's attention skills and executive function skills. Correlations identified a significant high link between the TEA-Ch and NEPSY-II means, suggesting a link between general attention and executive functions. At the subtest level there were several significant correlations between TEA-Ch and NEPSY-II variables. The results suggest that sustained and selective attention is linked more closely to executive functions, whilst switching and divided attention are more separable from executive functions. The present study's results also suggest that inhibition is closely related to attention. The results lend support to Barkley's (1997) model in which he proposed that response inhibition develops first and may be a necessary prerequisite for other executive functions. Analysis of the data using Spearman's correlation coefficients suggested that attention and executive function should not be treated as the same thing, but rather as linked concepts.

The fact that strong links were found between attention skills and executive function skills in primary school children without ADHD indicates that the concepts are more generally related. This has important implications for practice. Where children have difficulties with their attention, EPs should carry out assessments of executive function whether or not the child has a diagnosis of ADHD. This links to the research carried out by Hedges, unpublished, who found that EPs would carry out similar interventions for children referred to them with attention difficulties, whether or not that child had a diagnosis of ADHD.

Mackay (2005) suggests that Neuropsychology should be seen as an integral part of EP practice. EPs are often asked to see children with attention difficulties. Given the link between attention difficulties and executive function difficulties, it is very important that EPs are knowledgeable about executive functions. Impairments in executive functions are also seen in children with a large number of other difficulties (see section 1.3.1) that may require EP input. Gioia and Isquith (2004) suggest '*the level of executive functions, whether impaired or intact, has substantial implications for everyday social and academic function*' (p136). It will be important for Universities carrying out initial training of EPs to consider including course content on Neuropsychology, and more specifically on executive functions.

The importance of interventions for children with attention difficulties and executive function difficulties was discussed in sections 2.91 and 2.92 respectively. Recent NICE guidelines

(2008) recognise that more needs to be done in relation to children with ADHD in school and that intervention needs to occur as early as possible. Given the links between attention and executive function, carrying out executive function interventions may be one way to address attention difficulties in school. Meltzer and Krishan (2007) suggest that executive function processes affect academic performance. McCloskey, Perkins and Van Divner (2009) highlight academic skills problems such as reading, writing and maths, as occurring as a result of executive function difficulties. Given the importance of executive functions for the curriculum it is particularly important that interventions are carried out at school. It is important to empower school staff by increasing their knowledge about executive functions. Given the important role of executive functions in school, knowledge could be passed on to teachers during initial teacher training.

Feedback from the staff evaluation questionnaires suggests that staff found the executive skills training sessions useful. The training was successful in increasing staff knowledge about executive functions and therefore may be useful to carry out in other primary schools. The consultative approach was particularly useful. Many staff commented on the usefulness of sharing ideas with their colleagues. This has implications for the delivery of executive function training in schools. The fact that the staff could already recognise what they were doing to help children develop their executive function skills enabled them to build on practice and integrate strategies at the class and whole school level. The results of the study have wider ranging implications for staff training in general. The consultation model of training was welcomed by staff. Results suggested that 'starting from where the staff are at' was particularly important in relation to them following through by using strategies from the training session.

The categories identified from the staff interviews suggest that the training was worthwhile. These categories were:

- Recognising differences in the development of children's skills within the class
- Recognising that children may need to be taught executive function skills.
- Staff were already helping children to develop their executive function skills.
- Increased awareness of executive function skills.
- Usefulness of the written materials' which were given to support staff following the training sessions.
- Identifying and understanding individual children's needs.
- Staff having a framework and the language to talk about executive function skills.
- Changing children's self perceptions.

The training appeared to fulfil expectations by McCloskey, Perkins and Van Divner (2009) that clinicians should share executive function knowledge, help guide the implementation

and evaluation of interventions and advocate for system level change. The current training package and supporting written materials was received well by the school staff. It may therefore be useful to carry out the training in other schools.

There is a role for the EP in ensuring that relevant knowledge is shared with other professionals. The pack of supporting written materials prepared as part of this study has already been shared with other EPs in the local authority in which the author works. Other EPs have been using the materials to facilitate discussions with staff about individual and groups of children.

Following the staff training, significant gains were made by participants in attention and executive function skills. This suggests that the whole school intervention led to some positive changes and would therefore be useful to do in other schools. The fact that participants' attention scores increased suggests that executive function interventions may have some success in addressing attention difficulties, particularly selective attention.

Finally, there are implications for the EP's role as a researcher. The author found it beneficial to carry out research in a school where she was already working as a TEP. This was because she had already built up a good relationship with the staff. It was useful for staff to see the TEP in her role as a researcher because it led to them asking the TEP further about the role of the EP. Many members of staff were interested to hear that EPs could also carry out research. It is particularly important now that initial training of EPs increasingly focuses on developing research skills, that those working with EPs understand the work that they can do in terms of research. The staff's view of the role of an EP seems to have moved away from seeing an EP as someone who works with individual children and instead as someone who can plan and evaluate interventions at the systemic level. This is especially important given the DfEE (2000) report into the current role of the EP, good practice and future directions finding schools want more involvement from EPs in INSET and intervention.

5.9 Overall summary and future directions

The present study uses subtests from the TEA-Ch and NEPSY-II to gain a standardised measure of primary school children's attention and executive function skills. Spearman's correlation coefficients were carried out and suggested significant links between the concepts. A package of executive function staff training sessions was developed alongside a supporting pack of written materials. A consultation model of training was used to work with teachers and teaching assistants in one primary school. Evaluation questionnaires and staff interviews indicated that staff found the training useful. Following a period of whole school intervention, the 31 participants were reassessed using the TEA-Ch and NEPSY. Significant gains were made in both attention and executive function skills.

A number of possible areas for future research have been identified and are briefly outlined below.

It would be particularly useful for further research to be carried out using the same executive function staff training but with a matched control group being used to see whether the findings were replicated. If the findings were replicated, and a difference was identified between the control group and intervention group, with the intervention group making significantly more gains in attention and executive function, it would make the findings related to the impact of staff training more robust. This would also increase practitioner confidence in the training and greater efforts may then be made to extend this training to other schools. It would also be useful to use a larger sample than in the present study in order to see whether the findings were replicated. If findings were replicated then this would make the findings related to the links between attention skills and executive function skills in primary school children, more robust. It will be important (as identified in section 2.8) for future research to use the same measures as the present study (TEA-Ch and NEPSY-II) to allow results to be compared.

Another interesting piece of research could look at matching teacher perceptions with standardised assessments such as the TEA-Ch and NEPSY-II to give a clearer picture about how well these assessments capture what is seen by staff on a daily basis in the classroom. If teacher perceptions were well matched with the standardised assessments it may give greater confidence that the TEA-Ch and NEPSY-II are a good approximation of primary school children's attention skills and executive function skills respectively. This would also tell us about the usefulness of these standardised assessments in terms of their validity. If teacher perceptions and standardised assessment measures were incongruent, it may be that other forms of different assessment are needed to mediate between teacher perceptions and standardised assessments, such as structured observations.

Previous research has focused on evaluating executive function interventions at the individual level (e.g. Dawson and Guare, 2004, and McCloskey, Perkins and Van Divner, 2009). Given that the present study has provided some evidence that carrying out whole school interventions may be successful, it may be useful for future research to combine the two approaches. Executive function staff training could be carried out at the whole staff level but additionally children with attention difficulties or executive function difficulties could be identified and given individual interventions in addition to staff training. This would enable targeted interventions to be carried out with individual children. It would be useful to gain teacher perceptions of progress made following interventions. For example, if individual children were not considered to make gains following intervention according to teachers but had made gains according to standardised assessment measures, it may be that a different

analysis of their attention and or executive function difficulties would be needed to see whether the interventions are appropriate for that individual. It could be that there are different underlying difficulties for individual children. If this was the case, it is possible that from this piece of further research we could learn more about comorbidity issues and discover more about how other difficulties are linked to executive function difficulties. Of particular interest would be whether more gains in attention and executive function are made when combining the two approaches than when carrying them out alone. If more gains are made when the two approaches are combined than when carrying them out alone, this would encourage practitioners to use this combination of whole school and individual intervention approaches in their practice.

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