An investigation of communication and peer interaction in children identified with Behavioural, Emotional and Social Difficulties in primary school

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Abstract

Background: Concerns are often expressed about the numbers of children in primary schools who are described as having behavioural, emotional and social difficulties (BESD). BESD place children at increased risk for poor social relations, educational under-achievement and are of considerable concern to parents and teachers alike. Furthermore children with BESD often experience associated language and communication difficulties; these can accentuate difficulties forming social relations and engaging in the classroom and can adversely affect response to intervention and management. However, the nature of the relationship between behaviour and language/communication and how they interact has not been well described, especially in non-clinical populations.

Method: Three linked enquiries:

1. An examination of the language communication skills of BESD children based on standardised report assessment.
2. Direct observation of children interacting in a structured context.
3. A descriptive case series of peer dyad interaction.

Participants: 40 children aged 4-9 years; 20 with BESD, 20 with typical development (TD).

Results: The children in the BESD group had significantly greater pragmatic and structural language difficulties relative to TD peers although there was considerable within-group variability. Associations were found between the severity of behaviour and language/ communication difficulties and between social behaviour and pragmatic language characteristics. Direct observation indicated behaviour and language may be used together in interaction to provide mutual operational reinforcement for communication. The descriptive case series suggests that dyads vary considerably in the interaction strategies that they employ and the effectiveness and coherence of their communication overall.

Conclusions: Results support the existence of associations between behavioural and language/communication difficulties in children in a non-clinical sample, but coherence within child dyads shows variability. Interaction is likely to be influenced by peer partnering and the use of scaffolding strategies. The findings have implications for the promotion of social interactions and cooperative learning in the classroom.

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I declare that this thesis is my own work and that I have correctly acknowledged the work of others.

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Glossary of Terms

Term	Definition
Behavioural, emotional and social difficulties (BESD)	A term used to refer to children who have problems with internalised and externalised behaviour that are greater in severity and persistence for their age group, yet are not severe enough to class as a deficit or disorder.
Communication	Expression of information such as ideas, attitudes, thoughts or feelings, shared from one person to another.
Comorbid	Refers to the presence of one or more difficulty or disorder co-occurring with another difficulty or disorder.
Difficulties	Refers to problems that are not severe enough to reach clinical significance or diagnosis.
Disorder	Refers to problems that are greater in severity than ‘difficulties’, and are identified as clinically significant and may be categorised. For example, ‘Conduct Disorder’, ‘Attention Deficit Hyperactivity Disorder’.
Pragmatic language	The appropriate use of language in social contexts. Includes the ability to adapt language and communication to suit different audiences and social contexts.

Special Educational Need (SEN)	A term referring to children who have a learning difficulty that calls for them to have special educational provision in school.
Structural language	Language form and content. Includes syntax (the arrangement of words to form appropriate sentences), semantics (word or phrase meaning) morphemes (the internal structure of complex words) and grammar (the system of construction of sentences to form meaning).
Typically developing (TD)	Refers to children who have no deficits, disorders or difficulties.
Vocalisation	The voice, which possesses the acoustic qualities of pitch, loudness and quality. Includes speech-sounds such as a words, and non-speech sounds such as laughing.

Chapter 1. Introduction

1.1 Background

Behavioural, emotional and social difficulties (BESD) in children are frequent concerns for parents, teachers and other professionals. They commonly make it difficult for children to socially relate to peers and adults and can make it difficult for the child to cope in class, impacting on educational learning and achievement. Speech, language and communication difficulties (SLCD) also place children at increased risk of poorer peer relationships and educational outcomes. The substantial prevalence of both BESD and SLCD among primary-school-aged children is represented in rates of Special Educational Need (SEN), where BESD and SLCD are among the top three most prevalent types of need. Furthermore, these rates include children from non-clinical populations within mainstream schools. Therefore, although no diagnosis of disorder has been made, BESD and SLCD are persistent and problematic enough to warrant attention from teachers and parents.

The terms BESD and SLCD are standard educational terms frequently referred to in recent educational reports of SEN in England (Dfe, 2013a). Reflecting the significance of BESD and SLCD within education, there is increasing research evidence for the co-occurrence of behaviour and language and communication problems in children. This evidence comes primarily from clinical samples of children; however, there is some recent evidence for co-occurrence within non-clinical samples. These samples are distinct, since the term ‘clinical’ is a medical construct associated with *disorders*; therefore, clinical samples of children have problems that are severe enough to lead to a diagnosis of disorder. The term ‘non-clinical’ is an educational construct associated with ‘non-clinical’ *difficulties*; therefore, children’s problems are less severe and do not reach the clinical threshold. Many studies (Benner, Nelson and Epstein, 2002; Benner, 2005; Nelson, Benner and Cheney, 2005; Ripley and Yuill, 2005; Bruce, Thernlund and Nettlebladt, 2006; Mackie and Law, 2010; Leonard, Milich and Lorch, 2011) have identified language and communication problems in children with behavioural, emotional and social disorders or difficulties, as well as a high prevalence of behavioural, emotional and social problems in children with language and communication disorders or difficulties (Beitchman et al., 2001; Hooper et al., 2003; Brownlie et al., 2004; Conti-Ramsden and Botting, 2004; Hart et al., 2004; Horowitz, Westlund and Ljungberg, 2007; van Daal, Verhoeven and van Balkom, 2007; Menting, van Lier and Koot, 2010; Schoon et al., 2010; St Clair et al., 2010; Whitehouse, Robinson and Zubrick, 2011). Such associations are likely to increase the adverse impacts that behaviour and language and communication difficulties have as separate problems. However, it remains unclear to what extent these problems are related, or to what degree *co-occurring* difficulties impact on children's social interactions, the way they act and react to those around them, and/or educational outcomes. As stated above, the majority of research evidence focuses on clinical populations, yet prevalence rates of BESD and SLCD SEN within mainstream schools indicate an important need to explore these difficulties in non-clinical populations of children.

In this chapter, behaviour and language and communication are defined alongside the educational terminology 'behavioural, emotional and social difficulties' and 'speech, language and communication difficulties'. The impacts of these difficulties on children's educational and social outcomes are also introduced.

1.2 Defining Behaviour

In order to understand behaviour, an operational definition must be adopted which determines what a behaviour is. Behaviour involves actions which enable individual adjustment to environment. Operationally, it may be defined as an action that can be *observed*, *measured* and *repeated* (Bicard and Bicard, 2012). It is therefore a concrete as opposed to an abstract concept. This means that internal processes which cannot be observed, such as thought and cognition, are not considered as behaviour. As behaviour is measurable and concrete, it is implied that it has a definite beginning and end; it is therefore countable because of this and countable as it may be repeated, creating multiple frequencies of occurrence.

In non-clinical populations of children, difficulties with behaviour that exceed typical, or what may be considered as 'normal', levels of expectation, severity and persistence for their age group may be classified by an umbrella term, 'behavioural, emotional and social difficulties' (BESD). These difficulties are not considered disordered enough to be classed as a 'mental illness' or to lead to a clinical diagnosis. BESD is also known as 'emotional and behavioural difficulties' (EBD) and social, emotional and behavioural difficulties (SEBD), although effectively they describe the same types of difficulty. Variability in terminology is addressed in Chapter 2.

BESD represents a spectrum of behaviour where difficulties vary in severity and type of presentation across children. Difficulties include externalising and/or internalising behaviours. Externalising behaviours are behaviours directed *outward* towards the individual's external environment. Such behaviours are present in typical populations of children; however, considered as BESD they are more persistent and problematic. Problematic externalising behaviours within BESD may include heightened aggression, frustration, disruptive, hyperactive or attention-seeking behaviours, or difficulties with appropriate social conduct. Internalising behaviours are focused *within* the individual rather than upon the external environment. For example, a child may appear withdrawn, depressed, anxious, inattentive or unmotivated (Howarth and Fisher, 2005). Again, such behaviours exist in typical populations yet are observed as more persistent and problematic within BESD. In addition, gender is considered a better predictor of BESD than other variables such as social class or ethnicity; boys are four times as likely to be identified as having BESD as girls (DfE, 2007). Although externalising and internalising behaviours are both considered under the umbrella of BESD terminology, the most common forms of behaviour observed in children with BESD are externalising, antisocial behaviours. Aggression, non-compliance, over-activity, temper tantrums and persistent disruptive behaviours are all common occurrences within a classroom context; it is clear to see how these behaviours present most problems to teachers and other pupils. However, even within the construct of externalising behaviour, there is variability between individuals in terms of which *type* of behaviours are most prominent and frequently expressed by the child.

1.3 Defining Language and Communication

Language and communication, although separate constructs, are intricately linked together. Within research, clinical, and educational contexts they are frequently referred to in combination with each other. Essentially, language is a mechanism whereby communication can occur. Communication involves the expression of information such as ideas, attitudes, thoughts or feelings, shared from one person to another. Therefore, it is concerned not only with the expression of our own thoughts and feelings, but with the comprehension of others'.

Although various classification systems exist for language and communication, three primary domains are commonly identified; speech, structural language and pragmatics. Within these lie relative subdomains. Speech is the human oral *expression* of thoughts, feelings or ideas through the organisation of *vocalisations* into identifiable sound patterns (National Institute on Deafness and Other Communication Disorders, 2010). Vocalisations may be defined as the noise made by the vocal chords and lungs. It is the voice which possesses the acoustic qualities of pitch, loudness and quality. Within the term 'vocalisation' there is differentiation between a speech-sound such as a word or babies' babble, and a non-speech sound such as a cry or laugh. Both types of sounds are, however, expressive and communicative.

Structural language relates to language form and content. Like speech it is also concerned with expressive verbal language, but in addition with written language. Structural language includes subdomains of *syntax* (the arrangement of words to form appropriate sentences), *semantics* (word or phrase meaning), *morphemes* (the internal structure of complex words) and *grammar* (the system of construction of sentences to form meaning).

Pragmatic language is associated with the use of language in social contexts. It allows for the understanding of meaning that goes *beyond* the structural and spoken aspects of language, and for us to adapt our communication to suit different audiences and social contexts. The ability to successfully communicate mostly draws upon pragmatic language and skill, that is, the appropriate social application of verbal and non-verbal language and behaviour. This includes appropriate *initiations* (e.g. not interrupting others, turn taking in conversations), the ability to consider and evaluate the *context* of language and adapt appropriately (such as using language to suit different purposes and situations), and *non-verbal* communication. Non-verbal communication is communication without the use of verbal language, but with the use of overt and discrete behaviours. For example, it may include facial expressions and bodily gestures (overt), or posture and spatial distance between people (discrete). Pragmatic language is the only domain that incorporates non-verbal communication. It is however important to note that there is one exception to this in regards to sign language. In sign language the use of gestures and non-verbal communication replace speech and vocalisation, therefore gestures are also concerned with structural language, conveying expression of thoughts, feelings and ideas. Successful communication can be entirely non-verbal and still be fully understood, not only through sign language, but also through the use of overt and discrete behaviours.

In children with typical language and communication development the above domains are operationally used effectively and appropriately in line with children's age-related stage of development. However, it is important to note that individual variability in competency may still exist within 'typical' populations. The term 'speech, language and communication difficulty' is commonly used within educational contexts in relation to Special Educational Need, referring to difficulties that are observed in non-clinical populations of children. Children who have SLCD may present with variable degrees of difficulty and types of difficulty. They may have problems with language production (expressive, spoken language), comprehension (receptive understanding of language), or the phonology of language (sounds).

Some children may have difficulty with structural language, word order and/or sentence formation. Diagnostic terminologies that define language and communication problems in children include Specific Language Impairment (SLI), Dyslexia and Dyspraxia. Specific Language Impairment is identified when a child has problems producing or understanding complex sentences, learning new words, and perhaps making the correct speech sounds. SLI refers to significant impairment in language that cannot be explained by other difficulties such as low intelligence, hearing loss or physical impairment. Children may demonstrate difficulty with understanding and/or with producing spoken language. Dyslexia and Dyspraxia are considered specific learning difficulties. Dyslexia affects the skills involved in accurate and fluent word reading or spelling, while Dyspraxia affects fine and/or gross motor co-ordination, which may impact on articulation and speech, writing, perception and thought. It is therefore possible that children may have speech *and* language/communication difficulties. However, there is no agreed label for children with unexplained language problems, such as those in non-clinical populations (Bishop, 2014).

1.4 Educational Impacts of BESD and SLCD

1.4.1 *Special educational needs (SEN)*

Behavioural, emotional and social difficulties and speech, language and communication difficulties have significant impacts for children within education. Both types of difficulty are among the top three most prevalent types of special educational need within England's primary education system (where pupils are aged between 4 and 11). SLCD prevalence is reported as 30.6% of children, and BESD prevalence is reported as 18.4% of children (DfE, 2013b). Prevalence of moderate learning difficulties (LD) lies between SLCD and BESD, reported as affecting 20.3% of children. Across childhood, one in five pupils has a special educational need which makes it more difficult for them to learn than for children of the same age without such needs (DfE, 2010c). There is a higher prevalence of SEN in boys than girls: 2% of boys have statements of SEN compared to 0.8% of girls, and 20.5 % of boys have SEN without statements (at School Action Plus), compared to 11.3% of girls (DfE, 2013b). The prevalence of SEN without statements within primary schools in England rose from 19% in 2006 to 21% in 2010 (DfE, 2010b). However, the latest figures show a decrease of 5% in rates since 2010, reporting 2015 prevalence of SEN as 15% (DfE, 2015). This decrease since 2010 is likely to be a consequence of more accurate identification of those children who have SEN, and those who do not. This was a result of a special educational needs and disability review in 2010 by the Office for Standards in Education, Children's Services and Skills (Ofsted).

Between 2014 and 2015 alone a 2.5% decrease in SEN prevalence has been reported. This decrease is also likely to be the result of more accurate identification, but in addition may be due to the implementation of Education, Health and Care (EHC) plans in 2014 which replace statements of SEN. Despite a decrease in SEN without a statement, the proportion of pupils with a statement/EHC plan has remained stable since 2007 at 2.8%. Between 2014 and 2015 there was an increase of 3,975 in the number of pupils with a statement/EHC plan to 236,165. Therefore there remains the need to address SEN as representing increased potential for detrimental impact upon the learning and educational attainment of children within England's primary schools.

A further influence on children's learning and educational achievement is the degree of deprivation in their local area. Deprivation refers to adverse economic circumstances experienced by a family in the area in which they live. It is primarily defined within education by those children who receive free school meals (FSM) (representing their family receiving state benefits) and by the Index of Multiple Deprivation (IMD). IMD is a national government measure of local area deprivation calculated on the basis of income, education, health, employment, barriers to housing, crime and living environment circumstances. It has been proposed by the Department for Children, Schools and Family (DCSF, 2009) that associations between deprivation and education are 'crucial for understanding the significant impact deprivation has on later outcomes in adulthood'. These associations lead to poor educational attainment, reduced employment in adulthood and long-term mental health difficulties (DCSF, 2009). The proportion of free school meals is also shown to be related to proportions of children with special educational needs, which indicates that children with SEN are more likely to come from deprived backgrounds. Pupils with a statement of special educational need are almost twice as likely to be eligible for free school meals. The national average percentage of pupils with statements of SEN eligible for free school meals is 31.5%, compared to 15.3% for children without SEN (DfE, 2013a). Furthermore, eligibility for free school meals is particularly high for children with behavioural, emotional and social difficulties; approximately a third of pupils identified as having BESD are eligible for free school meals (DCSF, 2009). Degree of deprivation is therefore a good indicator of risk of poor educational attainment and rates of SEN within primary schools.

The close relationship between behaviour and language is also reflected within an educational setting through rates of exclusions in schools. Pupils with SEN are over seven times more likely to be excluded from school than those without SEN (DfE, 2012b). In primary schools, the most common reason for both permanent and fixed period exclusions is persistent disruptive behaviour. This reflects the severity of impact poor behaviour has on classrooms and schools; persistent disruptive behaviour is predominantly externalised. The greatest increments in rates of SEN occur between the foundation stage (ages 3–5 years) and key stage 2 (11 years) of education, an important transitional stage of development for children which involves adjustment to changes in classroom activities. Therefore, learning difficulties are likely to become more apparent during this stage. The investigation of the association between behaviour and language and communication is important in children throughout this transitional stage, beginning at age four. Early detection of difficulties is more likely to improve the chances of remediation of problems in the child's future.

1.4.2 *Educational achievement*

Developmental difficulties in the early years are reflected in national educational achievement statistics. There is consistent pressure on children to reach adequate levels of educational attainment, and thus pressure on teachers to support and bring about this attainment. In England there exists national discrepancy between regions regarding young children's educational achievement at the foundation stage (DfE, 2010a). These differences represent variability in children's level of development and the 'Early Years Achievement Gap', the degree of inequality of performance between the highest and lowest achieving children. In 2013, a gap in achievement of 46 percentage points between pupils with and without special educational needs was reported (DfE, 2013b). Local authorities within the north east of England have the most unequal early years foundation stage attainment levels, with more than 50% displaying achievement inequality, representing large discrepancies between high and low achievers (DfE, 2013c). This achievement gap remains evident across ages and special educational needs remain a main factor contributing to this gap. Nationally, over 70% of children age 16 without any SEN achieved at least five A–C GCSE grades, compared to only 10% of children with statements of special educational needs (DfE, 2013d).

Poor outcomes in education are therefore highly related to special educational needs. Learning difficulties that do not necessarily represent clinical disorder, but are greatly prevalent across England's education system, must be addressed if rates of SEN among children are to continue to decrease and educational attainment is to increase. In support of this, children with SEN are less likely to progress in their learning and meet expected targets of achievement. In 2012, 93% of children without SEN met the expected level of progression between key stage 1 and key stage 2 in English, compared to only 46% of children with a statement of SEN (DfE, 2013c).

Aside from moderate to severe learning difficulty, poor educational achievement is particularly associated with behaviour and language difficulties. Around 56% of children with BESD and 54% of children with SLCD met expected targets of achievement in English in 2010 (DfE, 2010b). Language skills are among the best predictors of academic success (DfE, 2011b). Children with SLCD are less likely to gain adequate academic achievement, achieving half the number of A–C GCSE grades as their peers (Conti-Ramsden et al., 2009). Externalising behaviours are also related to underachievement and have been found to be related to difficulty in reading, mathematics and written language (Nelson et al., 2004). Furthermore, it is frequently proposed that children with BESD may have language difficulties that have not been recognised, that is, until a child falls behind the standards of their peers. Unless a formal assessment of language ability is carried out, a child's difficulties may remain undetected (Cohen et al., 1993, 1998; Cross, 1998; Ripley and Yuill, 2005). There is a possibility that poor educational attainment of children with BESD is explained by problematic behaviour, when alternatively it may be due to underlying language difficulties (Mackie and Law, 2010).

1.4.3 *Classroom management and learning strategies*

BESD and SLCD also impact on classroom management and learning strategies. The Department for Education's Research Report 218 (DfE, 2012) regarding pupil behaviour in schools in England summarises some effective strategies from existing research literature for classroom management. These include the provision of structure through teacher behaviour, establishing rules and expectations, the reinforcement of positive behaviour as well as consequences for negative behaviour, and the formation of good-quality teacher–pupil relationships (Stage and Quiroz, 1997; Marzano and Marzano, 2003; Pianta and Stuhlman, 2004; Swinson and Knight, 2007; Simonsen et al., 2008; Thomas, Bierman and Powers, 2011). Teachers are therefore an integral part of the educational and social development of children and their influence is mediated by the teaching strategies that they adopt.

Co-operative learning strategies are popularly applied in current education practice as a result of strong evidence for their efficiency in improving children's academic achievement and socialisation. Derived from the ideas of Vygotsky (1978) about child development and learning (discussed in Chapter 5), these strategies are concerned with the effects of scaffolding by adults and peers on children's developmental progression. Co-operative strategies aim to help teachers to meet the needs of children who have differing cognitive abilities (including children who are typically developing (TD) and those who have developmental or learning disabilities) and children from a variety of different socio-economic and cultural backgrounds (Putnam, 1993). They may be considered at teacher level or student level. At the teacher level they alter the typical role of teachers, as teachers become *facilitators* of students' learning as opposed to information *providers* (Chiu, 2004; Cohen, 1994). At the student level they instigate collaborative group learning where students may utilise resources and skills from one another to capitalise upon their own learning (Chiu, 2000). There exists evidence that this type of learning increases children's educational achievements and self-esteem, and improves peer relationships (Slavin, 1990; Zammuner, 1995; Terwel et al., 2001). Therefore, the educational attainment and socialisation of children with special educational needs such as BESD and/or SLCD may benefit from this type of learning. However, dual sets of difficulties may present real challenges in applying such strategies.

Co-operative learning is essentially based upon interaction between a teacher and student or between child peers. It promotes social interdependence whereby the outcomes of an individual are formed from their own and others' actions (Johnson and Johnson, 2009). There is some evidence that teachers may find this type of learning strategy difficult to implement owing to variables relating to task construction and the characteristics of children. Teachers have reported difficulties with managing students' socialising and conflicts, and recognise that student group composition (gender, ability and friendships) affects the efficiency of co-operative working (Gillies and Boyle, 2010). Co-operative learning is therefore more difficult for children who have behaviour and/or speech language and communication difficulties, as it involves socially-oriented behaviour and the ability to understand the perspectives of others (Terwel et al., 2001).

There is evidence that teachers often provide praise for academic achievements but not for the correct behaviour of children who have behaviour difficulties (Sutherland, 2000). However, there is a suggestion that students' academic responses and on-task engagement can be promoted by increases in praise from teachers, and opportunities for children to respond (Sutherland, 2000; Sutherland, Wehby and Yoder, 2002). Problematic behaviour in the classroom is a frequent occurrence and may impact detrimentally upon teaching strategies. A survey of the National Union of Teachers (NUT) in 2001 (Neill, 2001) indicated that 69% of members reported experiencing disruptive behaviour by children weekly or more frequently.

Disruptive behaviour is persistent and is more frequently observed in the classroom than more severe assaults on teachers and peers (DfE, 2012). Children with BESD also often display non-compliance with teacher instructions. Non-compliance is a prominent feature of problematic behaviour in children and it has been suggested that it is central to their difficulties. This would mean that other problematic behaviours are ultimately a reflection of non-compliance (Rhode, Jenson and Reavis, 1998). Nelson and Roberts (2000) suggest there is a low probability that children with disruptive behaviour will comply with a teacher's attempt to correct their behaviour.

Children who have difficulty with speech, language and communication may also struggle in co-operative learning as language ability is important for successful social interaction with others. Social interaction is the dynamic process by which an individual acts towards others and others act towards them; it is a social exchange of behaviour. Through this social exchange, individuals reciprocally present themselves to, and respond to, others around them. Social interaction may involve verbal language, such as conversation, statements and vocalisations, or non-verbal behaviours, which may be overt (e.g. a hand wave) or discreet (such as eye gaze). It may occur between two individuals (a dyad), or larger groups. There is evidence that children with language difficulties are more likely to be dominated by their partner in social interaction (Bruce, Hansson and Nettelbladt, 2010). Furthermore, children with receptive language problems may have difficulty comprehending and understanding instructions from teachers and so may be less likely to respond appropriately.

1.5 Social Impacts of Behaviour and Language and Communication Difficulties

In the light of significant impacts of BESD and SLCD on children's co-operative learning, it is important to consider the impacts difficulties may have on children's peer interactions. In addition, difficulties are likely to have reciprocal influences, and may become maintaining factors for each other. In support of this, co-occurring behaviour and language and communication difficulties have been shown to be consistent throughout childhood (Stevenson, Richman and Graham, 1985; Beitchman et al., 1996; Nelson, Benner and Cheney, 2005), thus suggesting that a reciprocal and maintaining relationship exists between the two. Furthermore, if association is consistent over time there are likely to be longer-term effects, which may be detrimental to social functioning, personal relationships or employment opportunities in adolescence and adulthood.

1.5.1 *Peer interaction*

In child social development, difficulties with peer relationships and interaction may appear as a core symptom of a clinical diagnosis or as a secondary consequence of other developmental disorders. For example, deficits in social interaction in children with Autism Spectrum Disorders (ASD) are a core symptom of their disorder; however, social interaction problems may also exist as a result of a child's speech and language impairment (Bruce and Hansson, 2011). Language skills therefore play a very important role in the development of social relationships and effective interaction between children. Children's quality of peer relationships may also affect their educational attainment and social skill development. Peer interaction may be considered a 'platform' upon which children share experiences and learn to understand others' perspectives, essential for their cognitive and social development (Williams, 2007).

In support of this, there is empirical evidence that children with behaviour and/or speech, language and communication difficulties have poor peer relationships and difficulty with peer inclusion (Fujiki, Brinton and Todd, 1996; Menting, van Lier and Koot, 2011). Peer rejection has been shown to be related to increased aggression, withdrawn behaviour, decreased levels of sociability and cognitive ability (Newcomb, Bukowski and Pattee, 1993; Dodge, 2003). Peer relationships may also be mediated by children's language abilities through the direct influence language has on quality of interaction. Language and communication skills are an essential requirement for gaining access to peer interaction. Children with poor language experience more peer rejection and less peer acceptance, and are at greater risk of victimisation, than their typically developing peers (Gertner, Rice and Hadley, 1994; Evans, 1996; Conti-Ramsden and Botting, 2004). Alternatively, children who have language skills within normal limits expected for their development have access to a greater quality of interaction experiences with their peers (Bruce and Hansson, 2011). As language is necessary for accessing peer interaction, peer interaction itself may be considered a requirement for and predictor of successful language development (Bruce and Hansson, 2011). Children with behaviour and/or speech, language and communication difficulties are therefore left in a difficult position, as they are unable to gain access to good-quality interaction with their peers, and unable to further develop their social and language skills without such interaction. They are at increased risk of poor social development through their reduced exposure to typical social interaction, and are therefore less likely to learn normative adaptive models of social conduct (Parker and Asher, 1987). These children are, therefore, in need of support from those with whom they interact to structure and support their communication, language and behavioural interaction (Bruce and Hansson, 2011).

In social interaction, there is a suggestion that children synchronise their behaviour (Farmer and Cadwallader, 2000). Effective synchronisation, however, may be difficult for children who have social interaction difficulties. In addition, the social roles of children may impact on synchronisation. For example, if aggressive and disruptive students take on a leadership role, there is likely to be less synchronisation as they lead and dictate the interaction. Alternatively, children with speech, language and communication difficulties may be unlikely to adopt a leadership role as a result of their poorer-quality interaction experiences, and so in interaction these children may be more submissive. This is supported by research evidence mentioned above that these children are more likely to be dominated by their partner in social interaction (Bruce, Hansson and Nettelbladt, 2010). However, it is less understood how children with *combined* behaviour, speech, language and communication difficulties interact with their peers, or how typically developing peers interact with children with these difficulties. To what extent does supportive behaviour by either of these groups of children occur?

1.6 Summary

Behavioural, emotional and social difficulties and speech, language and communication difficulties commonly co-occur and have a great impact on children in educational and social relationship contexts. From a broad perspective, educational impacts include classroom management and teacher interactions with children. At a more specific level, there are direct impacts on the child. These include poor peer interaction and educational progression and achievement, as well as risk of longer-term outcomes, as association has been shown to be consistent across time. Furthermore, educational implications are evident from children's early years within primary school, and so exploration of associations at this age is important.

The current study is developmental in its perspective as the focus of investigation is how BESD and language and communication difficulties may dynamically interact during children's primary years in mainstream education, and impact on children with regard to peer interaction. Investigation will include children from a non-clinical population within mainstream primary schools situated in the north east of England. The term 'language and communication difficulties', as opposed to 'speech, language and communication difficulties', will be adopted throughout the study. Rates of SEN among primary-school-aged children have informed the target age range for child inclusion. The greatest increments of SEN rates occur at the foundation stage when children are crossing from the early years of education (aged 3–5) and throughout key stages 1 and 2 (up to age 11). Difficulties have a significant impact on children's educational attainment and long-term achievement, with the most prominent gaps in achievement evident at ages as young as 3–5 years. The present study aims to recruit children between the ages of 4 and 9 years. This will capture behaviour, language and communication associations in children at an appropriate age, when difficulties may begin to impact detrimentally upon educational, social and wellbeing variables, yet it will not include younger children, where development is still occurring, and older children in adolescence.

In order to investigate associations and impacts in a non-clinical sample of primary-school-aged children, it is necessary to identify those children whose difficulties exist on a spectrum with a clinical threshold. This group of children could be considered to be related (in terms of behaviour and/or language severity) to clinical groups, but may differ on some characteristics in terms of frequency, severity or profile of difficulties in behaviour and language/communication. It would be expected that the behaviour and language/communication characteristics of these children would be less severe in terms of degree of difficulty than those presented by 'above-threshold' clinical groups of children with a diagnosis of disorder. Difficulties between children may still represent variability in severity and presentation (from less problematic to more problematic), yet may be considered as existing within a 'sub-clinical' range. Measured against a spectrum of severity, they would lie below the clinical threshold for disorder, yet present as more problematic than the behaviour and language of typically developing children. These children therefore represent an alternative group to the clinical groups that the majority of current research evidence samples and reports on (Chapter 3).

The following chapters will address appropriate conceptual frameworks (Chapter 2), review relevant existing research literature (Chapter 3), and consider suitable measurement techniques for behaviour, language and communication (Chapter 4). This will be followed by a consideration of existing theories of behaviour, language and communication (Chapter 5). The following chapters will therefore aim to inform the current study and provide directions for appropriate methodology.

Chapter 2. Conceptual Frameworks for Behaviour and Language and Communication Difficulties

In Chapter 1, it was highlighted that there are distinctions between clinical and non-clinical difficulties in behaviour and language and communication. As a result, there are variable definitions of behavioural, emotional and social difficulties (BESD) and language and communication difficulties. How each of these is defined, their 'conceptualisation', is influenced by the framework upon which their definition is based, for example an educational or clinical framework. Conceptualisation also influences the measurement of behaviour and language and communication constructs, as it provides guidance as to which characteristics are to be measured. Appropriate conceptualisation is therefore critically important for study design and for evaluating the validity of research findings.

This chapter will address current issues within the conceptualisation of behavioural, emotional and social difficulties and language and communication difficulties in primary-school-aged children. It will consider educational and clinical frameworks for the definition of BESD and language and communication difficulties in order to adopt one framework for the current study.

2.1 Current Conceptual Frameworks for BESD and Language and Communication Difficulties: Definitional Variability

Conceptual frameworks provide definitional guidance, by specifying characteristics that are considered under each type of difficulty, and therefore those which are to be measured in research. However, the existence of several frameworks, variability in definitional criteria, and diagnostic categories across frameworks creates the risk that some important behaviour may be overlooked. A recent report by Bishop (2014) highlights this by addressing current issues concerning diagnostic categories and the terminology around children's developmental difficulties. With a focus on language difficulties, Bishop argues that there is an abundance of different labels for children's difficulties, which results in an 'unconstrained set of descriptive terms'. This, Bishop argues, causes confusion and hinders progression in research as well as access to appropriate services for children. As stated in Chapter 1, there is no agreed label to describe *unexplained* language difficulties, such as those reported to co-occur in children with BESD.

2.1.1 *Behavioural, emotional and social difficulties: educational frameworks*

The label 'BESD' is widely used in conceptualisation within research literature and in educational guidance. Educational frameworks provide guidance as to which behaviours observed in children constitute behavioural, emotional and social difficulties. These frameworks vary, however, with regard to their terminology and descriptive detail. Early educational publications in which such guidance is provided referred to "emotional and behavioural difficulties" (EBD) (DfE, 1994, p.4), and the term 'EBD' is frequently referred to within research literature. The Department for Education Circular 9/94 (DfE, 1994, p.4) describes the extent to which behaviour may be considered to represent 'difficulty' in comparison to the norm and clinical populations. It also identifies that emotional and behavioural problems exist on a continuum, stating that children's problems "are clearer and greater than sporadic naughtiness or moodiness and yet not so great as to be classed as mental illness". Whether a child is considered to have emotional and behavioural difficulties is, according to the circular, dependent upon the persistence, frequency, nature and severity of cumulative behaviours. 'Nature' may be defined as an 'essential quality'; for example, behaviour may be 'externalising in nature', or 'social in nature'. This can be differentiated from behaviour characteristics, which refer to distinct features. Characteristics may, therefore, have shared or similar natures. In description of the characteristics of behaviours that constitute EBD, the Circular 9/94 lists "withdrawn, depressive, aggressive or self-injurious behaviours" (p.4).

A more recent publication, the revision of the Special Educational Needs (SEN) Code of Practice guidelines (DfES, 2001), has extended the original EBD terminology to also include the term 'social' (Visser and Cole, 2005). This discusses 'behaviour, emotional and *social* development" (Section 7:60, p.93) and places behaviour, emotional and social difficulties (BESD) as one of four areas of special educational need. This inclusion also formed the additional term 'social, emotional and behavioural difficulties' (SEBD), which is less used within research literature (Visser and Cole, 2005). Unlike the Department for Education Circular 9/94 (DfE, 1994), the SEN Code of Practice (2001) does not specify the extent to which behaviour may be considered to represent difficulty in comparison to typical and clinical populations. It also does not comment on the persistence, frequency, nature and severity of BESD. However, the SEN Code of Practice (2001) provides an additional description of the *characteristics of children* with BESD. This describes children who are "withdrawn or isolated, disruptive and disturbing, hyperactive and lack concentration; those with immature social skills; and those presenting challenging behaviours arising from other complex special needs" (Section 7:60, p. 93). It then goes on to suggest the help that these children may need in an educational context.

These educational frameworks typically describe a broad range of behaviour characteristics which may be considered as behavioural, emotional and social difficulties. Although the majority of these characteristics are similar across these frameworks, they differ in their included terminology and level of descriptive detail. While one defines the degree of severity of behaviours in BESD, another provides operational guidance on how to help children with such difficulties, the latter perhaps reflecting the recognition of the importance of early intervention and remediation of children's difficulties. Broad definitions, as such, may present problematic application across different educational authorities as standards of practice vary (Visser and Cole, 2005). They also create a lack of clarity about what constitutes BESD, as there is no concise definition. There is also little guidance on how to differentiate between transient and persisting difficulties. Only the Department for Education Circular 9/94 (DfE, 1994) provides guidance as to how the label of 'EBD' might be applied through consideration of the persistence and frequency of cumulative behaviours. However, this circular does not consider 'social' difficulties, and one might anticipate that the persistent and frequent behaviour difficulties that it describes may impact on children's social competency. Yet it remains unclear to what extent characteristics may represent general, sub-clinical problematic or deviant behaviour, or more severe underlying mental health issues. Furthermore, it may be questioned whether behaviours observed in children with BESD have a biological underpinning or are occurring only as a behavioural response to context (Evans, Harden and Thomas, 2004). As regards detecting BESD in children, these difficulties in definition and application are likely to confuse teachers, meaning that they may be more likely to adopt their own BESD interpretations on the basis of individual experience. Whether a child is labelled with BESD may also be dependent upon the variable tolerance rates of individual teachers across different schools (Visser and Cole, 2005).

2.1.2 *Behavioural, emotional and social difficulties: clinical frameworks*

Clinical classifications of behaviours that constitute BESD exist within worldwide classification systems and address behaviour characteristics as well as severity of difficulties. The *Diagnostics and Statistical Manual* (DSM) (American Psychiatric Association, 1994), now in its fifth edition (2013), is used in the diagnosis and classification of mental disorders; it therefore conceptualises BESD from a mental disorder perspective. Under this perspective an individual may be classified as having a mental disorder if they possess at least one of three characteristics: psychological distress, impaired functioning, or risk of harming self or others. Unlike educational definitions, the DSM provides no formal definition of BESD as an individual diagnostic category.

The International Classification of Diseases-10 (ICD-10) (World Health Organisation, 1992) is another manual used in the diagnosis and classification of diseases, mental and behavioural disorders and health problems. The ICD-10 is the official coding system used across many countries, most particularly within the UK and Europe (Kent et al., 2013). Despite this, it has been said that the DSM-IV is more popular among mental health professionals (Andrews, Slade and Peters, 1999), and there is hope that its latest revision, the DSM-V, will "lead to more accurate diagnoses, better access to mental health services, and improved patient outcomes" (Jeste, 2012). In relation to language, the DSM-V includes a new diagnosis of social (pragmatic) communication disorder (SCD). SCD aims to recognise individuals who have significant problems using verbal and nonverbal communication for social purposes, which leads to impairments in their ability to effectively communicate. However it does not make any links between language and behaviour. 'Disruptive behaviour disorders' are categorised independently of language and communication. Overall, the DSM-V has aimed to narrow diagnostic criteria. However, there are concerns that stricter DSM criteria may exclude some individuals who already have a DSM-IV diagnosis, such as those with high-functioning autism and Asperger syndrome, as these are no longer part of the DSM (Kent et al., 2013). A particular advantage of the ICD-10 over the DSM-IV is that it lists a range of childhood disorders under BESD categorisation. These include hyperkinetic disorders such as disturbances in activity and attention, conduct disorders including aggressive and defiant behaviours, emotional disorders such as anxiety, and problems in social functioning such as attachment disorders and tic disorders. Some of these behaviours are also observed in educational definitions, indicating overlap between the two (Visser and Cole, 2005).

Despite such guidance, diagnosis remains a descriptive and subjective element based on the decisions of clinicians. Diagnosis therefore reflects clinicians' beliefs about which conditions underlie an individual's external presentation (Andrew, Slade and Peters, 1999). In addition, it is worth noting that defining atypical behaviour is not solely based upon the criteria provided in such manuals; often, alongside these a variety of other assessments may be carried out to enhance the validity of diagnosis. As stated above, educational and clinical definitions are not entirely distinct from each other. Worldwide clinical classification systems may be considered more specified than educational definitions of BESD; however, they effectively encompass the same types of behaviour. Both incorporate the use of the words ‘problems’ or ‘disorders’, and overlap exists in numerous areas, including externalising behaviours such as disruptive, aggressive and antisocial difficulties, over-activity, and attention and concentration problems, as well as problematic emotional relationships with peers or family.

2.1.3 *Language and communication difficulties: educational frameworks*

Comparably to definitions of BESD, language and communication difficulties may be defined from both educational and clinical perspectives. Current educational guidance reports place ‘speech, language and communication’ at the forefront of the national curriculum, stating that these are to form part of the curriculum for all subjects from September 2014, and not just to be focused upon in English (DfE, 2011a). ‘Communication and interaction’ is one of four primary categories of educational need highlighted by the SEN Code of Practice (2001), which speech and language difficulties fall under. This guidance refers to children with ‘diverse and complex communication needs’ and states the importance of focusing on the development and improvement of these difficulties in order to support children’s thinking as well as communication. Definitional criteria within this educational framework include children with ‘speech and language delay, impairments or disorders, specific learning difficulties such as Dyslexia and Dyspraxia, hearing impairment and those who demonstrate features within the autistic spectrum’. The Code of Practice goes on to state that language and communication difficulties may also be the result of ‘permanent sensory or physical impairment’ (SEN Code of Practice, 2001). Such guidance is less detailed than clinical frameworks and to an extent relies upon readers’ existing knowledge of the broad range of different language problems and an understanding of language terminology. Furthermore, it is subject to individual interpretation of what ‘diverse communication needs’ are.

As ‘communication and interaction’ is a primary category of SEN, this highlights the importance of these skills within child development and educational contexts. Without it explicitly being stated, educational guidance indirectly refers to pragmatic skill; effective communication is inherently pragmatic. As was discussed in Chapter 1, language, alongside pragmatic language, also includes structural and spoken aspects of language; however, without the correct social application of these aspects effective communication may be lost. Therefore, the use of these skills appropriately may also call upon pragmatic ability (Sahin et al., 2009). This also suggests a relationship between the different aspects of language and communication. Educational guidance fails to explicitly outline different aspects of language, yet does address these in guidance as to how children with difficulties may be supported, which clinical frameworks do not. Therefore, in defining language and communication, each may be considered in their own right, as well as being intricately linked together, something which educational frameworks reflect. Furthermore, there is a distinction between problems at the observable surface level, where the child clearly has difficulty with spoken or written language or communication, and underlying difficulties which may or may not be causational factors, such as phonological processing deficits (Frith, 1998; Rice, Warren and Betz, 2005; Rapin, 2011). This leads to the question of whether language and communication difficulties are themselves primary problems, or whether they occur secondarily to other difficulties. Understanding the underlying cause of the problem is vital in attempting to remediate the child's difficulties. Educational guidance considers and outlines the varying causes of language and communication difficulties, which helps those in education to be aware of and consider individual differences and causational factors.

2.1.4 *Language and communication difficulties: clinical frameworks*

The SEN Code of Practice (2001) discussed above is underspecified in comparison with mental classifications. Mental classification systems of language and communication deficits go beyond educational classification and further specify the *nature* of a child's problem. The DSM-IV categorises language deficits under communication disorders. This category includes expressive language disorder, missed expressive/receptive language disorder, phonological disorder, stuttering, and communication disorder not otherwise specified. The greater specificity of mental health classifications is reflected in the DSM-IV guidance of when a diagnosis should be made. Diagnosis is made when there is a substantial difference between the child's language abilities and non-verbal performance, and difficulties do not meet the diagnostic criteria for other disorders. The ICD-10 classification of mental and behavioural disorders classifies speech and language deficits under two separate categories of receptive and expressive difficulties, as well as including a separate category for specific speech articulation disorders. The categorisation of receptive difficulties as a separate deficit differentiates the ICD-10 from the DSM-IV, as the DSM-IV does not categorise receptive language disorder on its own. Furthermore, ICD-10 diagnostic criteria are based more on disparity between language scores than the DSM-IV. Diagnostic criteria include: that children's language skills are two standard deviations below the norm on standardised tests and at least one standard deviation below the norm on tests of non-verbal IQ; and that there are no neurological, sensory or physical impairments that directly affect the use of language.

Unlike the DSM-IV, the ICD-10 does not state that for diagnosis difficulties must interfere with academic, occupational achievement or social communication (Bishop, 1997b). Therefore, the DSM-IV addresses the everyday impact of language deficits for diagnosis, whereas the ICD-10 mainly considers statistical indications of impairment.

Receptive language difficulties include problems with listening and understanding others; expressive language difficulties include problems with speech formation and conveying thoughts and ideas. While the distinction between these in the ICD-10 may be helpful in conceptualising whether a child's problem lies within incoming (receptive) or outgoing (expressive) language and communication ability, this categorisation is still simplistic. It does not reflect the heterogeneous nature of language and communication deficits; it reveals nothing about structural or pragmatic impairment or severity of impairment. It is important to consider that language and communication disorders in children may not be of one specific nature only, and a child may possess difficulty with more than one aspect of language and communication. Clinically, diagnostic 'boxes' have been created to classify developmental disorders including language disorders (Rapin, 2011). In reality, one child may fit into more than one diagnostic category, whether this be different language categories or across different types of disorders. As the ICD-10 states, and in spite of distinction between the two, a child with receptive difficulties will almost always possess expressive difficulties also. This combination of expressive and receptive difficulties is reflected in the DSM-IV categorisation. An alternative way of conceptualising language and communication is to categorise deficits according to several factors: the aspect of language that is impaired (phonology, morphology, semantics, syntax or pragmatics); the severity of impairment; and its effect, whether it impairs expressive or receptive abilities (Bishop, 1997b). Persistence of impairment alongside severity is also important to consider in differentiating between what may be typical delayed language development and what may manifest as atypical disordered language. As Rapin (2011) describes, the observable phenotype may be considered a disorder only to the extent to which it interferes with everyday life. Clinical frameworks of language and communication reflect this; however, Rapin (2011) argues that there is no clear distinction between what constitutes a *disorder* and what represents a *trait*. Differentiation between characteristics of disorder and those of a trait is subjective and ultimately the decision of clinicians.

2.2 Summary

The educational and clinical conceptual framework represents definitional variability in what constitutes BESD and language and communication difficulties. Clinical frameworks provide the most detailed definitions and are most widely used to guide research and for diagnostic purposes. However, their clinical nature makes them less appropriate for the identification of BESD and language and communication difficulties in a non-clinical population where impairment is less severe. Educational frameworks, on the other hand, are less descriptive. Perhaps this is because there is resistance within these frameworks to providing children with a diagnostic label as mental health frameworks do (Bishop, 2014). They do not aim to identify clinically significant deficits, but are tailored towards remediation by educationalists and towards the characteristics observed in children in school contexts.

By definition and diagnostically, and under educational and clinical frameworks, difficulties are considered to be mutually exclusive of each other. Existing frameworks do not account for co-occurring 'comorbid' difficulties across domains, and so do not appropriately represent clinical reality (Bishop, 2010). The adoption of an appropriate conceptual framework when investigating co-occurring problems is further confounded by difficulty in identifying the *type* of impairment in children. Overlapping impairments may make it difficult to determine and separate primary and secondary difficulties. In the case of behaviour and language, one may ask, in mainstream schools, are we frequently seeing children with primary behaviour problems struggling with language, or primary language and communication problems causing them to struggle with behaviour? This question remains unanswered. Neither educational nor mental health definitional criteria identify a 'behaviour/language' difficulties group; they are consistently defined as separate constructs.

As the current project is not targeting clinical samples or exploring diagnosis of disorder, but rather, focuses on the identification of characteristics in a non-clinical population within an educational context, an educational framework is adopted. In line with the target population the term 'difficulties', rather than 'deficits' or 'disorder', will be used to refer to behaviour and language problems. This is important, since there is a distinction between mental health frameworks, which discuss 'deficits' or 'disorder' in clinical populations, and educational frameworks, which discuss 'difficulties' or 'problems' in non-clinical populations. A further advantage of adopting an educational framework is that it addresses the social characteristics of children's behaviour and language, which is important in considering the impacts of characteristics on children's social interactions.

The following chapter will review the existing literature surrounding the association between behaviour, language and communication difficulties. This will help inform the current investigation as to which measurement techniques are frequently employed to measure behaviour, language and communication difficulties, as well as identifying gaps in existing research for the current study to address.

Chapter 3. Literature Review

As was indicated in Chapter 2, educational and clinical conceptual frameworks differ in the way they describe behaviour and language difficulties, and the behaviour/language overlap is rarely considered. The impacts that difficulties have on children's education and social relationships with peers are also considered separately (Chapter 1). In this chapter, current prevalence rates of *co-occurring* behaviour and language difficulties and the reported nature of their association will be explored by reviewing relevant research literature ('literature review 1'). In addition, observational research investigating the peer interaction behaviours of children will be reviewed ('literature review 2'). The chapter will present search outcomes, synthesise evidence, and provide conclusions and directions for the current study.

3.1 Literature Review 1: Exploring the Prevalence and Nature of Behaviour and Language/Communication Difficulties

Literature review 1 was first carried out in October 2010, and its results were used to help inform the initial directions of the study. A more recent search was carried out in February 2014 to update this and provide current data for comparison with the project findings. The following five research databases were searched: Sage journals, ERIC, Taylor & Francis, Informa, and Web of Science (social science domain). Search terms were 'behavioural, emotional and social difficulties', 'emotional and behavioural difficulties', 'externalising behaviour', 'language difficulties', 'language deficits', and 'communication'. Papers were included in the final literature review if they met the following inclusion criteria:

- Children included in the study were of primary school age (4–11 years). Older children were included only if the sample age range spanned the majority of primary years and ran into adolescence.
- Children had clinical behaviour or language deficits, or formed a non-clinical sample with behaviour or language difficulties.
- The authors reported upon both the behaviour and language of their sample.
- The study was not a report on an intervention.
- The paper was written in English.
- The paper was published within the last ten years for the initial search (2000–10), and the previous four years for the updated search (2010–14) (to ensure that the most recent findings were considered).

As was stated in Chapter 1, the current study aims to explore behaviour and language associations in children of primary school age, where difficulties have the greatest impact on children's development. During these years, behaviour- and language-related special educational needs are most prevalent; therefore, it was important to explore research that included primary-school-aged children. The literature search initially found 852 papers using the above criteria. First, three existing literature reviews were selected from search results in order to provide an overview of the current status of the relevant research literature. The remaining 848 papers were then examined for those that included populations of children with behaviour or language deficits or difficulties. This resulted in 72 papers. Six of these studies met the full inclusion criteria. Here, the three existing literature reviews and the six individual research papers that were found in the above literature search are discussed.

3.1.1 *Literature reviews discussing the relationship between behaviour, language and communication difficulties*

Literature reviews support the existence of the co-occurrence of behaviour and language/communication difficulties (Benner, Nelson and Epstein, 2002; Goh, Yew and O'Kearney, 2013; Hollo, Wehby and Oliver, 2014). Table 1 presents the key descriptive elements of each of these three reviews.

Literature Review	*Number of studies (Number of children)*	*Age range of children*	*Population explored (BESD/Language and communication difficulties)*	*Proportion of co-occurrence and key outcomes*
Benner, Nelson and Epstein (2002)	26 (2,358)	4–19 years	Clinical EBD	71% clinically significant difficulties in pragmatic, expressive and receptive language
			Clinical expressive, receptive and/or pragmatic language deficits	57% recognised as having EBD
Goh, Yew and O'Kearney (2013)	8 cohort studies (553)	2–12 years	Clinical language deficits (SLI)	Children twice as likely to show clinically significant disorder levels of EBD in late childhood and adolescence
Hollo, Wehby and Oliver (2014)	22 (1,171)	5–13 years	Clinical EBD	81% unidentified language comprehension difficulty

Table 1: Key descriptive elements of the three literature reviews exploring the relationship between behaviour, language and communication difficulties.

As Table 1 shows, each literature review is similar, in that each includes clinical populations of children with diagnosed behaviour or language and communication deficits. The age ranges of children are also similar across the three reviews, each spanning early childhood through to adolescent years. This may reflect the persistent and problematic nature of comorbid difficulties throughout a child's school years into adolescence, as mentioned in Chapter 1.

Examining these reviews as a whole, we see that they present evidence for both pragmatic and structural difficulties being related to problematic behaviour. With the exception of Goh, Yew and O'Kearney (2013), findings are presented proportionally and report large degrees of overlap between deficits in children. Most strikingly, higher rates of comorbidity of behaviour and language difficulties seem to be reported in children with behaviour difficulties than children with language difficulties; 71% co-occurrence in children with EBD reported in Benner, Nelson and Epstein (2002), and 81% reported in Hollo, Wehby and Oliver (2014). Reported language and communication difficulties include pragmatic, expressive, receptive and comprehension difficulties. The review by Goh, Yew and O'Kearney (2013) is slightly different as its main focus is on children with SLI as opposed to EBD. This review also considers comparisons with control groups of typically developing children, allowing for outcomes to be identified as distinctly different from the 'norm'. Evidence indicates that children with receptive or joint receptive and expressive language difficulties are more likely to experience frequent disorder levels of problem behaviour than those who have expressive difficulties only. Difficulties reported include internalising, externalising, and Attention Deficit Hyperactivity Disorder (ADHD) behaviours. The authors conclude that this finding may suggest that children with SLI have difficulty managing their behaviours and/or emotions, or that external variables such as parenting or environment may mediate the impact of language difficulties.

The focus on clinical populations within these reviews means there is a chance that many children with difficulties that are below the clinical threshold are overlooked. In support of this, research by Ripley and Yuill (2005) found significant rates of expressive and receptive language difficulties among a non-clinical sample of children who had been excluded from school for various behaviour problems (in comparison to children not excluded). There may also be unidentified difficulties within clinical populations, in that many children with a clinical diagnosis of disorder may have co-occurring difficulties which are undetected, as demonstrated in the Benner, Nelson and Epstein (2002) review.

These reviews are further limited, in that outcomes are proportional and shed little light on the specificity of associations, the social impact of comorbidity, or guidance about the effective management and remediation of difficulties. In addition, only one reports on language and communication outcomes *and* behavioural outcomes. There is also a lack of information about possible underlying processes or other factors influencing behaviour and language, such as cognition, personal characteristics, environmental influences or familial background. Variability in ages from childhood into adolescence also provides little information for early intervention; there is a need for younger children to be assessed to determine the onset of related difficulties. There is also some variability in reported proportional association across reviews as well as within reviews. In Benner, Nelson and Epstein (2002), co-occurrence varied to a great degree, from 35% to 97%. It is argued by the authors that this is due to differences in the placements of children, definitions of EBD or criteria for determining difficulty in language. This can be supported by reference to the conceptualisation difficulties discussed in Chapter 2.

3.1.2 *Studies reporting on behaviour and language/communication difficulties*

Six research papers that met the inclusion criteria outlined above were reviewed to clarify the behaviour, language and communication relationship. These six papers may be grouped into those that report on the *language* of children with primary behaviour difficulties or disorders (Gilmour et al., 2004; Nelson, Benner and Cheney, 2005; Mackie and Law, 2010) and those that report on the *behaviour* of children with primary language and communication difficulties or disorders (van Daal, Verhoeven and van Balkom, 2007; Ketelaars et al., 2010; St Clair at al., 2010). The studies are discussed here in line with these two groups.

3.1.3 *Evidence of language and communication difficulties in children with behaviour problems*

Table 2 presents the key descriptive elements of three papers which explore language and communication difficulties in children with behaviour problems.

Study	*Sample*	*(n)**	*Age, gender (M/F)*	*Assessment*	*Key outcomes*
Gilmour et al. (2004)	Non-clinical antisocial difficulties – high risk of school exclusion	54	5–10 years (49M, 6 F)	CCC-2**	69% within clinical range for pragmatic deficits 94% within clinical range for social relation language deficits
	Clinical Conduct Disorder	55	10.2 years (mean) (49 M, 6 F)		69% within clinical range for pragmatic deficits
Nelson, Benner and Cheney (2005)	Clinical Emotional Disturbance	166	7–17 years (136 M, 30 F)	CELF-III**	68% clinically significant difficulties: mainly expressive (89%) and receptive (77%) language
Mackie and Law (2010)	Non-clinical EBD	16	7–11 years (13 M, 3 F)	CCC-2	91% significant difficulties with at least one of the following: pragmatics, word decoding or structural language
				SDQ**	94% high risk of a diagnosis of EBD

Table 2: Key descriptive elements of three studies exploring language/communication difficulties in children with primary behaviour disorders or difficulties.

*(n) = Number of children, **CCC-2: Children's Communication Checklist (Bishop, 2003), CELF-III: Clinical Evaluation of Language Fundamentals (Semel, Wiig and Secord, 1995), SDQ: Strengths and Difficulties Questionnaire (Goodman, 1997).

As Table 2 shows, the studies report on samples of children from clinical and non-clinical populations. All the studies focus on children during primary school years (as specified in inclusion criteria), one including children in adolescence as well. This also supports the suggestion made above that difficulties are persistent across time and ages. Most strikingly, there is a high predominance of boys in these studies, which reflects typical patterns of gender differences in children with behaviour difficulties or disorders, or special educational needs (Chapter 1).

A broad range of language and communication difficulties are reported in these studies, and they include pragmatic, expressive, receptive and structural language difficulties as well as more specified problems in the areas of social relation language and word decoding. Pragmatic difficulties appear to be more frequently reported in this literature than structural difficulties. These studies report that emotional and behavioural difficulties, including persistent behaviour problems such as aggression, delinquency, hyperactivity and attention problems, are significantly related to this broad range of language and communication difficulties. Such difficulties are also reported to reach the clinical range for severity, regardless of whether sampled children are from clinical or non-clinical populations.

Outcomes of two of the studies are enhanced by the inclusion of a typically developing control group for comparison. This allows for the identification of these clinical or non-clinical samples as a distinctly different group of children from those with no behaviour or language difficulties or disorders. The measurement of the social use of language is important in regards to children who present behaviour difficulties that impact on their social environment and interactions. The Children's Communication Checklist-Second Edition (CCC-2) (Bishop, 2003), used in two of the above studies (Gilmour et al., 2004; Mackie and Law, 2010), provides this, as it measures children's structural and pragmatic language ability. In addition, it measures the extent to which these are disproportionate to each other, providing a 'communicative profile' of children. In comparison, the Clinical Evaluation of Language Fundamentals (CELF-III) (Semel, Wiig and Secord, 1995) used in Nelson, Benner and Cheney (2005) provides no distinct measurement of pragmatic ability. This is a limitation as externalising behaviour exhibited by children with ED (and as measured in the study) has a profound impact on the social relations and interactions of these children. Reported outcomes are therefore dependent upon the targeted characteristics of the included measurement techniques. Mackie and Law (2010) included the CCC-2 alongside a behavioural measure, the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997). This study is the only one of the three to measure language *and* behaviour to provide key outcomes. By comparison, other studies have relied on the known behaviour characteristics of the included sample to measure the behaviour and language/communication relationship. Behaviour difficulties may, however, change in severity, persistence and presentation over time, and so it is presumptuous to assume that children's difficulties are the same at the time of the study. The SDQ captures socially-oriented behaviour as well as the common characteristics of BESD. However, no detailed information is provided about which specific types of behaviour the children in Mackie and Law (2010) presented with; their scores on each of the SDQ assessment subscales are not provided, nor is there an indication of the nature of their behaviour within school which is causing concern. A further limitation of this study is that the comparable sample size of 16 children in each group is small. Sample size was reduced again in terms of overall data collection where full scale analysis was only possible for 11 of the children in the EBD sample and 12 in the control group. Reduced sample size impacts on the ability to carry out regression analysis, which may identify the extent to which language factors may be predictor variables in terms of behavioural referral. It also reduces the reliability of findings, and the extent to which outcomes may be considered to be representative of, or be generalised to, reality. The recruited sample is also relatively specified. It was taken from a socially deprived area where a number of key factors contributed to antisocial behaviour and crime, such as low levels of education, family breakdown and unemployment. Therefore, it can be argued that findings in this study may be representative of deprived areas only and cannot be generalised to wider communities or other populations.

A significant measurement limitation of the CELF-III, CCC-2 and SDQ used in these studies is that they can only assess children's *current* language, communication and behaviour. Longitudinal assessment may reveal the dynamics of the behaviour/language association over time, and functional assessments may also be useful in identifying maintaining or exacerbating factors. The CCC-2 and SDQ are also report instruments only, completed by parents or teachers, and so the validity of findings may be compromised by reporter bias or misjudgement. Furthermore, there is a mixture both between and within studies of parent and teacher reports. This is problematic, in that responses may reflect contextual variability in behaviour and language, the teacher considering the characteristics of children in school and parents considering characteristics at home. In Mackie and Law (2010), no information is given about differences between or variability in parent or teacher responses. Gilmour et al. (2004), however, do provide data about the *correlations* between parent and teacher ratings. Overall, no significant correlation was found (therefore there was little agreement) between parents and teachers on the pragmatic language skills of the children as reported using the CCC-2; however, they did agree on subscales of speech, syntax and coherence. Limitations to measurement techniques will be addressed in greater depth in Chapter 4.

The frequent use of report data for the measurement of behaviour and language/communication indicates that there is a gap in research where there is need for *on-line* ‘as it happens’ assessment of live operational behaviours and language/communication in a consistent naturalistic setting. As was also observed in the literature reviews above, individual studies have provided no indication of the nature or impact of the behaviour and language association, and their explorations have focused on proportional data only. However, the research that has been discussed so far does provide evidence for language and communication difficulties in children with behaviour problems or disorders.

3.1.4 *Evidence of behaviour difficulties in children with language problems*

The literature presented above suggests the existence of pragmatic, structural, expressive and receptive language problems as being present in children with behaviour as their primary difficulty. Table 3 displays the key descriptive elements of three studies that address behaviour difficulties in samples of children with primary language and communication difficulties or disorders.

Study	*Sample*	*(n)*	*Age, gender (M/F)*	*Assessment*	*Key outcomes*
van Daal, Verhoeven and van Balkom (2007)	Language Impaired (speech, syntax, semantics and phonology)	71	5 years (51M, 20 F)	CCC-2 CBCL (Dutch version)*	40% scored in the borderline/clinical range for behaviour difficulties. Phonology associated with social behaviour, attention, withdrawal, anxiety, depression, delinquency and aggression
St Clair, Pickles, Durkin and Conti-Ramsden (2010)	SLI	234	7, 8, 11 and 16 years (179 M, 55 F)	CCC-2 SDQ	15-49% scored over the behaviour impairment threshold. Expressive language related to hyperactivity and conduct problems, pragmatic related to emotional and social (peer) difficulties.
Ketelaars, Cuperus, Jansonius and Verhoeven (2010)	Non-clinical pragmatic language difficulties	1364	4 years (678 M, 673 F)	CCC-2 SDQ	56% of boys in the PLI group showed hyperactivity. Pragmatic ability correlated with hyperactivity, peer problems and pro-social behaviour

Table 3: Key descriptive elements of three studies exploring behaviour difficulties in children with primary language/communication disorders or difficulties.

*CBCL: Child Behaviour Checklist (Verhulst et al., 1990).

The studies displayed in Table 3 report upon samples of children from clinical and non-clinical populations. Two of these focus on young children aged 4 and 5 years, while one looks more longitudinally at children over primary school age. Unlike the studies reporting upon children with behaviour difficulties or disorders, none report upon children in adolescence. Perhaps this indicates behaviour difficulties as being more problematic during adolescence or more persistent than language and communication difficulties.

The reported behaviour difficulties in children with language/communication impairments are broad, including social behaviour, thought and attention, withdrawn behaviour, anxiety, depression, delinquency and aggression, hyperactivity, peer problems, pro-social behaviour, and emotional problems. Although some emotional (and therefore internalised) problems were found to be associated with language impairment, these behaviour characteristics are mostly representative of externalising and social behaviour difficulties. An important distinction may be made here between rates of comorbidity in children with language problems, and rates of comorbidity in children with behaviour problems as previously presented in Table 2. As observed in literature reviews of the relationship between behaviour and language, formerly displayed in Table 1, reported degree of association displayed in Table 3 seem to be lower in samples of children with language difficulties.

Two studies report social behaviour problems as related to pragmatic language difficulties, detected by the CCC-2 (Ketelaars et al., 2010; St Clair et al., 2010). This supports evidence of pragmatic language difficulties in children with primary behaviour problems discussed above (Gilmour et al., 2004; Mackie and Law, 2010). St Clair et al. (2010) also report externalising behaviour as related to expressive language difficulties as well as pragmatic language difficulties, which supports evidence reported in Nelson, Benner and Cheney (2005) discussed above. This study further indicates that the relationship between behaviour and language remains consistent over time; it is evident at each of the four time-points measured. St Clair et al. (2010) conclude that children with a history of language impairment are at increased risk of social problems in adolescence. Since pragmatic and expressive impairments showed the most global relationship to problem behaviour in this study, it is likely that social impairments in adolescence may be the result of pragmatic and expressive problems impacting on peer interactions, reducing the frequency and quality of interaction experiences with others. Ketelaars et al. (2010) report association between pragmatic language and hyperactivity and peer behaviour problems. They conclude that pragmatic language difficulties may be considered a good *predictor* of behaviour problems, more so than structural language difficulties. The strong evidence for pragmatic difficulties in the studies reviewed in this chapter would support this. Furthermore, this study reports a direct correlational relationship between certain behaviour and language characteristics. The heterogeneous nature of behaviour and language association means that it may be expected that severity of difficulty would not be correlated; however, if behaviour and language characteristics share similar natures and perhaps reciprocally influence each other, correlations between subscales may be expected. This is also one of a few studies which sample children as young as 4 years. It is therefore significant, in that it provides indication of early developmental association, points to a need for early intervention, and provides support for children aged 4 years to be included in the current study.

One study did not report pragmatic difficulties associated with behaviour, but did report some structural language difficulties associated with behaviour. Van Daal, Verhoeven and van Balkom (2007) found that the sample of children in their study had language impairment in the areas of speech, syntax, semantics and phonology, and each of these apart from speech showed medium to large correlations with problem behaviour. Phonology was found to have the strongest associations with problem behaviour. The authors suggest that these findings are representative of language operating within the context of communication, influenced by cognitive processes such as thought and attention, and also indicative of shared neurological processes. No pragmatic difficulties were reported in this study despite the inclusion of the Children's Communication Checklist-2. This leads to the question, if language is operating within the context of *communication* in a sample of children who are language and cognitively impaired, why is there no reported evidence of pragmatic impairment? A limitation of the van Daal, Verhoeven and van Balkom (2007) study is that phonology was shown to be most broadly associated with behaviour problems, which creates the potential for a misinterpreted association. It is indicated that the majority of the included sample of children probably had phonological impairments; therefore, the chances that phonological impairments were related to behaviour presentations will surely be increased. However, the reverse may also be true: if the whole sample had phonological impairments, variability among the sample will be lower, and so associations between behaviour and language would be more difficult to determine. The addition of a control group for comparison would improve this research, as observed in Ketelaars et al. (2010).

The characteristics of behaviour that are reported in these studies are dependent upon the measurement of behaviour that was used. Mainly, they reflect target characteristics of the

CBCL and SDQ techniques that were employed. Across studies measurement includes the assessment of both language and communication *and* behaviour, which is in comparison and contrast to the above studies sampling children with primary behaviour problems, as only Mackie and Law (2010) measured both of these constructs. Behaviour and language outcomes are, however, based on report data, thus increasing the risk of reported bias and contextual influences, as also discussed above. One study, however, correlates behaviour and language subscales of the CBCL and CCC-2 (van Daal, Verhoeven and van Balkom, 2007). Correlations provide an advantage over proportional statistics as they indicate the nature and extent of the behaviour and language/communication association, that is, which characteristics across these domains may be related to each other. Despite this, it may be questioned whether what is being correlated is merely the opinions of reporters, rather than the actual competencies of the child.

3.1.5 *Summary of literature reviews and individual studies*

The literature reviews discussed above are limited in that they report proportional data only, which sheds no light on the nature and extent of the behaviour and language/communication relationship, or their social impacts. Individual studies are more descriptive, as they specify co-occurrence at the characteristic level; however, evidence is based upon report data only. There is a need for the assessment of behaviour and language/communication during 'live' interactions as they are operationally used by children.

Existing evidence suggests a broad range of behaviour and language and communication problems as being associated with each other. Association in both behaviour difficulty and language difficulty populations are reported to exist, however prevalence of comorbidity is reported as greater in children with behaviour difficulties than children with language difficulties. As such a broad range of problems are suggested as associated, there is a need for further clarity and the disentangling of these associations. Pragmatic language difficulties are frequently reported in the above literature in relation to externalising and social behaviour, yet structural difficulties in language are also reported. It is possible to group individual studies into those which primarily report *pragmatic* language difficulties (Gilmour et al., 2004; Ketelaars et al., 2010; St Clair et al., 2010) and those which report *structural* language difficulties (van Daal, Verhoeven and van Balkom, 2007; Mackie and Law, 2010), regardless of their population sampling. The majority of studies included in this review, however, sample clinical populations of children. Despite this, there is overlap between clinical and non-clinical studies with regard to the types of behaviour and language difficulties that are reported to be related to each other. However, more research is needed investigating non-clinical populations of children.

Evidence indicates that *co-occurring* behaviour and language/communication difficulties are apparent in behaviourally challenged children and children with language difficulties or disorders. It is unclear whether these children with comorbid difficulties represent a distinct group in comparison to typical children, or are instead a subgroup at one end of a spectrum of difficulties. Although the literature indicates a relationship between behaviour and language, there is no indication of the social *implications* of this relationship. We know from existing evidence that language and behaviour difficulties as *separate* constructs each have negative implications for social relationships and peer interactions, but how do these difficulties when they are *co-occurring* impact on children's everyday interactions with their peers? This is especially important when current evidence suggests that, whether a child's primary deficit is language or behaviour, the opposing domain is impacted upon. The assessment of pragmatic language and behaviour is important in considering social implications. Not all existing research includes this.

3.2 Literature Review 2: Exploring Observational Research into Peer Interaction Behaviours

Observational research has the power to enhance data by allowing for the measurement of behaviour and language/communication in a naturalistic setting, behaviour that otherwise would not necessarily be captured by standardised assessment. As discussed above, report data are frequently used in existing research, and this may be considered a limitation owing to the risk of bias, misrepresentation and contextual variability. Observation goes beyond report data and enables researchers to question the effect that the behaviour of one individual may have on another – for example, in child peer pairings. As the current project aims to investigate the communicative interaction of children, as well as the impact behaviour and language difficulties may have on interaction, it is necessary to consider the advantages of including observational techniques in the methodology.

A second literature search for observational research was carried out, which aimed to gather information about the characteristics of children's peer-to-peer interaction behaviour. As being relevant to the current study, the interaction characteristics of children with behaviour and/or social communication or language difficulties were principally important to explore. With caveats, research was also considered if interaction was measured between typically developing children only. Studies were included in the final review if findings were judged to be relevant to the current study, investigating social communication/interaction behaviours between children.

As with literature review 1, an initial search was carried out in October 2010, the results of which were used to help inform early directions for the current study. A more recent search was carried out in February 2014 to update this and provide current data for comparison with the project findings. The search used the five databases outlined at the beginning of this chapter, and included the search terms 'social interaction(s)', 'peer(s)', 'behaviour difficulties' and 'dyadic interaction'. Papers were primarily considered for inclusion in the current review if they met the following criteria:

- Reciprocal interaction behaviours between two children were measured.
- Children were of primary school age (4–11 years).
  Older children were included only if the sample age range spanned the majority of primary years and ran into adolescence.
- Measurement of interaction included the assessment of non-verbal behaviour and/or verbal language and communication.
- The study was written in English and published in the previous ten years for the initial search, 2000–10, and the previous four years for an updated search, 2010–14 (to ensure the most recent findings were considered).

Papers that included children with Autism Spectrum Disorder (ASD) were excluded from the final selection, as ASD symptoms represent impairment in social skills and interactions. Therefore, using these children for comparison with, or to provide theoretical direction for, the sample of children with BESD recruited for the current study may be unreliable. In total, 173 papers were found, five of which were selected as relevant to the current investigation. One of these papers was a descriptive review of research studies and four were recent individual studies.

A descriptive review of research studies was conducted by Farmer and Cadwallader (2000). This described the outcomes of research that has explored social interactions and peer support for problem behaviour. The report provides useful suggestions which may be borne in mind when considering the interactions of children. Farmer and Cadwallader (2000) suggest that in social interaction, children *synchronise* their behaviour with others through imitation, reciprocity and complementarity, 'imitation' referring to the copying of others' behaviour, ‘reciprocity’ referring to an interchange of behaviour between individuals that is of a similar nature, and ‘complementarity’ referring to behaviours between individuals that complement each other even though they may be dissimilar, as in the cases of teachers and students. They further suggest that social variables such as peer associations, social hierarchy and social roles directly influence how children respond to and synchronise with each other. For children with problem behaviours, interaction with others creates a social context that maintains continuity in their problematic behaviour patterns. Therefore, it is proposed that antisocial children develop peer associations that reinforce their problem behaviour as a result of this social synchronisation.

These attributes are associated not only with children with BESD, but with typically developing peers also. Therefore, it can be expected that the nature of interaction between children with BESD and their peers may be greatly dynamic and variable across different children. Furthermore, dominance in dyadic interaction may be influenced by social roles and hierarchical structures. For example, should a child with aggressive behaviour be regarded as a leader, he or she may be seen to dominate in their interactions with others.

Table 4 displays the key descriptive elements of the four individual studies that report upon observations of peer interaction.

Study	*Sample*	*(n)*	*Age, gender (M/F)*	*Assessment*	*Key Outcomes*
Xu et al. (2008)	English Language Learners	7	6–8 years (gender unknown)	SIOS * 15 social behaviours coded during class-wide peer tutoring	Positive interaction increased as a result of peer tutoring
	English Speakers	7			
Bruce, Hansson and Nettelbladt (2010)	Clinical SLI group	10	3.9–5 years (5 M, 5 F)	10 dialogues coded using audio and video with respect to 'response properties' and 'initiation properties'	Conversation responsiveness higher between SLI and age matched peers. SLI group vocally dominated by an age matched peer
	TD peers age matched with SLI group	10	3.8–5.1 years (7 M, 3 F)		
	TD peers ability matched with SLI group	10	2.11–3.10 years (5 M, 5 F)		
Wu et al. (2013)	Triads of 2 TD girls with one adult	66	1 and 2 years (all female)	ESCS * measures joint attention responses (JAR) and initiation (JAI) in co-operative task	JAR important for interaction involving alike roles, JAI for complementary roles
Murphy, Faulkner and Farley (2014)	Pragmatically high-skilled	48	5–6 years (16 male dyads, 8 female)	Coding of audio taped interaction. Talk segmented into utterances defined as speech, further segmented into expressed ideas	High-skilled peers showed sensitivity to low-skilled peers'. Low-skilled more likely to ignore requests from a high-skilled peer
	Pragmatically low-skilled + high-skilled	64	5-6 years (13 male dyads, 19 female)		

Table 4: Key descriptive elements of four observational studies of peer interaction.

*SIOS: Social Interaction Observation Scale (Kreimeyer et al., 1991), ESCS: Early Social Communication Scales (Mundy et al., 2003).

The studies displayed in Table 4 mainly report upon samples of children from non-clinical populations, with the exception of Bruce, Hansson and Nettelbladt (2010), who include children with diagnosed SLI. Children included in these studies vary in age from early and middle to late childhood, but are all within primary school age range, as specified in inclusion criteria. While the proportion of males and females included in these studies appears to be relatively even, only one study reports upon mixed-gender dyads (Bruce, Hansson and Nettelbladt, 2010). Therefore, it is difficult to determine from this literature differential gender-pairing effects on peer interaction.

Notably, each of the studies above focuses on either verbal language and communication, or non-verbal behaviour, as independent from the other, rather than exploring both of these aspects together. In relation to language and communication the outcomes of two of these studies indicate that peer interaction may be influenced by pairing children with better pragmatic language and social skills with less competent peers. In Murphy, Faulkner and Farley (2014), greater sensitivity to peer difficulties and adaptive behaviour occurred when a pragmatically high-skilled child was paired with a pragmatically low-skilled child. These high-skilled peers were able to adapt their language to suit their interaction, using more clarification, information giving, questions and directives to their peer. Low-skilled peers, however, were found to be more likely to ignore the questions and requests from the average-high-skilled peer. Therefore, despite highly skilled peers using adaptive techniques to interact, it may be questioned whether these techniques enhanced the overall quality and coherence of interaction. Furthermore, what contribution to overall interaction does the less competent peer provide? We could presume that the observed greater sensitivity and adaptive behaviour enhanced the overall interaction between children, including their greater quality and coherence of interaction. However, low-skilled peers ignoring high-skilled peers would question this. Focusing on differential dynamics of interaction within individual peer dyads, such as equality/inequality in behavioural contribution, would begin to indicate overall interaction quality and coherence. Better coherence and quality of interaction between children has potential implications for classroom management and co-operative learning between children.

Bruce, Hansson and Nettelbladt (2010) also indicate that interaction may be influenced by peer competency, suggesting a differential effect of age and ability on responsiveness in conversation with children with SLI. As children the same age of the sampled children with SLI had better language and communication ability, responsiveness was higher. Interaction was reported as less challenging for the child with SLI when they were paired with a language-ability-matched peer. However, it was also found that age-matched children vocally dominated children with SLI. Perhaps the more competent children used increased vocalisations to demonstrate and initiate vocal exchanges in conversation. As this study and Murphy, Faulkner and Farley (2014) both include pairs of children where there is discrepancy in competency between them; they perhaps provide evidence of children with better language and communication *scaffolding* the interaction. As Farmer and Cadwallader (2000) report, children may be able to synchronise behaviour in interaction, and so they can perhaps also structure and instigate interaction through similar adaptive skills, as observed in Murphy, Falkner and Farley (2014). In support of this, significant correlations were found in Bruce, Hansson and Nettelbladt (2010) between the conversational partner and the child with SLI on several aspects of dialogue, including responsiveness (r = .47), topic shifts (r = .57), and non-contributing turns (r = .62). Therefore, in pairs of children, these characteristics of dialogue were mimicked by each child; as one child was more responsive, engaged in more topic shifts or created non-contributing turns, so too did their partner. This could be evidence of children mutually influencing each other's interaction. Bruce, Hansson and Nettleblaldt (2010) however, suggest that without a scaffold, there are more opportunities for children to learn and develop as interactions are more fragmented, offering a challenge for the child. Children in this role adopt a more assertive role. When a scaffold is present, there is less need for these children to use and develop their abilities, and a greater risk that these children will be dominated by their more competent peers.

While studies discussed so far focus on language and communication in peer interaction, Xu et al. (2008) focus on non-verbal behaviour. Discrepancy in ability is also reported in this study; where children who were English language learners (with less competent English language/communication) were found to improve their positive social interaction behaviours as a result of class-wide peer tutoring more so than competent primary English speakers. These behaviours included positive peer interactions, co-operative play, positive linguistic interaction, positive initiations of interaction, and responding to interaction. However, what this study does not provide is the language or behaviour characteristics of the class-wide peers who tutored the target children. Although we know the greatest impact occurred for less competent peers, we do not know the degree to which the tutoring peers were more skilled in social communication.

These observational studies do not only suggest that difference in ability may influence interaction, but also that differences in types of behaviour may impact on interaction. In Wu et al. (2013), joint attention initiations had a more differential effect on co-operative tasks than joint attention responses. While joint attention responses contributed to successful co-operative interaction in activity that required children to complete the *same* roles, joint attention initiations contributed to successful co-operative interaction in activity that required children to form *complementary* roles. These outcomes are supported by other research that suggests joint attention is important for co-operative and collaborative interaction (Brinck and Gardenfors, 2003; Tomasello and Carpenter, 2007). However, the Wu et al. (2013) study examines joint attention behaviour in very young typically developing children, and therefore it may be questioned whether the same outcomes would be observed in older children and those with behavioural, emotional and social difficulties and/or language and communication difficulties.

The observational measurement in these studies influences the types of behaviour and language/communication that can be captured. Two of the studies included standardised observational coding schemes and two used novel coding systems which were created using existing literature (coding schemes will be addressed in greater depth in Chapter 4). Interestingly, only one of the coding schemes coded behaviour *and* language and communication, the SIOS used in Xu et al. (2008), listing various social behaviours alongside 'positive linguistic interaction'. However, it is unclear how this is defined or what it refers to. Other coding schemes focused on behaviour *or* language and communication. Of those that focused on language and communication only, one included audio and video data (Bruce, Hansson and Nettelbladt, 2010), while another used audio data only (Murphy, Faulkner and Farley, 2014). Therefore, behaviours and non-verbal communications cannot be observed in this latter study and they were not addressed in Bruce, Hansson and Nettelbladt (2010) despite the inclusion of video data. This is a limitation to the designs of these studies, particularly in light of the large sample size in Murphy, Faulkner and Farley (2014), which is likely to improve the study power and effect of outcomes.

3.2.1 *Summary of observational research into peer interaction behaviours of children*

Research discussed above suggests that children with better behaviour or language/communication competency may influence interaction by improving responsiveness in conversation or showing sensitivity to less able peers. It is suggested that more skilled peers may be able to scaffold interaction, demonstrating and instigating interaction behaviours. Furthermore, joint attention behaviours may be useful in co-operative tasks, with initiations suggested to be important in co-operation with others.

There remain gaps in peer interaction research where the focus appears to be mainly on the influence of the typically developing, more competent peer during interaction, and less so on children with difficulties. The research described above does not focus enough upon how behaviour and/or language difficulties impact on children's peer interaction. Equality and inequality of peer behaviours between children during interaction is also unexplored: do children make equal contributions to peer social interactions? In addition, although interaction techniques of typically developing children are reported, it is unclear whether these techniques improve the overall coherence of interaction through scaffolding effects. There also remains a need for detailed observation of co-occurring verbal *and* non-verbal characteristics of interaction between peers. The studies described above focus on verbal *or* non-verbal behaviour. It is unknown what type of verbal and non-verbal behaviours children with BESD and/or language difficulties use in peer interaction; the evidence discussed above is limited as it primarily focuses on typically developing children or children with SLI, as opposed to children whose difficulties may lie within a sub-clinical range.

The current study will address gaps in existing research by measuring behaviour, language and communication difficulties in a 'live' naturalistic setting alongside reported behaviour and language/communication difficulties. This will profile difficulties from an operational and characteristic perspective. A non-clinical sample of children with BESD whose difficulties lie within a sub-clinical range will be included alongside a typically developing control group for comparison. Observation will allow for characteristics of social interaction in children with BESD and typically developing peers to be explored and compared. This will include the investigation of whether scaffolding, synchronising and supportive behaviours occur in BESD/TD peer interaction dyads. The following chapter will address measurement techniques appropriate to these project aims.

Chapter 4. Measurement of Behaviour, Language and Communication Difficulties

Employing the appropriate measurement techniques in research is important in capturing reliable and valid reflections of the target variables and to maintain data collection integrity. Measurement not only includes the consideration of assessments, but also the key concepts or frameworks upon which these assessments are based. Assessment measures must provide for the best evidence of the target outcome variables, while also being appropriate to the sample population. Here, frequently used measurement techniques employed in behaviour, language and communication difficulties research will be discussed and considered for inclusion in the current project. These frequent measurement techniques were identified through the explorations of research literature in Chapter 3. In addition, two further literature reviews will be presented, one reviewing coding schemes for behaviour difficulties during social interaction, and one reviewing coding schemes for language and communication difficulties. The chapter will conclude by outlining the measurement techniques that will be adopted in the current project.

4.1 Commonly Used Measurement Techniques

Commonly used measurement techniques include direct elicitation, report measures and observation. As was highlighted in Chapter 3, reports and observations are most frequently used within research contexts; therefore most attention will be paid to the advantages and disadvantages of these.

4.1.1 *Direct elicitation*

Direct elicitation applies to the measurement of language and less so to behaviour as behaviour is primarily reported or observed. Elicitation of language enables comprehensive examination of language that is not left to chance or influenced by contextual variables. Therefore, there is a much greater degree of control and standardisation in direct elicitation than in naturalistic assessments. The New Reynell Developmental Language Scales (NRDLS) (Edwards, Letts and Sinka, 2011) represents one example of language assessment via direct elicitation. The scales are widely used by clinicians, educationalists and researchers as a means of gaining an overview of language ability, as well as for guiding intervention and evaluating the effectiveness of intervention. The assessment uses a variety of test procedures and stimulus materials to maintain children's attention and elicit language production while also testing comprehension. It can be used with children aged between 3 years and 7 years and 6 months. The NRDLS has been standardised on 1,200 children in the UK. Internal reliability coefficients are high; 0.95 for Comprehension scales and 0.96 for Production scales.

However, the advantages of direct elicitation, such as control over measurement and standardisation across children also present limitations to this type of measurement. It does not measure language that occurs in a naturalistic setting, without the elicitation from stimulus materials, or language that occurs during children's social engagements with peers. It could, therefore, be argued that this method exhibits a degree of bias and is less representative of the child's actual language ability in the real world. In relation to the current project, it is less relative to the exploration of language in a non-clinical, naturalistic setting and the measurement of language during peer interaction. Furthermore, eliciting targeted language from very young children may be challenging, and the assessment may be time intensive for children. In addition, while the NRDLS may be used with children during primary school years, it does not cover all primary ages as it is only applicable to 7 years and 6 months rather than up to age 11.

4.1.2 *Parent and teacher report measures*

As was indicated in the literature discussed in Chapter 3, parent or teacher reports of behavioural, emotional and emotional difficulties and language and communication difficulties in children are frequently-used measurement techniques in research. Reports possess many advantages. They are quick and easy to complete and cost-effective, and parents and teachers as informants are accessible and spend significant amounts of time with children; therefore, it is presumed they have a good knowledge of the child's behaviour. Reports also require little to no training to administer or complete. They are typically tested for reliability and validity by the developers, and the majority should carry good statistical levels of each of these. Therefore, researchers or clinicians can be confident that they are accurately measuring their targeted constructs.

4.1.3 *Measuring behaviour using reports*

Reports of behaviour commonly used in research include the Child Behaviour Checklist (Achenbach and Rescorla, 2001) and the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997). The CBCL is a parent report checklist which aims to detect behavioural, emotional and social difficulties in children aged 6 to 18 years. Advantages of the CBCL include that, in its revised version (2001), it includes subscales of behaviours that are recognised as clinical DSM diagnostic categories, and it has scope for adjustment to cultural norms. Therefore, the CBCL is in line with, and sensitive to, current mental health definitions of behaviour disorders, as well as recognising the influence of cultural and societal variance.

The CBCL has high rates of reliability; internal consistency coefficients based on Chronbach's alpha range from .75 to .84 and test–retest reliability ranges from .78 to .88 (Pearson correlation). The authors also report strong content validity of the CBCL. All items discriminate between behaviours of clinical and typical samples of children significantly at the .01 level, and show significant construct associations with other instruments and DSM criteria (Achenbach and Rescorla, 2001). A further advantage of the CBCL is that it has parent report and teacher report versions. However, its strong associations with DSM criteria contribute to the CBCL's clinical nature, and the form has been recognised and validated as being supportive in providing clinical diagnoses. Therefore, it may be questioned how appropriate the CBCL is to the recognition of behaviours within non-clinical populations and within an educational context. Furthermore, its use with children from age 6 years means it is inappropriate for younger children. As was indicated in the Chapter 3 literature, problematic behaviours may be evident from school entry age at 4 years old.

Alternatively, the Strengths and Difficulties Questionnaire expands upon this age limitation of the CBCL by measuring the behaviour of children aged 4–16 years. Like the CBCL it is completed by either parents or teachers (with different versions tailored towards each). The SDQ measures behaviour within the domains of emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and pro-social behaviours. It has an additional advantage in that it includes an 'impact supplement' which asks informants for their opinion about the child's difficulties and the impact these difficulties have at an individual and social level. Furthermore, it is a smaller report than the CBCL (2 pp. including the impact supplement) and so is quicker to complete. In a comparative study, the SDQ has been reported to be significantly better at detecting hyperactivity and inattention than the CBCL, and is preferred by mothers of low-risk children (Goodman and Scott, 1999). The SDQ also has good reliability and validity. Its reliability has shown internal consistency based on Chronbach's alpha of .73, an inter-rater correlation mean of 0.34, and test–retest stability mean score of 0.62 (Pearson correlation). Its validity has been judged on the extent to which its subscales are associated with the presence or absence of psychiatric disorders, with high SDQ scores (above the 90th percentile) being strong predictors of receiving an independent clinical diagnosis (Goodman, 2001). A further advantage of the SDQ is its greater focus on peer relationships and pro-social behaviour. These scales are useful in measuring the behaviour of children within school settings where their behaviour may enhance or exacerbate interaction with peers and therefore impact on their social development. It could, therefore, be considered to be more tailored towards (and more appropriate for) educational settings than the CBCL.

4.1.4 *Measuring language and communication using reports*

As reports of children's behaviour are frequently used, language and communication reports are also commonly employed to measure the language and communication skills of children. As previously stated, much research uses clinical population sampling. Likewise, many reports were initially developed for use with clinical populations. Some existing reports on child language and communication include the MacArthur-Bates Communicative Development Inventories (CDI) (Fenson et al., 1993) and the Children's Communication Checklist-2 (CCC-2) (Bishop, 2003). The MacArthur-Bates CDI assesses a range of language and communication skills in infants and toddlers and may be used with older children who are developmentally delayed. Its original full-length form is time-consuming, and so short versions were subsequently developed for rapid assessment (Fenson et al., 2000). Considering this more recent version, reliability based on Chronbach's alpha is reported at .97 for the infant assessment form, .99 for toddler form A, and .99 for toddler form B. Although the MacArthur CDIs hold strong reliability, its original normative study is skewed in its socioeconomic distribution (towards a higher socioeconomic status). It is therefore limited in its applicability to children from low income and low education families and administration to this population must be done with caution (Fenson et al., 1993). Furthermore, the assessment is designed for children aged 8–30 months. Trajectories of language development at this young age are variable; therefore, making predictions about language outcomes and children who are late-talkers is problematic (Law and Roy, 2008). This age range also makes the CDIs inappropriate for the measurement of the language and communication ability of older children (unless, as stated, they are developmentally delayed, which must be treated with caution, as Law and Roy (2008) suggest). Socioeconomic and age limitations make such an assessment inappropriate for the measurement of language and communication in children with behavioural, emotional and social difficulties, where the language and behaviour association becomes more prevalent with age and behaviour difficulties are seen more frequently in children from lower socioeconomic backgrounds and disadvantaged areas (Campbell, Shaw and Gilliom, 2000; Kalff et al., 2001; Huaqing Qi and Kaiser, 2003).

The Children's Communication Checklist-2 is a commonly used assessment of communicative and pragmatic language impairment in children in both clinical and research contexts. It was primarily developed to assess areas of communicative impairment that were not efficiently evaluated by existing language measures including pragmatic abnormalities in communication. The original form of the checklist was shown to be able to guide differential diagnosis, discriminating between children with pragmatic impairments and those with Specific Language Impairment (SLI), as well as highlighting children with pragmatic impairment who did not display traits common in ASD such as restricted interests and poor quality of social relationships. Developed on the basis of 7- to 9-year-old children receiving educational support for SLI, it has now been modified and revised to become the current version (CCC-2), which does not include differential diagnosis but rather exists as a more general screening tool for children 4 to 16 years who may have difficulty with communication. The assessment provides an overall score of communicative competence (General Communication Composite – GCC) and a score of social interaction deviance (Social Interaction Deviance Composite – SIDC). The SIDC provides a measure of pragmatic language ability in comparison to structural language ability. The CCC-2 reports internal consistency reliability ratings based on Chronbach's alpha ranging from .65 to .80, therefore indicating variable reliability from poor to good. It reports inter-rater reliability (between parents and teachers), measured in terms of Pearson's intra-class correlation coefficient, ranging from .16 to .52, again indicating variability in agreement between raters (Bishop, 2003). The checklist was further validated as a screening measure for communication impairment by Norbury et al. (2004), and found useful to identify children who have language impairment and pragmatic impairment and those who may warrant assessment for ASD.

The CCC-2 may be considered more appropriate for the assessment of language and communication in children than the CDI as it may be applied to a wider age range of children. Therefore, it is able to measure language development beyond word and sentence acquisition at age 30 months (as the CDI measures). This also means it can capture (and has been designed to capture) pragmatic language ability in children and overall communicative competence, which is important in assessing the everyday characteristics of children's language and how these skills might affect interaction and social functioning. Although developed with clinical samples, the CCC-2 can also be used in research settings. There is a wealth of research that has employed the CCC-2 as an objective measure of pragmatic ability in children with behavioural, developmental and language disorders (Botting and Conti-Ramsden, 2000; Bishop and Norbury 2002; Gilmour et al., 2004; Laws and Bishop, 2004; Geurts and Embrechts, 2008; Ketelaars et al., 2009).

4.2 Limitations to Using Report Measures

Despite their practical advantages, report measures have limitations in the current climate of research. These include the risk of informant bias, their clinical nature and that they primarily offer a snapshot of the child's development at a specific time-point, rather than informing researchers about the child's developmental status over time.

4.2.1 *Informant bias*

Many report assessments of behaviour and language are completed by parents or caregivers of children, or their teachers. Therefore, they are at risk of reflecting a substantial degree of bias towards the parent's or teacher's opinion of the child in question (Youngstrom, Loeber and Stouthamer-Loeber, 2000). There is also a risk of bias towards the interpretation or presumptions of these individuals in terms of what the researcher is looking for, creating results that may lack ecological validity. There are often discrepancies between informants with regard to ratings of child characteristics (De Los Reyes and Kazdin, 2005). Redmond and Rice (1998) found discrepancies between parent and teacher ratings of children's emotional and behavioural difficulties. Similarly, Lundervold, Heimann and Manger (2008) report moderate to low agreement between parents and teachers on behaviour; however, they found that agreement increased in ratings of behaviour-emotional problems in children with language impairment. Parents may be more reluctant than teachers to report negative aspects of their children's ability while teachers may be more sensitive to disruptive behaviour (therefore less sensitive to other behaviours), and in addition their reports may be influenced by the quality of teacher–child relationships (Youngstrom, Loeber and Stouthamer-Loeber, 2000). Prevalence of a disorder may be under- or over-represented depending upon whether a teacher or parent is the informer (De Los Reyes and Kazdin, 2005); for example, ratings of comorbid internalising and externalising behaviours in children have been found to be greater in parent reports and lower in teacher reports (Youngstrom, Findling and Calabrese, 2003). Furthermore, there is evidence that parental mental health status such as levels of depression and anxiety, or psychological functioning such as stress, may influence reporting, with evidence suggesting mothers with more mental health difficulties report more behaviour problems in their children (Najman et al., 2000, 2001) and levels of depression and stress being related to higher disagreement with other informants (Youngstrom, Loeber and Stouthamer-Loeber, 2000). With regard to language assessment, there is less research indicating discrepancies between informants. Moderate levels of agreement on reports have been found between parents and teachers, with parent ratings being more closely related to clinical reports (Bishop and Baird, 2001). There is an issue here that perhaps behaviour is more context-dependent than language, if more informant discrepancies are found for ratings of children's behaviour.

4.2.2 *Clinical limitations*

As mentioned above, a further limitation of using reports for measurement is their underlying clinical nature. Most existing research into behaviour and language which employs reports investigates their relationship in clinical populations, where it is clear to see overlap between disorders (such as language deficits in Autism Spectrum Disorders), as opposed to non-clinical populations in mainstream education.

Some reports have normative data which may be used to reference the child's ability to that of the typical population. Therefore, a child may be considered to possess a deficit if he or she scores significantly below typical expectation (Paul, 1997). In the case of language, a child's language problem must have adaptive consequences to be significant enough to be labelled atypical and therefore a 'deficit' (Paul, 1997). However, when exploring atypical development, the extent to which a problem is representative of a delay in development, or represents a deviance from normality, must be taken into account (Karmiloff-Smith and Ansari, 2003). There must be a clear distinction between difficulties that indicate a *disorder* and difficulties that represent a *characteristic* (Rapin, 2011). Report assessments must be sensitive to this. This is especially true in relation to children who are less severely impaired. As previously stated, report assessments often provide categorical cut-off points for identifying the child's degree of difficulty in terms of severity, and normative data provides comparison of scores with the 'normal' population. Such considerations are important. Dismissing a delay in development as insignificant may be negligent as it presumes that the ability delayed is operating independently of other developmental trajectories, that interaction with other developmental systems will not occur (Karmiloff-Smith and Ansari, 2003), which of course, due the interactive nature of development, may not be the case. This is where standardised assessments may falter. They may capture the child's ability at a specific time-point. However, we may question how accurate these assessments are and the degree to which they can inform us about a child's developmental status; a delayed ability may still develop into deviance from the norm.

4.2.3 *Additional limitations*

Other significant limitations common to the measurement of behaviour and language using reports include that they are unable to provide information as to *why* a behaviour or language difficulty has occurred, the *context* in which they occur, and also what variables are *maintaining* those difficulties. They also provide a picture of a child's ability in one domain yet are unable to provide any insight into overlapping difficulties, the extent of their overlap, or the dynamics between them. Furthermore, they are unable to inform how reported characteristics impact on children's interactions. In attempting to examine the wider picture of children's abilities, many researchers employ multiple assessment reports. In cases where overlapping difficulties are investigated, correlational analysis techniques of each report data may be used. However, this method still lacks ecological validity. The complex nature of comorbid difficulties, including individual variance in comorbid extremities, makes it difficult to rely solely on these correlations as evidence of overlap. As mentioned in Chapter 3, it may be argued that perhaps what is correlated are, at their most basic, the opinions of the informants, rather than the actual behaviours themselves. Such techniques may provide for interesting insights; however, they should be met with caution as regards what they imply, and in terms of generalisation to the wider population.

The investigation of the nature and extent of children's abilities is more suitably addressed by using *naturalistic* methods of measurement. Furthermore, the investigation of comorbidity may be improved upon by taking a closer look at the relationship between difficulties, by *observing* behaviour and language as they occur together in the real world.

4.3 Observation and Coding Schemes

Initially introduced in Chapter 3 (literature search 2), observational techniques offer an alternative way of measuring the behaviour, language and communication of children. They are commonly used as they allow for the measurement of several behaviours (non-verbal and verbal) within a naturalistic setting and across variable lengths of time. Observation is able to capture data that is otherwise not picked up by technology or report assessments. Observers can select out and code particular behaviours of interest, while also taking into consideration surrounding contextual, physical and interactional influences. It also allows for the measurement of the social dynamics such as inter-personal interactions between several children alongside the measurement of targeted behaviour and language.

Coding schemes designed to select out specific characteristics are typically used in observation, applied to video-recorded or audio-recorded data. Advances in computerised technology have allowed for improved observation and more complex analysis of behaviour. Laptops are now more portable, meaning that observations and coding schemes can be automatically processed on computer software instead of manual paper observations having to be transferred onto a computer. The development of new observation programmes has also allowed for more sophisticated and accurate data capture. Not only can the nature of behaviour or environment be observed, but reciprocal interactions between several subjects can be analysed. Furthermore, the time in which they occur can be pinpointed to a specific millisecond if necessary. One such programme commonly used in observational research with children is Noldus Observer (Noldus, 1991). However, despite computer programmes allowing for more sophisticated and accurate observations, the observational method and the coding schemes they employ still typically rely on manual, human application within the observational software. Therefore, they are liable to observer bias, which must be addressed to improve validity and reliability of observations. Importantly, observation studies must report upon rates of inter-rater (between observers) or intra-rater (within observer) reliability statistics, the degree to which codes applied to target behaviours are reliable and valid. Nevertheless, researcher/observer perspectives may be deemed more pure than parent or teacher reports as they are not contaminated by any prior knowledge or perceptions of the child being assessed. However, this seemingly advantageous aspect is compromised by the advantages of parent and teacher perspectives; it may be argued that these are more useful because parents and teachers are more familiar with the child.

A main advantage of observational techniques is that they have the power to address not only dyadic interaction between several subjects as mentioned above, but interaction between behaviour and language constructs also. In light of these potential benefits of observation and combining measurement techniques, it is necessary to review existing coding schemes for behaviour and language, to not only explore the characteristics of behaviour and language that may be observed in children with BESD but also to establish whether any existing schemes would be suitable to be used in observations of children with BESD.

4.4 Literature Review 3: Reviewing Coding Schemes for Behaviour Difficulties during Social Interaction

In order to inform the current project as to the types of behaviours that may be observed in children with behaviour difficulties during social interaction (i.e. those coded in existing research), a relevant literature review was carried out. Exploring existing coding schemes may inform the types of social behaviour characteristics frequently observed in children with behaviour difficulties. Two existing coding schemes of peer interaction behaviour were highlighted in Chapter 3 within literature review 2, the Social Interaction Observation Scale (SIOS) (Kreimeyer et al., 1991), and Early Social Communication Scales (ESCS) (Mundy et al., 2003). However, the SIOS is relatively dated and the ESCS focuses on the behaviour of infants.

Literature review 3 was first carried out in 2010 at the start of the project. Initially, the same five databases presented in Chapter 3 were used in this literature search. Databases were searched for papers published between 2000 and 2010. Search terms included 'observational coding', 'social interaction', 'behavioural difficulties', 'behaviour, emotional and social difficulties', 'peer interaction' and 'children'. Papers were to be included in the final review if the met the following inclusion criteria:

- The paper reported on coding social interaction behaviours of children.
- Children were of primary school age and had clinical or non-clinical behaviour difficulties.
- The coding scheme was clearly outlined and replicable.

Despite 167 papers being retrieved in the search, none was found to match inclusion criteria. An alternative search strategy was adopted in the form of a scoping review of behaviour coding schemes. This scoping review was informed by research cited on the Noldus Observer website that was published between 2000 and 2010 (www.noldus.com) and by existing knowledge of behaviour coding of children with social communication and/or behaviour difficulties (therefore including literature published outside of 2000–2010). A total of three papers were considered to be appropriate for final review. These reported on coding social interaction behaviour of children with behaviour difficulties. The key elements of these 3 papers are displayed in Table 5.

Study	*Sample*	*(n)*	*Age, gender (M/F)*	*Coding scheme*	*Key outcomes*
Erickson, Stage and Nelson (2006)	EBD	22	5–16 years (20 M, 2 F)	Coded 'off-task' 'out-of-seat' and 'refusal' behaviours, talking, provoking, tantrum, noise, aggression, peer talking, peer provocation during interaction with peers and teachers	The EBD group showed lower rates of on-task behaviour, higher rates of avoidance and inappropriate behaviours
	TD	Unknown	5–16 years		
Leekam and Ramsden (2006)	ASD	19	4.3 years (mean)	Verbal and non-verbal dyadic orienting: Joint attention (initiation and response) and Requesting coded during interaction with an adult	ASD group poorer at responding to adult bids for attention, initiated and responded to joint attention less than DD children
	DD*	20	4.5 years (mean)		
Mosconi et al. (2009)	ASD	53 27	2 years (49 M, 4F) and 4 years (26M, 1 F)	SOC-RS** Social Referencing, Joint Attention, Orienting to name Social Smiling, coded during interaction with an adult	Children with ASD scored lower on social referencing, joint attention, orienting to name and social smiling
	TD	15 20	2 years (49M, 4 F) and 4 (19M, 1F)		

Table 5: Key descriptive elements of three papers coding social interaction behaviour of children with behaviour difficulties.

*DD: Developmental Delay. **SOC-RS- Social Orienting Continuum and Response Scale (Mosconi et al. 2009).

Most noticeably, there appears to be a lack of research observing and coding the social interaction behaviours of children with BESD. In particular, there are few observations of these children's peer-to-peer interaction behaviours, as initially noted in Chapter 3. Of the three studies listed above, two code the behaviour of children with ASD (using Noldus Observer), who typically present with difficulties with social communication, and one codes the behaviour of children with EBD (using unspecified 'momentary time-sampling procedures'). In addition, only one codes behaviour during peer interaction while the other two observe children's interaction with an adult. Therefore, outcomes of these studies must be considered with a degree of caution in relation to the current study as they are not explicitly referring to peer interaction behaviour of children with BESD. However, although these are different populations of children, they share similar difficulties with regard to problematic social interaction. Outcomes, therefore, may provide some indication of the types of behaviours that may be observed in children with BESD during social interaction as well as inform which behaviour coding scheme may most suitably be applied to the current research. The three studies have similar outcomes regarding behaviour during social interaction, observing children to be less engaged with their interaction partner than typical or developmentally delayed children. ASD outcomes are similar across Leekam and Ramsden (2006) and Mosconi et al. (2009), reporting poorer responding in interaction including orientation to name, and less initiation behaviours including use of joint attention, social referencing and smiling. These characteristics are, however, commonly associated with children with ASD. Erickson, Stage and Nelson (2006) report lower levels of engagement during social interaction with peers in children with EBD, indicated by less on-task behaviour, higher rates of avoidance, and inappropriate behaviours including behaviour that would be considered disruptive in a classroom context (talking, provoking, noise, aggression and tantrums). As was outlined in Chapter 1, these disruptive behaviours are common characteristics observed in children with BESD. Furthermore, this study suggests an influence of peer behaviour on children with EBD; less attention from peers may increase the frequency of these disruptive behaviours. Influence of peers upon social interaction was also indicated in literature review 2 in Chapter 3. This further supports the need to assess peer interaction between children with BESD and their typically developing classmates. Perhaps lower levels of supportive behaviour (therefore less attention) from typically developing peers influences degree of disruptive behaviours by children with BESD during social interaction. However, observations in Erickson, Stage and Nelson (2006) were made within a classroom context; therefore, behaviours were subject to teacher influences, multiple peer influences, the social dynamics of the classroom, and the tasks being completed (potentially influencing level of engagement), rather than focusing on peer-to-peer interactions alone.

The type of tasks that children complete during observations or the observational setting itself may influence the behaviours observed by impacting on their level of engagement, whether they find it difficult or easy to complete, and whether it is a group task or individual task, competitive or a co-operative task. In the three studies above, as mentioned, one was a classroom observation (Erickson, Stage and Nelson, 2006), another involved the Autistic Diagnostic Observation Schedule (ADOS-Generic) (Lord et al., 2000; Mosconi et al. 2009), which is a standardised protocol for the observation of social and communicative behaviour associated with autism, and one employed a series of play tasks designed to measure initiating and response behaviours. Therefore, level of engagement could be variable across each of these tasks as well as between different children. The presence of adults rather than familiar peers during observation may also impact on behaviour observed. None of these tasks targets or elicits communicative interaction between peers, which is important in relation to the current study exploring the impact of behaviour and language on peer interaction. Furthermore, the behaviour characteristics of hyperactivity, inattention and conduct difficulties frequently observed in children with BESD mean a suitable task must be able to hold their attention to a degree where behaviour can be accurately measured. These three papers suggest that behaviours that may be observed from children with BESD during social interaction are those that may reflect lower levels of social engagement with their peer, such as less joint attention initiations and responses, less use of social referencing, increased talking and noises, and greater levels of aggression. However, these suggestions must be treated with caution as the outcomes of only one study discussed above relate to children with EBD. In addition, each coding scheme discussed is targeted at the detection of common behaviour characteristics of their sample, and so it could be said that they are biased towards detecting specific behaviours, increasing the likelihood of detecting group differences. In Erickson, Stage and Nelson (2006), codes are tailored to detect problematic behaviours only, and those that are frequently observed in children with EBD. A significant difference between groups is therefore less unexpected. Furthermore, only Leekam and Ramsden (2006) and Mosconi et al. (2009) report upon inter-rater and intra-rater reliability. This is missing in Erickson, Stage and Nelson (2006) and so the reliability of their coding scheme can be questioned.

4.4.1 *Summary of coding schemes for behaviour observed during social interaction*

The coding schemes described above are limited in the types of behaviours they detect (specific to their sample) and only one includes the observation of behaviours during interaction with peers (potentially influenced by classroom and teacher dynamics). While they may indicate the types of behaviours that *could* be observed in children with poor social behaviour and communication, evidence is too limited to derive a strong hypothesis predicting peer-to-peer interaction behaviour observed in children with BESD. It may be said that none of the coding schemes discussed above are entirely suitable for coding the communicative interaction behaviours of children with BESD and typically developing children during peer interaction; including positive as well as problematic behaviours, verbal and non-verbal behaviours.

4.5 Literature Review 4: Reviewing Coding Schemes for Language and Communication Difficulties

In Chapter 3, observations of peer interaction behaviour were reviewed, and this included coding of some verbal and non-verbal behaviour of children. However, there remained the question of whether the social language of children with BESD differs from that of children with language and communication difficulties or disorders. Evidence reviewed so far in Chapter 3 has suggested pragmatic and structural language difficulties in children with BESD as well as children with language difficulties. There is a need to disentangle overlap between behaviour and language in terms of their *applied* operational impacts, especially in light of evidence for association between pragmatic language and social/externalising behaviour difficulties. It is also unclear whether difficulties that are highlighted in report measures are also observed in children's social interaction. Such questions guided a fourth literature review exploring coded language and communication of children with behaviour or language difficulties/disorders.

Literature review 4 was first carried out in 2010 at the start of the project. An updated search was carried out in November 2014 (searching 2010–2014) to update this and provide current data for comparison to the project findings. The same five databases presented in Chapter 3 were used in this literature search. Search terms included 'communication', 'conversation', 'language characteristics', 'language observation', 'language coding' 'behaviour difficulties', 'behaviour disorder', 'externalising behaviour', 'ADHD', 'Conduct Disorder', 'language difficulties', 'language disorder', 'Specific Language Impairment', and 'Pragmatic Language

Impairment'. Papers were included in the final literature review if they met the following inclusion criteria:

- Children recruited were of primary school age (4–11 years).
- Children were identified as having a primary behaviour difficulty/disorder or primary language difficulty/disorder.
- The paper reported upon distinct coding of children's language and communication during social interaction or conversation.
- The paper was published within the previous ten years for the initial search, 2000–2010, and the previous four years for an updated search, 2010–2014 (to ensure the most recent findings were considered).

This resulted in 329 papers. Of these papers, seven met the full inclusion criteria. Three of these reported on the use of the same coding scheme within the same sample (Adams et al., 2005, 2006; Adams and Lloyd, 2007). The most recent of these will be included here as a main paper for review (leaving four papers in the final review). Key descriptive elements from each of these four papers are presented in Table 6.

Study	*Sample*	*(n)*	*Age (mean), gender (M/F)*	*Coding scheme*	*Key outcomes*
Stroes, Albert and van der Meere (2003)	ADHD	20	8.10 years (all male)	Latency of speech responses, communicative speech, subject change, talk to self, duration and frequency of visual looks to the adult	ADHD group: more subject changes, longer duration of speech, slower responses, and interrupted less than TD group
	TD	19	9.1 years (all male)		
Ziatas (2003)	ASD	12	8.3 years (10M, 2F)	SAT* Internal reports, attributions, explanations, identifications (objects/events), descriptions predicate events, judgement, procedurals	ASD children made fewer internal reports, explanations and descriptions. SLI made more internal reports and fewer assertions
	Asperger Syndrome	12	6.11 years (8 M, 4 F)		
	SLI	24	8.2 years (10 M, 2 F)		
	TD	12	5.8 years (10 M, 2 F)		
Redmond (2004)	ADHD	10	6.9 years (9 M, 1 F)	KLTD* Speaking rate, formulation and length, lexical diversity, morphosyntactic development (tense marking, grammar)	ADHD group: difficulties with formulation, greater mean length speech. SLI group: difficulty with lexical diversity
	SLI	10	6.6 years (7 M, 3 F)		
	TD	13	6.6 years (9 M, 4F)		
Adams and Lloyd (2007)	PLI	6	7.10 years (all male)	ALICC* pre- and post-therapy. Conversational dominance, participation and loquacity	High discourse participation, dominance and loquacity common characteristics

Table 6: Key descriptive elements of four papers coding the language of children with behaviour or language disorders.

*SAT: Speech Act Taxonomy (Dore, 1986). KLT: Kansas Language Transcript Database (Howe, 1996). ALICC: Analysis of Language Impaired Children’s Conversation (Bishop et al., 2000).

The four papers listed above all report on clinical samples of children with behaviour or language disorder. Only one includes observations of children who may present with co-occurring behaviour and language difficulties, those with ASD (Ziatas, 2003). Three studies include the use of existing coding schemes for coding various aspects of statemented or conversational spoken language. The ALICC codes pragmatic difficulties in language (in line with the characteristics of the PLI sample it has been applied to). The KAT codes structural aspects of language and the SAT codes both pragmatic and structural aspects of language. Noticeably, the KAT and SAT are both relatively dated in comparison to the ALICC. One paper includes a novel scheme which codes verbal (pragmatic) and non-verbal behaviour. Each of these four coding schemes was applied to the language and communication of children used during direct semi-structured conversational interaction with adults. Aspects of language and communication that are coded impact on the type of difficulties detected. Outcomes of these coding schemes, however, may be cross-referenced between behaviour or language impaired samples of children.

For those children with primary behaviour difficulty, outcomes of the studies by Stroes, Albert and van der Meere (2003) and Redmond (2004) suggest that while their communicative speech may be longer in duration than that of typical children, the structural aspects of their language may be impaired. This is evidenced by reported difficulties with utterance formulation such as false starts, fillers, revisions and repetitions in speech. Outcomes also suggest that the coherence of their speech and conversation may also be impaired, evidenced by frequent subject changes and slower speech responses. This may be indicative of pragmatic language difficulties.

Reported language outcomes of children with primary language difficulty are also indicative of structural and pragmatic impairment, likely to be the result of different types of deficits. For children with SLI, evidence suggests less verbosity, shorter utterance lengths, less lexical diversity and less speech about others. Some of these qualities therefore indicate structural impairment, and some pragmatic impairment in language. Children with PLI are reported to be verbose and dominant in conversation, reflecting primary difficulties with pragmatic language. Additional language characteristics of children with PLI are reported in the two studies prior to Adams and Lloyd (2007) mentioned above, Adams et al. (2005) and Adams et al. (2006). Within these, responsiveness in conversation was also observed. Children with PLI were found to be less responsive and more likely to bring conversational topics back to their own preferred ones. Difficulties with conversational turn taking were also found, disrupting conversation. This suggests less engagement in conversation, egocentricity in speech and disruption to the coherence of conversation. Egocentricity in speech is also reported in children with SLI, noted above. Ziatas (2003) indicates that children with SLI make more internal reports and fewer reports about others. Disruption to coherence and flow of conversation is similar to disrupted coherence of utterance formulation (false starts, fillers, revisions and repetitions) reported above in relation to children with primary behaviour difficulties.

The Ziatas (2003) study also reports on children with ASD who have difficulties with social behaviour and language, indicating that this sample made fewer internal reports, explanations and descriptions than children with SLI or typically developing children, despite being matched on verbal mental age. This suggests children with ASD may use language less to engage with their external world or to report upon their inner thoughts and feelings. Children with Asperger Syndrome, however, made more internal reports and fewer assertions about others. This suggests greater egocentricity and may demonstrate difficulty with theory of mind, a common characteristic of children on the Autistic spectrum. Therefore, differential difficulties with behaviour that are coupled with or independent of, additional language difficulties may impact on how children use social language. This is supported by the studies above sampling children with ADHD (not reported to have any language difficulties), within which increased talkativeness and structural language difficulties are suggested.

4.5.1 *Summary of coding schemes for language and communication difficulties*

It was questioned whether the social language of children with BESD differs from that of children with language and communication difficulties or disorders. In addition it was questioned whether difficulties that are highlighted in report measures are also observed in children's social interaction. Evidence above indicates the existence of structural and pragmatic difficulties in language and communication of children with behaviour disorder or language disorder; therefore, there is overlap between these samples in the characteristics of their conversational or statemented speech. Observations of both structural and pragmatic impairment also support the types of difficulties frequented within report data, as discussed in Chapter 3. It is less clear, however, what characteristics of social language are observed in children with co-occurring behaviour and language difficulties. The little evidence discussed above suggests that differential behaviour difficulties in children with comorbid difficulties may impact on social language and communication. Furthermore, the coding schemes discussed here were applied to direct conversational interaction of clinical samples of children with adults. Therefore, there is no indication of the types of language and communication non-clinical samples of children with difficulties use during peer to peer interaction.

4.6 Novel Language Coding: The Language ENvironment Analysis 'LENA' Software

Aside from report measures, manual observation and coding schemes of language, an alternative and primary method of language analysis is transcription analysis of recorded data. Transcription allows for the measurement of language at a more fine-grained level, identifying characteristics of language and vocabulary used by children. It is essentially the representation of language in written form. It may be considered under the category of observational measurement as it involves researchers transcribing audio data and assigning meaningful codes to the data which relate to specific characteristics of language or the vocabulary spoken by the child. Language used in communicative interaction may also be analysed using transcription in the form of conversation analysis (CA), whereby conversational turns may be analysed. However, the greatest limitation of transcription is that it is a lengthy, time-consuming process, which subsequently places delays on retrieving research findings.

In response to the limitations of language transcription, novel automated language analysis software, 'LENA', has been developed. The database search for coding schemes of language difficulties previously presented in this chapter did not detect any research literature using LENA. This may be because LENA is typically considered as, and referred to as, a 'language analysis' system rather than a 'language coding' system. In addition, existing LENA research focuses mainly on language environments of typically developing children or on vocalisations of children with Autism Spectrum Disorder, rather than children with primary language impairment or disruptive externalising behaviour. Furthermore, the database search specified research sampling children of primary school age however current LENA research samples younger children between 2 and 36 months. It is yet to be used with older children.

LENA is an automated vocalisation analysis system which has eliminated the need for laborious techniques of human transcription as a primary analysis of audio data and language assessment. The system enables the analysis of fundamental characteristics of language use such as verbosity of children, and frequencies of initiations and responses in language. Therefore, while human observation is useful in determining the nature and context of language, counting words and initiations, for example throughout an interaction scenario, is laborious, which is where the LENA system offers its main advantage.

LENA was initially developed in the USA and was designed in response to Hart and Risley's (1995) 'Meaningful Differences' research, which reported that children who hear more words between birth and age 3 develop more sophisticated language and have increased academic achievement at age 9. The LENA system's initial use in research showed that the technology was able to replicate these findings through the development of advanced speech recognition algorithms and automatic segmentation of audio files (Montgomery et al., 2009). Since then, the software has continued to improve in its performance through continuous development, to become more widely recognised and used globally in child speech and language research; however, the technology remains relatively unknown in the UK.

The LENA system allows for the automatic processing of audio files to provide information about a child's vocalisation and their environment. It provides count data for child vocalisations, adult words, conversational turns, and proportion data about the child's surrounding environment, and electronic (television) and background noise. These data are produced by the use of a small recording device, the 'Digital Language Processor' (DLP), which sits neatly in a chest pocket of specifically designed clothing worn by the child. The DLP can record up to 16 hours of continuous audio data, and so is highly efficacious in its ability to capture language use and environment across different contexts of a child's day. Data from the DLP is uploaded by USB port onto the software on a laptop or computer and processed automatically with no need for human intervention. LENA provides these data via an Audio Processing System which comprises four components: information flow, information processing, algorithmic processing models, and professional human transcriptions.

Acoustic properties of the audio are segmented by algorithmic models to identify sounds of varying amplitude and intensity. Feature extraction identifies the source of the audio signal through iterative modelling, which results in eight categories of audio signal: the key child (wearing the LENA DLP); other child; adult male and adult female; overlapping sounds (at least one human); noise; electronic sounds (e.g. television/radio); and silence. Statistical fit of each segment to the selected model (which is compared to a silence model) allows for these to be further specified into clear and unclear or quiet/distant noise sub-categories. Statistical fit is based on the likelihood or certainty of the sounds' initial classification into one of the above eight categories (Ford et al., 2008). LENA categorises these eight audio signals to produce four key reports about a child's language environment. These four reports are: key child vocalisation count, adult word count, conversational turn count (between adult and key child), and audio environment information (TV and electronic media, proportions of meaningful and distant sound, noise, silence and background noise).

The audio processing models were trained and optimised for accuracy by professional audio transcriptions that identified a variety of segments from audio accurately and reliably so as to differentiate between them, for example between key child speech and adult speech, or non-speech sounds. After these segments are identified, further iterative processing generates key LENA data, distinguishing speech sounds (words, babbles, communicative speech sounds) from non-speech sounds (fixed signals which refer to emotional responses to an event such as screams, and vegetative sounds which result from respiration and digestion). Therefore, a vocalisation in LENA terms refers to *meaningful speech sounds* made by children. This is important to note as the vocalisation definition given in Chapter 1 (p.3) incorporates both communicative speech sounds and non-speech sounds. Statistical modelling estimates the number and duration of vocalisations produced and conversational turns between child speech and adult speech. Ultimately, within the LENA DLP the audio data are segmented into the key reports by a three-step process: feature extraction, preliminary classification (into appropriate category) and segment identification (confirmation of classification via statistical fit) (Xu et al., 2008).

In addition to the four key reports produced by the primary LENA software, LENA is accompanied by additional analysis software called the Advanced Data Extractor or 'ADEX' (www.lenafoundation.org). ADEX allows for the selection of finer audio characteristics to be analysed beyond those of the four key reports. For example, within conversational turns it can identify which speaker initiated the turn and who the turn was between. It may also provide duration information for each turn or vocalisation, type of vocalisation such as cries, proportions of overlapping noise in an audio (co-occurring audio such as multiple speakers), uncertain noise, vegetative noise/signal, proximity of vocalisation (near or far) and average signal level data (db). By exporting data from LENA, ADEX produces an Excel file with this additional audio data for each child.

The LENA system's reliability was reported by Xu, Yapanel and Gray (2009) by comparing LENA counts with that of human transcription. The system's differentiation between speaker vocalisations was shown to match human transcribed codes for 82% and 76% adult and child vocalisations respectively. As regards adult word counts, a significant positive correlation is reported between LENA counts and human transcribed counts ($r = .92$, $p < .01$). LENA mean adult word count was on average 2% lower than human counts. The identification of a child vocalisation versus a non-speech child sound was then compared, with agreement between LENA and human transcription at 75% and 84% respectively. Each of these key measures of LENA reports good levels of reliability in comparison to human transcription. However, the authors state that the most deviance in agreement between LENA and human transcription occurred in audio segments where there was a significant amount of noise and overlapping speech by multiple people; therefore, this would be an important area for caution in employing LENA in research, since a quieter environment would perhaps generate more reliable count data.

4.6.1 *Exploring the Language ENvironment Analysis (LENA) software in research*

The LENA system appears to offer advantages over traditional manual transcription for the measurement of conversational language used by children. In order to begin to identify the LENA profiles of children with different disorders that are currently reported, and explore the degree to which these might differentiate between disorders, existing research using the LENA technology was reviewed.

As the LENA software is still a relatively new development in the research field, there is little existing research using the technology. Investigations using LENA with typical children have very much focused on the influence of language environments on language development (Gilkerson and Richards, 2008; Christakis et al., 2009; Montgomery et al., 2009; Zimmerman et al., 2009). Key findings include that adult–child conversational turns are associated with healthy language development (Zimmerman et al., 2009) and that exposure to audible television is related to reductions in exposure to adult speech and child vocalisations (Christakis et al., 2009). Gilkerson and Richards (2008) looked at the effects of family socio-economic status, gender, and birth order on language learning of 329 typical children and found children from higher socio-economic households were exposed to more adult words and conversational turns, girls hear more words than boys overall, and first-born sons hear more words and engage in more conversational turns than latter born sons, with no such difference occurring for girls. Such evidence has provided significant insight into the importance of environment on language development. Use of the LENA system, it seems, has the potential to contribute valuable information to the fields of child development and language acquisition. Each of these studies of typical children included children of the same age, between 2 and 48 months. Considered altogether, they begin to indicate what an optimum language learning environment for children during the first three years of life looks like, and what aspects of an environment may be detrimental to learning. It is questionable, however, what the effects of language and environment are on development after these first three years; once the child has acquired language, does their own interaction affect development and does their environment continue to influence development?

The majority of research using LENA with clinical samples of children has focused on children with ASD (Oller et al., 2010; Warren et al., 2010; Xu et al., 2012). Warren et al. (2010) used LENA key reports to investigate vocalisation differences between children with ASD and typically developing children, aged between 16 and 48 months. Compared to the typically developing group, the ASD sample demonstrated 26% fewer conversational turns and 29% fewer speech-related utterances. The ASD sample also had a higher frequency of speech monologues than the TD sample. This may be related to the fact that children with ASD often display inappropriate initiations of topics in which they are most interested, and can talk repetitively about their interests, meaning that their speech was non-social and responded to less by adults, and so did not become conversational. Furthermore, adult–child turns were negatively correlated to ASD symptom severity; therefore, fewer conversational turns were occurring with children with more severe ASD. This reflects the findings of Zimmerman, Gilkerson, Richards et al. (2009), who suggest conversational turns generate a healthy language learning environment. However, the reduced engagement in conversational turns in children with ASD is likely to be due to difficulty with social communication, rather than, as Gilkerson and Richards (2008) suggest, lower socio-economic status of the families. The families recruited into the Warren et al. (2010) study were all highly educated, a limitation pointed out by the authors as results cannot be generalised to families with lower educational status. Further limitations of this study included the fact that their typically developing sample recordings were not collected concurrently with the ASD sample. Instead, data from a previous project were used as comparison; therefore, there existed differences in the number and length of recordings between each group. Finally, the data are correlational, and so no causality can be suggested.

Similar investigation using LENA analysis at a finer level looked at the acoustic features of the audio recordings. Oller et al. (2010) used LENA to compare vocalisation syllabifications between children with Autism, children with language delay, and typically developing children aged between 10 and 48 months and found that the system could differentiate between these three groups on the basis of each of their speech syllabification patterns. Likewise, Xu et al. (2009) found that the LENA acoustic vocalisation features could identify children aged 24 months and above who were at risk of ASD. Such findings are the result of investigating LENA recordings at the finest level, which goes beyond its standard automatic generation of key reports about vocalisation. They indicate that children with different diagnoses may be differentiated by their acoustic vocalisation characteristics, which in turn may have implications for the early detection of behaviour and/or language difficulties. This literature on LENA and ASD samples seems to suggest children with ASD may have different vocalisation profiles from typical children, and provides scope for future early detection of ASD, although no research has yet pinpointed the age at which vocalisations become different across groups. Could it be that the same is true for children with behavioural, emotional and social difficulties, that their vocalisations are different from those of typical children? Furthermore, this research, like much of the normative sampling LENA research, has provided insights into the environmental influence of the children, with the number of adult word counts to children being higher in high socio-economic status households. Such research provides novel information on the vocalisation characteristic differences that may exist between clinical and typical samples of young children. However, in investigating the language ability of children with ASD, we would perhaps expect such a difference, as children with ASD are typically delayed in all areas of language use including pragmatic language, the ability to use language for social communication. Where LENA studies have provided matched controls for children with ASD they have not accounted for this. Yet what the LENA system has allowed for is the quantitative measurement and empirical evidence of such difference.

4.6.2 *Summary of the Language ENvironment Analysis (LENA) software*

LENA has considerable strengths in measuring the vocal characteristics of typical and clinical samples of children. The vast majority of successive LENA research since Hart and Risley's (1995) initial study has followed suit and recruited children from 2 to 36 months and primarily children with ASD. Its application to older children and with those with BESD has not been explored. A limitation of existing LENA research is the lack of consideration of non-verbal behaviour and how this may contribute to communication or language learning; non-verbal behaviour is equally as important as vocalisations in social communication and has the potential to influence learning through non-verbal cues provided by parents or caregivers. Adding the opportunity to record the nature of vocalisations as well as non-verbal behaviour alongside LENAs key reports would enhance the investigation of language and communication in children from an alternative population (those with BESD), as well as typical children. Furthermore, while the LENA system is able to provide count data for vocalisations, it cannot describe the nature of vocalisations or transcribe language used. It also cannot provide information about linguistic complexity, and so a child who might speak several short but repetitive words may be considered to be at the same developmental stage as a child who speaks using more full complex sentences. Considering the nature of speech alongside count data could improve measurement of language used in a social interaction context.

4.7 Conclusions

Reviewing frequently-used techniques for the measurement of behaviour and language, techniques for inclusion in the current investigation have been identified. Firstly, measurement of social and pragmatic aspects of behaviour and language and communication in children is important. Impairment in understanding the intentions of verbal messages of peers may exacerbate interaction difficulties, having implications for peer relationships, classroom management and inclusion. The same is true for social non-verbal behaviours, as impairment in reciprocal interaction skills (such as shared attention behaviours) and socially inappropriate or disruptive behaviour may also exacerbate interaction problems and create peer and classroom difficulties.

In light of the limitations of relying solely on report data, the current study will employ the Strengths and Difficulties Questionnaire (Goodman, 1997) and the Children's Communication Checklist-2 (Bishop, 2003) as background *supportive* assessments alongside observational techniques, rather than as primary assessments of behaviour and language difficulties in children. These address pragmatic communication and social interaction skills. In addition, the CCC-2 also captures structural language difficulties. The measurement of both pragmatic and structural language difficulties is important as existing research discussed in Chapter 3 indicates both of these to be impaired in children with behavioural, emotional and social difficulties. Furthermore, as also highlighted in Chapter 3, both reports are most commonly used in research exploring behaviour and language associations. Their inclusion in the current project will therefore allow for comparisons to be made to existing research. Both reports are also reported to have high levels of reliability and validity, and are applicable to the age range of children in the current study. Incorporating report data into the current study also has implications for analysis of specific areas of strength and weakness in language and behaviour; the subscales of each of these assessments will be discussed and correlated to investigate behaviour and language associations at the reported characteristic level.

Secondly, the investigation of communicative interaction must include measurement of behaviours of children in the same social and naturalistic context (avoiding variable contextual influences). Currently, the most suitable measurement technique for assessing communicative interaction of children with others, as well as the interaction between behaviour and language constructs, is observational coding. In the two reviews above, three coding schemes for behaviour and four coding schemes for language that have been successfully used in previous research were identified. However, behaviour coding was primarily targeting ASD characteristics, problematic behaviours and interactions with an adult (some peer observations in one study). In the language coding schemes, each was primarily a measurement of the language and communication of children that occurs during semi-structured conversational interaction with an adult. They are also designed for use with clinical samples of children with language or behaviour disorder. Therefore, the current study will develop a novel coding scheme to explore the peer-to-peer verbal and non-verbal communicative interaction of a non-clinical sample of children who are likely to have co-occurring language and behaviour difficulties during a naturalistic context. The development of this will, however, be informed by considering behaviour and language/communication outcomes of existing schemes discussed here. The coding scheme will be used in conjunction with Noldus Observer in order to apply codes to video-data of children. Development and presentation of this coding scheme will be discussed in forthcoming chapters and Appendices A and B.

In order to measure social interaction between children in the same social and naturalistic context without the influence of variable external influences, there is a need for interaction to be standardised across different children. As mentioned above in relation to tasks used during observations in studies in Literature review 3, none discussed would be suitable for measuring or eliciting communicative interaction behaviours of children with BESD; the engagement of the children, and therefore the behaviours observed, may be influenced by the type of task employed as well as the setting in which the observation takes place. As a result of this, existing interaction tasks that children could complete to allow for standardisation were explored. These explorations are detailed in Appendix C. Tasks were found to be inappropriate to the current research context. Therefore, a novel communicative interaction task was developed which allowed for the measurement of behaviours specified within the coding scheme: the ‘Story in a Box’ (Charlton, 2014). This task was appropriate to the educational research context and elicited communicative interaction behaviours from children to a degree where they could be accurately measured. The ‘Story in a Box’ task centred upon story-telling and problem solving where peers must work together to solve problems at various stages of the story in order to complete the task. The task was initially tested with children to ensure appropriate behaviours were elicited and could be measured using the novel coding scheme. Details of the ‘Story in a Box’ development and exploratory testing may be found in Chapter 9 (p.123) and Appendix E.

Finally, in light of the advantages of an automated language analysis system (LENA), its reported efficacy, and the fact that LENA is yet to be used with children with behavioural, emotional and social behavioural difficulties as well as children of primary school age, the current project will include LENA as a measurement of count language data (such as number of conversational turns and child vocalisations). This adds an alternative dimension of language measurement to coded language, which primarily focuses on the nature of language and the context in which it occurs. Furthermore, the mobility of LENA means it is practically suitable for the measurement of language in a naturalistic context such as the current project employs. Therefore, LENA measurement will reflect the use of language in the real world in addition to parent-reported language ability. LENA inclusion will also provide an opportunity to explore its capabilities for language measurement further through its use with older children with BESD. The current study will be one of the first LENA projects to be carried out within the UK.

Combining multiple methods of measurement rather than relying solely on one technique will provide improved measurement of behaviour and language associations. The current project will combine observational coding techniques (Noldus Observer) and automated language analysis (LENA) alongside report assessment, with the aim of capturing holistic, live ‘as it happens’ and ecologically valid profiles of the children’s abilities and interactions at individual and construct level. Furthermore, these combined techniques will allow for capturing various individuals’ perspectives rather than relying on one perspective, those of the observer, teachers or parents. Since the existing literature has confirmed a relationship between behaviour and language and communication difficulties in children, and the present chapter has looked at the measurement of these, the following chapter will address theoretical perspectives relating to behaviour and language in order to attempt to understand why such associations between difficulties exist.

Chapter 5. Theoretical Perspectives

As was stated in Chapter 1 (p. 12), the current study incorporates a developmental perspective of behaviour and language/communication and their association. Appropriate theories for behaviour and language association would consider the dynamic influences occurring throughout child development of experiential and internal constructs. In this chapter a number of developmental explanatory theories of behaviour and language will be reviewed that will be judged with regard to their appropriateness for providing an explanation of behaviour and language difficulties and their association.

Currently, there is no widely accepted theoretical explanation for BESD and co-occurring language difficulties. The present study, through its recruitment of a non-clinical sample of children with BESD and typically developing children, incorporates a developmental perspective allowing for individual differences in ability, and different severities and profiles of co-occurring or individual difficulties, manifesting at various different developmental stages. Developmental perspectives may explain variability in behaviour and language presentation by multidimensional (more than a single criterion impacting on development) and multidirectional trajectories of development (Baltes, 1987). Within this chapter, judgement criteria for each theory will reflect the principles of this perspective; contemplating the *underlying developmental processes* and *dynamic* interactions occurring between internal and external influences, the *plasticity* of within-person development, and *contextual* and *historical* influences on development. Explanatory theories must therefore be able to account for these dynamics.

5.1 Theories of Behaviour

As stated above, there is no single accepted theory to account for the development of behavioural, emotional and social difficulties. There are a range of theories which attempt to explain behaviour, but few which accurately account for the development and presentation of atypical behaviour. Theories of behaviour will be addressed here with consideration of atypical development. Webber and Plotts (2008) have suggested five main theoretical models that may be applied to the presentation of behaviour: Biophysical, Psychodynamic, Humanistic, Behavioural and Cognitive. These make reference to internal constraints, personality and genetics, unconscious motivations, instinctual drive and cognitive processing respectively. However as individual theories they fail to distinctly consider development itself, including the dynamics of internal and external influences on development, which an adequate explanation of BESD requires. Furthermore, only the Behavioural theory regards the influence of environment on development, suggesting that behaviour is learned. If behaviour may be learned from environment, we must presume that socio-cultural variables influence the development of behaviour. Cultural 'norms' of behaviour, what is deemed as appropriate in one culture, may not be in another. Therefore, frequent exposure to cultural norms throughout development impacts on thought processes and psychological functioning, and subsequently operational behaviours. However, placing emphasis on environment to explain behaviour development disregards internal factors that the other theories account for, and is still simplistic in its explanation. Behaviourism may account for the visible, surface behaviour of a child, but not the processes and emotions that underlie the behaviour. It is also unable to explain the heterogeneous nature of behavioural, emotional and social difficulties, the comorbidity of behaviour problems, variance in severity of problems, or variance in manifest behaviours, because of its simplistic view. Cognitive theory, alternatively, does consider the processes that underlie behaviour, suggesting that individual variability in cognitive processing of events influences behaviour; thought processes and perceptions determine and control behaviour, and this process is genetically influenced (Webber and Plotts, 2008). However, this genetic influence presupposes that that an individual is predetermined to process an event in a certain way. This account is also too simplistic as processing may also be influenced by dynamic interactions between cognition and environment.

There is a need to combine the propositions of each of these theories in order to provide a more fitting explanation of the development of atypical behaviour in children. The influences of the external environment (behavioural theory) and internal processes (cognitive theory) must be considered together. Cognitive-behavioural perspectives integrate these and are frequently referred to in research and clinical practice, because of their consideration of mixed influences (internal–external). Referred to here as 'perspectives', they form no one cognitive-behavioural 'theory', but a broadly defined, general theoretical framework which acknowledges the individual's internal capacities and their external environment, and considers the interplay between them. This perspective could potentially provide a more comprehensive and appropriate explanation for the development of behavioural, emotional and social difficulties. Cognitive-behavioural theoretical perspectives and the role of emotion and thought on behaviour will be discussed here.

5.1.1 *Cognitive-behavioural theoretical perspectives*

The term 'cognitive-behavioural' represents a family of psychological methods and approaches which each includes similar conceptual statements regarding the relationship between emotions, thoughts, and behaviour (McGuire, 2000). Cognitive-behavioural perspectives address the *dynamics* of interactions between individual variables, such as self-regulation, automatic and controlled cognitive processing of stimuli and neural networks, and external situational variables, such as family environment. Behaviour from a cognitive-behavioural perspective is the result of interactions between each of these.

Under the cognitive-behavioural framework two early comparative theories may be considered for the explanation of behaviour and these are Social Development theory (Vygotsky, 1978), and Cognitive Development theory (Piaget, 1977). Both of these theories combine behaviourism and cognition, but in opposite ways. Social Development theory argues that social interaction precedes consciousness and cognition. Behaviour is therefore the result of social observations and cultural influences. We might presume that under the Social Development theory, atypical behaviour is the result of social interaction. However, this theory is often considered too generalised and greater emphasis is placed on social interaction and culture, rather than underlying cognitive processes. In comparison, Cognitive Development theory suggests cognition precedes development. Here, primary emphasis is placed on cognition and the child's own active construction of their world. Under this theory behaviour develops as the result of a series of cognitive stages, involving the child recognising discrepancies between what is already known, and what is unknown in their immediate environment. We may presume that atypical behaviour is the result of deviances from or within these cognitive stages. However, this theory is criticised for categorising cognition into four stages, whereas it is probably a more continuous process. Furthermore, emphasis on cognition means less attention is paid to social interactions and cultural influences. What these two theories do both recognise is the influence of *social interaction* on development, and that interaction occurs between the child and his or her environment (despite differences in the proposed direction of this interaction).

An advantage of the cognitive-behavioural framework is that there is a great deal of research evidence confirming its underlying perspectives. It is used within many scientific disciplines including behavioural and developmental psychology, evolutionary ecology and biology, where each has focused their research attention on the relationship between an organism and their surrounding environment (West-Eberhard, 2003). Evidence confirms the existence of an interaction effect between an organism's genotype and its environmental conditions; genotype, therefore, determines effectiveness of adaptation to environmental stimuli (Bateson et al., 2004). Differential adaptation may therefore produce different behavioural outcomes. Considering the development of problematic behaviour, cognitive-behavioural perspectives are reflected in diathesis-stress models of cognitive functioning. These argue that some individuals are more genetically vulnerable to adverse or negative effects of the environment than others, subsequently leading to atypical development. In support of this, Morrell and Murray (2003) found that distressed four-month-old boys who experienced rejecting mothering showed evidence of emotional and behavioural dysregulation when assessed five months later, and this predicted symptoms of conduct disorder at five and eight years of age. This evidence indicates the potential for negative effects of nurturing on development.

Cognitive-behavioural perspectives are at a further advantage over other theories with regard to explaining development that may deviate from the 'norm' as they reflect the modern tenets of developmental plasticity. Plasticity theory states that cognitive processing, and cognitive development, is malleable in nature, not only affected by natural maturation throughout ageing, but also subject to change as a result of life experiences (Kolb, 1995). Although plasticity has biological, genetic foundations, it is still influenced by environment (Boyce and Ellis, 2005). Plasticity is therefore influenced by nature and nurture. Furthermore, plasticity theory also suggests that individuals vary in degree of adaptation to environmental experiences. Some are more susceptible to such effects than others. Such cognitive change subsequently alters brain functioning, which therefore may lead to atypical development.

5.1.2 *The role of emotion, thought and temperament in behaviour*

As stated above, cognitive-behavioural perspectives regard the relationship between emotions, thoughts, and behaviour (McGuire, 2000). Emotion, as part of the reactivity process, has the ability to influence a child's response to social situations through association of emotions with past experiences. Particular behaviours may be associated with particular emotions, and therefore the child learns to respond to social situations in a certain way; for example, a specific behaviour may be the child's way of reducing feelings of anxiety. Alternatively, a certain emotion may trigger certain behaviour; for example, anger may trigger hitting behaviour. Emotion as a reactive response is also regulated by the child. The child's ability to regulate their emotions may directly affect behavioural response to social situations. Poor regulators may present avoidant or challenging externalising behaviours, whereas good regulators may experience greater quality of interaction with others, by first considering various different responses and therefore responding more appropriately (Lemerise and Arsenio, 2000). This raises an important question about the relationship between behaviour and language. Self-regulation, beginning in infancy, is initially controlled by external environment (parental input and guidance). Yet, once established, the child becomes independent at self-regulating his or her own thoughts and behaviour, which is assisted by language. For example, children may give themselves internalised guidance on how to respond in a certain situation (McGuire, 2000).

This is also supported by Vygotsky's (1962, p.79) theory of inner speech, where external ego-centric speech becomes internalised thought which regulates behaviour. This is further discussed in relation to language later in the chapter (p.80). Paris and Paris (2001) suggest self-regulation involves active engagement with others that allows knowledge, existing or new, to be organised into schemas, or categories of thought. They state that this can be aided by the use of questions, where new knowledge can be 'accommodated' and then 'assimilated' with existing perceptions. Therefore, new problems may be solved through the use of questions, and the individual must re-evaluate and assess their own level of understanding. This, therefore, is one process of self-regulation. Thus, self-regulation to some extent involves not only controlled decision-making from the child, but the influence of language and thought. It may be questioned to what extent language and thought mediates behaviour, and the extent to which a child may actively construct his or her own development and presentation of behaviour.

Temperament includes individual variability in emotion, attentional reaction to stimuli and motor activations. It has the power to influence children's development through its influences on how children respond to their environment and subsequently how others respond to them. One dimension of temperament is the executive function effortful control (EC), which includes the capacity for attention, inhibition and perception. Rothbart and Bates (2006, p.137) define effortful control as 'the ability to inhibit a dominant response to perform a subdominant response'. Individual variability in effortful control and extraversion (traits of impulsivity, motor control, positive affect and excitement) have been found to have direct effects on behaviour; low levels of effortful control and high levels of extraversion are associated with greater levels of externalising and aggressive behaviours (Rothbart, 2007). Externalising and aggressive behaviour are dominant characteristics of BESD, and so it may be that characteristics such as extraversion, and executive functioning processes such as effortful control, influence the presentation of BESD.

However, according to Henderson and Wachs (2007) there remains confusion about which behavioural characteristics, such as persistence, attentional control and flexibility, adaptability and distractibility, among others, define temperament. Furthermore, it is uncertain to what extent these characteristics overlap with other areas of behaviour such as motivation, cognition and executive functioning. Difficulty distinguishing the characteristics of temperament and their relationship with cognitive processes is not only evident in confused categorical definitions, but in the dynamic neural correlates in the brain (Steinmetz, 1994; Henderson and Wachs, 2007).

Rothbart and Bates (2006) have attempted to clarify the relationship between temperament and behaviour. They propose two biologically based and neurologically processed characteristics that can differentiate between individual temperament and subsequent behavioural effect: *reactivity* and *self-regulation*. Reactivity concerns automatic responses to change and environment, including emotional responses to stimuli, and self-regulation relating to behavioural and emotional control. It is the interaction between reactivity and self-regulation that determines effective development, allowing for self-expression and development of socially acceptable behaviour. Conflicts between these processes represent a failure to adopt a balance between these systems, which may result in atypical development (Posner and Rothbart, 2000).

Considering behavioural characteristics of BESD as occurring within the processes of reactivity and self-regulation combines cognition and behaviour. This consideration between executive functions and behaviour also provides a scaffold for other cognitive-behavioural processes to be defined, and for theories about how the brain influences behaviour and psychological function. Reactivity and self-regulation may be applied to BESD through their biologically-based constructs. Effortful control is regarded as a self-regulatory process mediated by the executive attention network, evidence of which stems from neuroimaging studies and experimental studies of attention (Gerardi-Caulton, 2000; Rothbart et al., 2003; Chang and Burns, 2005; Fan et al., 2005). Self-regulation is important for the socialisation of a child. A child’s ability to regulate their own information input and responses may determine their developmental experiences. Poor regulation may lead to poor development.

5.1.3 *Summary of cognitive-behavioural perspectives on behaviour*

Cognitive-behavioural perspectives could provide the most comprehensive and appropriate accounts of behaviour by incorporating biological, environmental and cognitive factors. It is possible to derive from these perspectives that variability in BESD presentation may be accounted for by dynamic interactions of these factors and plasticity of development.

However, although perspectives address the interactions between these factors, less regard is paid to the interactions occurring *within* each of these domains, the active decisions of the child, or neurological development or influences. Furthermore, the focus is primarily on the explanation of the development of typical behaviour; it may be questioned to what extent cognitive-behavioural perspectives may account for the relationship between behaviour and language. However, in addressing cognition and thought, these perspectives consider the impact of language on behaviour. Language and thought are important for the self-regulation of emotions and behaviour. Emotional and behavioural responses to environment are therefore mediated by language and thought processes. This therefore connects behaviour and language, which theoretically may be the beginnings of an explanation for association.

5.2 Theories of Language Development

There are many theories of language acquisition in children, yet most may be categorised into three dominant theoretical perspectives: Behaviourist, Nativist and Interactionist. These perspectives will be considered here as underlying frameworks for the consideration of language development in children.

The work of the most influential developmental theorists such as Piaget, Vygotsky and Bruner may be divided across Behaviourist, Nativist and Interactionist perspectives. Behaviourist theories of language development assume language learning occurs through the development of habitual responses. It adopts the perspectives of B. F. Skinner whereby language, just like learned behaviour, is imitated and reinforced through reward and punishment. Typical language development therefore occurs as children form correct responses to stimuli. For example, a child is rewarded by caregivers when they begin to 'babble' or speak words, and begin to repeat and imitate the language around them. The Behaviourist perspective, however, fails in accounting for the way in which children deal with learning irregular grammar, often applying the rules of regular grammar instead of adopting irregular forms; the process known as over-regularisation or overgeneralisation. For example, children may learn to add 's' to a word to form the plural, or overgeneralise the use of '-ed' to imply past tense, which they then apply incorrectly, resulting in words such as 'tooths' or incorrect grammar in sentences such as 'I drinked it'. If children are merely imitating adult speech, why do they use incorrect grammar? This phenomenon seems more indicative of the existence of a developmental, maturational process than of basic imitation. However, maturation alone is insufficient in explaining language development. The variances in linguistic abilities we see in typical language development in children (differences in the onset of language production and rate of development) are more pronounced than variances observed in other developmental stages such as walking. Therefore, a global genetic maturation account of typical language development does not account for such variances (Lenneberg, 1967).

In opposition to the Behaviourist position, Nativist theorists argue that language is innate; that we are all born with a language acquisition device (LAD) (Chomsky, 1965) which contains universal language structures and grammatical rules, allowing children to understand grammatical constructs such as word order. LAD has been used to explain the fast rate of acquisition of language in children, and cultural similarities in the way children acquire language and apply grammatical rules. Under this position, we are all predisposed to develop *typical* language. However, a major limitation of this view is that the influence of extraneous variables such as parent/adult input and surrounding environment cannot be ruled out completely. Nativist accounts cannot explain why some children fail to develop language *without* the input of a surrounding language-enriched environment, or why some experience delays in development despite their language-enriched surroundings. If environment had no contribution to language development, all children would form typical language. Furthermore, the existence of such an innate construct does not adhere to the facts of evolution. The human brain has developed and matured over time to adopt language: it was not present in early human existence. Behaviourist and Nativist perspectives, therefore, cannot on their own account for language development. An alternative perspective must be considered which integrates biological influences and socio-physical experiences.

The third theoretical perspective, the Interactionist, provides this integration. It combines Behaviourist and Nativist theories, and argues for the effect of both internal and external capacities. Many current developmental theories adopt this view, including Social Development theory. This developmental approach is appropriate to the current research project, the variability of the presentation of problems and behaviour and language associations. Interactionist views recognise that cognition *and* social context affect language development. This view was initially adopted by Vygotsky and Bruner.

5.2.1 *Social development theory and the perspectives of Vygotsky*

Social development theory, first introduced above in relation to behaviour, is derived from the work of Vygotsky. As previously mentioned, the theory emphasises the influence of social interaction and learning on development, stressing that social interaction is necessary for ‘developing culturally organised, specifically human psychological function’ (Vygotsky, 1978). Social Development theory thus provides a *socio-cultural* perspective on language development. Within this theory lies the concept of the ‘Zone of Proximal Development’ (ZPD), proposed by Vygotsky (1978). Vygotsky recognised that a child’s learning should be matched with their actual developmental level. However, in order for progression to occur, and to measure the relationship between learning and development, a second developmental level must also be recognised, which is the maximum level the child *could* achieve. The ZPD therefore represents the difference between the actual level of a child’s development, and the point of achievable development through adult guidance or peer collaboration. Vygotsky views this guidance and collaboration as important for child development. Interactions *between* children, adults and peers are therefore central to Vygotsky’s concepts.

The concept of the Zone of Proximal Development is highly appropriate to the current project. It is not only concerned with social interactions, which the current study will investigate, but it is concerned with child development within the school years. Vygotsky (1978) suggests that teachers provide guidance via collaborative learning strategies (as stated in Chapter 1, p. 8) where children who are less competent may progress in development through interactions with more competent peers. Teachers and peers, therefore, ‘scaffold’ the development of children. ZPD is also appropriate to apply to the current research context, as in its developmental approach it accounts for maturational processes and plasticity. It has capacity to consider the maturational processes that have occurred up to the child’s actual developmental level, providing a retrospective characterisation of development, and also the occurring processes that are currently happening to improve upon development, providing a prospective characterisation of development. Furthermore, the ZPD highlights the existence of individual differences in the developmental levels of children, which is important to consider when assessing their language skills and comparing children with language difficulties with their peers: appropriate matching criteria must be applied.

The ZPD and social development theory place attention on the influence of external environment on children’s capacity to develop language; development is constructed by their surrounding adults and peers. As a result of this, it could be argued that social development theory disregards the child’s ability to construct their own development through thought and self-regulating processes. As in behaviour theory, previously discussed, it may be questioned how much *internal* language influences the quality of children’s interactions. Furthermore, it is uncertain how children with co-occurring behaviour and language difficulties (and thus difficulty with social interaction and problems with pragmatic language, frequently highlighted in the research literature considered in Chapter 3) respond to such scaffolding from teachers and peers. If children with BESD have interaction difficulties owing to the nature of their behaviours, they may be less likely to respond positively to guidance from others, which therefore could be detrimental to their language development. The appropriate construction of language development, guided by others or by the child him-or herself, could therefore be impaired in these children. Social development theory is also unable to explain the existence of a wide range of language disorders: for example, why some children possess difficulty with syntax, some with speech production or some with grammar. Individual differences in cognitive processing may influence this. It also does not explain why language problems are present in other developmental disorders which have a genetic basis and are not the result of social learning, such as Autism Spectrum Disorder, a phenomenon which suggests comorbid difficulties or the influence of impairment on other domains.

5.2.2 *The role of thought within language*

Consideration of the role of thought was previously addressed in relation to behaviour. Although internal processes of language (including thought) are less accounted for within Vygotsky's (1978) ZPD theory, they are addressed in Vygotsky's catalogue of work *Thought and Language* (1962), which presents various theories about the relationship between thought and language. Vygotsky suggested most significantly that the pathways of thought and speech do not run parallel; instead, their curves of development cross and re-cross. He proposed that initially thought and speech develop independently of each other. This is evidenced by the existence of a pre-linguistic phase of thought, and a pre-intellectual phase of speech such as child babbling. However, thought and speech interact around the age of two, which means thoughts become verbal and speech becomes rational (Schütz, 2004). Language, for Vygotsky, influences thought processes and determines how a child will think, and subsequently how personality will develop. Speech, he believed, is predominantly communicative in function, developing first for external, social communication purposes. 'Ego-centric speech', a term coined by Vygotsky, develops as the child begins to relate social activity to him-or herself. Examples of this include instances where children talk to themselves, such as counting aloud numbers on their fingers, or saying aloud 'Now I will feed the doll'. Speech therefore becomes individualised, which Vygotsky argues is important as it conveys 'expressive and release' functions as well as 'a planning function' where it turns into thought (Vygotsky, 1962, p. 86). Ego-centric speech is fundamentally, as Vygotsky states (1962, p.86), speech 'on its way inward'. It is a prerequisite for the final part of speech to develop, inner speech.

Typically, ego-centric speech becomes internalised, inner speech. Inner speech represents verbal thoughts, which may be very similar in form to external speech yet occur in thought without external noise. Inner speech, therefore, is the result of the development of speech structures; external language informs and develops internal thinking. It is, however, important to consider that inner speech does not represent all forms of external language or all forms of thoughts; thoughts occur which are not related to our verbal speech, and verbal speech occurs which is not related to our thoughts.

If external speech is predominantly communicative in function, as Vygotsky proposes, could inner speech be performing some form of ego-centric communication, perhaps mediating the link between what is and what is not spoken aloud? Some inner speech may transfer into external speech for communicative purposes, yet if the child has difficulty with this process of verbal self-expression, is there means for their inner speech presenting in a non-verbal form instead? Furthermore, if a child has difficulty suppressing his or her inner speech they may be considered more verbally impulsive and loud in nature, yet is the expression of their inner speech still communicative in function? Vygotsky's theories about thought and language provide insight into what internal processes may be occurring between children's acquisition and production of language. Like many models of typical language production, his work also refers to development along age-related stages, providing a framework which typical development may be compared against. However, Vygotsky's theories do not account for or explain the development of language that deviates from 'typical acquisition' or the presentation of language disorders. We may merely hypothesise about the outcome of children failing to meet such age-related stages, or what the result of disordered cognitive processing may be upon a child's language acquisition or production.

5.2.3 *Summary of social development theory in relation to language*

Social development theory and the work of Vygotsky are useful in considering the impact of environment on development, and the impact of internal cognitive processes like thought. If social interaction and learning impact on language development they may also impact on behavioural presentation, as suggested above. However, this theory does not explain how problems in behaviour and language are *related*. These perspectives do not provide a detailed enough account of the interaction effect occurring *between* environmental and internal factors, the interaction processes occurring *within* these domains, or neurological influences. Theory that addresses the *connections* between domains and their processes may be more suitable to explain how language development may impact on behaviour. Furthermore, these accounts are not sufficient to explain language difficulties or disorders in children. In order to explain the development of language difficulties or disorders, and to consider how language may impact on behaviour, alternative theoretical perspectives which can explain the existence of variable profiles of language ability are needed. Such perspectives would incorporate biological and experiential constraints, and consider the impact of underlying cognitive processing (beyond that proposed by Vygotsky) such as internal regulation. Interactions within and between these factors may explain the development of atypical language and variability in types of language impairments.

5.3 Connecting Behaviour and Language

Interactions between internal and external constraints, cognitive processing and active construction are common factors within both language and behaviour theories. Together these could begin to provide an underlying framework for association between behaviour and language difficulties within non-clinical populations of children. Yet so far, no theory exists which is able to, or has attempted to, account for behaviour/language associations. An explanatory link connecting behaviour and language, however, must also consider interactions *within* each of these domains, not just between these domains. This would include the consideration of neural associations, the interaction processes within cognition, which is missing from the above theories. Under current perspectives where cognitive processing is important for both behaviour and language development, it may be likely that behaviour and language share (to some degree) the same underlying neural connections and processes. The lack of one explanatory behaviour/language theory, and the fact that the theories reviewed so far have not incorporated impact at the neurological level, leave space for a theory which does address these issues.

It is possible for explanations for the co-occurrence of behaviour and language and communication difficulties to adopt three forms: that language problems give rise to or provide risk of behaviour issues, that behaviour difficulties lead to language problems, or that the two both share the same risk factors that lead to their co-occurrence (Carpenter and Drabick, 2011). These three explanations suggest the existence of shared underlying processes. It is likely that each of these is true and that reciprocal impact between behaviour and language occurs. This would also account for individual variability in profiles of behaviour and language difficulties; the result of dynamic impacts from each of these reciprocal interactions. It is argued here that the relationship between behaviour and language is best understood under a developmental, dynamic framework, considering the role of interactions occurring between and within biological architecture and external environment. Currently, behaviour and language association remains theoretically unexplored, and unexplained.

Chapter 6. Research Hypotheses

In previous chapters, the impacts of behaviour difficulties and language/communication difficulties on children's educational and social development have been presented, and associations between difficulties have been suggested by existing research evidence. Despite evidence of association, currently there is no theoretical explanation for this. Impacts have been discussed in relation to behaviour and language as separate constructs, yet it remains unclear what impact *co-occurring* difficulties have on children's peer-to-peer social interactions. In addition, the majority of evidence for association is taken from clinical samples of children, mainly reported proportionally. This limits the understanding of behaviour and language associations in non-clinical populations, and of associations at the observed, operational and characteristic level.

The present study aims to investigate behaviour and language/communication difficulties within a non-clinical sample of children with BESD aged 4–9 years relative to a control group of typically developing children (reported to have no behaviour difficulties). This will include investigating the existence of associations within a non-clinical sample, and exploration of association at the *characteristic* and *operational* level (based on report and observational measurement respectively), and of the effects co-occurring difficulties may have on children's peer-to-peer social interaction. In this chapter, *research hypotheses* which have been derived from existing evidence discussed in previous chapters will be presented.

In Chapter 3, gaps in observational research into peer interaction were identified. These gaps included:

- Exploration of the impact co-occurring difficulties have on peer interaction.
- Investigations of equality of contribution to interaction between children.
- Exploration of children's techniques for social interaction.
- Detailed observation of co-occurring verbal *and* non-verbal characteristics of interaction between peers in a naturalistic setting.

Therefore, as these explorations could not be informed by existing literature, *exploratory research questions* will be used to guide the analysis of these areas of investigation. These questions will be outlined in subsequent and relevant methods chapters (Chapters 7, 9 and 11). In addition, the LENA system has not been used with children of primary school age, or those with BESD (identified in Chapter 4); therefore, *supplementary research aims* relating to the utility of LENA with this alternative sample of children will also be included in the current project, outlined within the LENA methods chapter (Chapter 9).

6.1 Research Hypotheses

Research hypotheses primarily relate to differences in behaviour and language/communication between children identified as having 'behavioural, emotional and social difficulties', and 'typically developing' children identified as having no behaviour difficulties. Hypotheses have been derived from literature reviews (Chapters 3 and 4).

Research hypothesis 1: Children with identified behavioural, emotional and social difficulties have additional language/communication difficulties to a greater extent than typically developing children. They will score more poorly on reported overall language and communication ability, have more pragmatic and structural language difficulties, and score more poorly on multiple subdomains of reported language than typically developing children. This hypothesis is supported by literature review 1 presented in Chapter 3 that indicated the existence of a relationship between behaviour and language/communication difficulties. Within the literature reviewed, pragmatic and structural language problems (and multiple areas of language that constitute these difficulties) are frequently reported as associated with externalising and social behaviour difficulties.

Research hypothesis 2: There will be a relationship between reported behaviour and language and communication difficulties however the degree of and direction of a correlation between scores in the current sample is unknown and difficult to predict based on existing evidence. This hypothesis is supported by research evidence from literature review 1 in Chapter 3. Studies reported association between behaviour and language difficulties based on report data, yet there was great variability between studies in the degree of co-occurring behaviour and language difficulties. Therefore predicting the degree of and direction of a correlation between scores of severity of behaviour and scores of severity of language difficulties is difficult and uninformed by existing literature.

Research hypothesis 3: Pragmatic language difficulties are related to social behaviour difficulties, including peer problems and pro-social behaviour problems. This hypothesis is supported by evidence presented in literature review 1 in Chapter 3 that suggests a direct relationship between pragmatic competency, hyperactivity, peer problems and pro-social behaviour (Ketelaars et al., 2010). Additional evidence also indicates a relationship between lower pragmatic ability and peer difficulties (St Clair et al., 2010).

Research hypothesis 4: During peer interaction, children with identified behavioural, emotional and social difficulties will vocalise more but engage in fewer conversational turns during peer social interaction than typically developing children. This hypothesis is derived from LENA evidence discussed in Chapter 4 (p. 65), which suggests that children who have difficulty with social communication and interaction engage in fewer conversational turns and have longer durations of speech than typically developing children (Warren et al., 2010). Similar characteristics including longer durations of speech, increased talkativeness, verbosity, and slower responses in conversation are also reported in studies coding the language of children with behaviour or language difficulties (Albert and van der Meere, 2003; Redmond, 2004; Adams and Lloyd, 2007) (Chapter 4).

The four research hypotheses outlined above will be tested by three research enquiries. These enquiries will each incorporate two chapters, a chapter detailing methodology and a chapter presenting relevant results. The three enquiries will pertain to the following aspects of the research:

- Enquiry One: Group comparisons of reported behaviour and language/communication difficulties.
- Enquiry Two: Group comparisons of observed and coded behaviour, language and communication difficulties.
- Enquiry Three: Descriptive exploration of peer interaction in a series of case studies of child dyads.

As stated above, additional exploratory research questions and supplementary aims will be outlined in the following methods chapters.

Chapter 7. Study Participants and Research Enquiry One Method

In this chapter, the research design, the characteristics of participants and schools, and recruitment and ethical procedures of the study are presented. These aspects relate to the overall study. As was stated at the end of Chapter 6, investigations are split into three research enquiries. The first research enquiry presents the methodology employed for group comparisons on behaviour reports (SDQ) (Goodman, 1997) and language/communication reports (CCC-2) (Bishop, 2003). This will be followed by the results of this enquiry. The second enquiry presents the methodology used to explore group comparisons on LENA and Observer coding systems, followed by enquiry results. A third and final enquiry describes the methodology used to explore the qualitative descriptive elements of the peer interaction of a case series of six pairs of children, followed by the case study findings. Individual methodology and results relating to these three research enquiries will be presented in subsequent chapters. Within each enquiry, the research hypotheses stated in Chapter 6, and exploratory research questions, will be addressed.

7.1 Overall Study Design

The overall study is a two group observation comparing young children with teacher-identified behavioural, emotional and social difficulties with typically developing matched peers on behaviour, language and communication difficulties.

7.1.1 *Schools and participants: target sample size*

To calculate appropriate sample size, Cohen's *d* effect size (Cohen, 1992) was referenced. Cohen's *d* calculates the standardised mean effect. Effect size represents the *magnitude* of an effect. Study power may also be considered alongside effect size and is incorporated into the calculation of sample size. This refers to the power of a study to detect an effect, which most commonly is set at 80%. For studies using t-tests, the sample size necessary for 0.8 power and an effect size of 0.5 (a moderate effect) is suggested as 26 per group (52 children in total).

7.1.2 *Schools and participants: total sample size recruited*

The total number of children included in the final study was 40, recruited from seven schools. Therefore, the current study is underpowered, creating an increased chance of a Type II error; failure to detect an effect that is present. Children were split into two groups; 20 were categorised as having behavioural, emotional and social difficulties (BESD), and 20 were typically developing (TD) children. English was the primary spoken language of all the children.

The study was under-recruited as a result of the drop-out of two recruited schools. Nine schools were initially approached and agreed to take part with the aim of recruiting 3–4 children for each group (BESD/TD) per school. This would enable the recruitment of enough children to match the power calculation while also allowing for any attrition (providing a minimum of 54 children in the study). Furthermore, the recruitment of 3–4 children per group per school meant observations could comfortably be completed in one day in each school, meaning less disruption for the school. Of these nine schools, one subsequently declined to take part and became uncontactable. A second school, after receiving project information and agreeing to take part, subsequently reported no children on its SEN register that matched the inclusion criteria. Owing to project time constraints as well as school timetables and holidays, the inclusion of other schools was problematic, thus leaving the study under-recruited.

7.1.3 *Characteristics of the schools*

Seven schools consented and were included in the final study sample. Children recruited into the study were mainly from socially disadvantaged schools. One school was in the Newcastle Local Education Authority area and six in the North Tyneside Local Education Authority area. Data pertaining to the degree of area deprivation, proportion of special educational need and free school meals relative to the local area and England are reported in Table 7. Area deprivation was established using the Index of Multiple Deprivation (IMD) described in Chapter 1 (p. 6).

School (most deprived–least deprived)	*% SEN Statement or School Action Plus*			*% Free School Meals*		
	School	Local Area	England	School	Local Area	England
1*	8.1	5.6	8	64.5	29.5	19.2
2**	16.6	8.7	8	42.9	21.1	19.2
3**	12.2	8.7	8	40.6	21.1	19.2
4**	13.7	8.7	8	30.2	21.1	19.2
5**	12.7	8.7	8	27.6	21.1	19.2
6**	9.8	8.7	8	33.6	21.1	19.2
7**	9	8.7	8	3.8	21.1	19.2

Table 7: Degree of deprivation, proportion of special educational needs and free school meals of each school recruited in comparison to local area and England statistics. (Data taken from DfE, 2011c).

* Newcastle Local Authority, ** North Tyneside Local Authority.

The data presented in Table 7 show that schools included in the final sample were relatively disadvantaged in comparison to their local authority area and England in terms of their proportions of SEN and FSM, but with a degree of variability among them. School selection criteria were, therefore, met. This is further supported by their IMD decile. Out of the six schools recruited from within the North Tyneside Local Authority, three of these are considered to be within the 20% most deprived areas of England, two are in the 30–40% most deprived, and one is in the 50–60% most deprived (meaning it is the least deprived in comparison to the others). The one school recruited in the Newcastle Local Authority area was ranked as being in one of the 10% most deprived areas of England.

7.1.4 *Characteristics of the children*

Characteristics of the two groups of children are displayed in Table 8. For the purposes of research enquiries two and three in which children are paired, their characteristics are presented in these numbered pairs in the table.

Pair number	*Children's age in years and months and gender (Male/Female)*			
	BESD group		*TD group*	
1	5.10 years	M	6.1 years	M
2	5.8 years	F	5.9 years	F
3	6.0 years	M	6.4 years	M
4	5.2 years	M	5.1 years	M
5	5.10 years	M	6.1 years	M
6	4.4 years	M	4.5 years	M
7	6.6 years	M	6.5 years	M
8	6.10 years	M	6.5 years	M
9	6.1 years	F	6.7 years	F
10	6.0 years	M	5.11 years	M
11	7.9 years	M	7.5 years	M
12	6.7 years	M	6.3 years	M
13	9.1 years	M	9.3 years	M
14	4.6 years	M	5.0 years	M
15	5.10 years	M	5.10 years	M
16	6.6 years	M	6.8 years	F
17	7.3 years	M	6.9 years	F
18	4.11 years	F	5.2 years	F
19	5.11 years	M	5.8 years	M
20	6.10 years	M	6.6 years	M

Table 8: Age and gender of each child in each group, and their corresponding pair number (enquiries two and three).

The BESD group of children consisted of 17 males and 3 females. In this group the children were aged between 4 years and 4 months and 9 years 1 month.

The TD group of children consisted of 15 males and 5 females. The TD children were aged between 4 years 5 months and 9 years 3 months.

The mean age of the two groups was 75.3 months (6.3 years). Nineteen out of the total of 20 BESD group children were on school special educational needs (SEN) registers, and none of the TD group children were on SEN registers. One child was referred to the study because of parent concerns about her behaviour, primarily that she experienced internalised, emotional symptoms; however she was not on the school SEN register. This child was included in the BESD group and their inclusion was later confirmed by behaviour assessment (discussed in results, Chapter 8).

7.1.5 *Group categorisation*

Categorisation of children in the BESD group was based on criteria provided to school Special Educational Needs Co-ordinators (SENCO) and class teachers. These criteria specified the selection of children who presented *one or more* of the following difficulties:

- Persistent disruptive externalising behaviour in school.
- Difficulties interacting and engaging with peers (e.g. problematic peer relationships).
- Difficulty with hyperactivity and attention.
- Problematic externalising behaviours such as aggression or conduct difficulties.
- Children with internalised emotional difficulties (e.g. heightened levels of anxiety).

These characteristics are in line with existing educational guidance of BESD and the definition adopted by the current project (Chapter 2). Within each school it was specified to the SENCO and teacher that the project aimed to recruit children who were not clinically diagnosed with disorder, yet their difficulties were persistent and problematic enough to warrant attention from educational services, teachers or parents. Therefore, it is likely that children whose problems were above the clinical threshold (more severe) would have already been clinically identified. Study participants' difficulties therefore existed on a dimension with a threshold for clinical identification. Targeted participants were those whose difficulties lay within a 'sub-clinical' range (defined in Chapter 1, p. 13).

The SENCO and teacher were asked to select children on this sub-clinical basis and if they met one or more of the criteria listed above. For the children selected, they were asked to indicate which criterion points each child met and this was noted down by the researcher. It was possible that children in the BESD group could meet one, two, three, four or all five behaviour inclusion criteria outlined above. All children in the BESD group met one or more inclusion criteria of behaviour characteristics. Table 8 shows the number of behaviour criterion points met by the BESD group children. Table 9 shows the proportion of children in the BESD group who met each criterion.

Number of behaviour criterion points met	*1*	*2*	*3*	*4*	*5*
% of BESD group	15	15	40	10	20

Table 9: Number of inclusion criterion points met by the BESD group.

Criterion met	*Disruptive behaviour*	*Peer difficulties*	*Hyperactivity and attention*	*Externalising behaviour*	*Emotional difficulties*
% of BESD group	90	35	80	85	30

Table 10: Proportion of BESD group children that met each inclusion criterion.

Tables 9 and 10 indicate the heterogeneity of the BESD group in terms of their behaviour profiles as the majority of the group met three different behaviour criterion points for inclusion in the study. As the BESD group children were selected because their difficulties lay within a sub-clinical range they do not have a primary diagnosed disorder; their difficulties are less specified, and this is reflected in the considerable overlap between types of difficulty displayed in Table 10. It is important to note that although it was specified to each SENCO and teacher that the project aimed to recruit children without a clinical diagnosis; this was deviated from in the case of four children. It is speculated that this was the result of misunderstanding during the delivery of criteria specification; in addition, diagnoses were not disclosed to the researcher until testing had begun. One child had Autism Spectrum Disorder, one had Attention Deficit Hyperactivity Disorder, and two had Learning Disability. Despite this it was decided that these children would be included in the study as the main reason for their identification by teachers was that their behaviour characteristics matched educational definition of BESD.

The typically developing group were categorised as children who had no known difficulties with behaviour or language/communication and were therefore considered to have ‘typical’ or ‘expected’ developmental ability (selected by teachers; procedure outlined below).

7.1.6 *Recruitment*

Schools were selected for participation on the basis of their level of area deprivation according to the English Index of Multiple Deprivation decile (IMD decile) (Northumberland Indices of Deprivation, 2010). This indicates the degree of deprivation of the area each school is situated in in relation to England as a whole, and the proportion of children receiving free school meals. As indicated in Chapter 1 (p. 6), area deprivation and free school meal rates are indicative of higher rates of Special Educational Needs (SEN); therefore, children with behavioural, emotional and social difficulties are more likely to be found in areas with more deprivation.

Each school was initially contacted by an email to the head teacher. This email included background information about the project via an attached information sheet (Appendix I). This information stated that the study aimed to investigate the communication behaviours of children aged between 4 and 9 years with behavioural, emotional and social difficulties. It advised what participation would involve and asked whether schools would be willing to take part in the project. For those schools which agreed to take part, a meeting was arranged between the researcher, the Special Educational Needs Co-ordinator and a class teacher who taught children aged between 4 and 9 years (those who would be included in the project). The aim of this meeting was to inform the SENCO and teacher about child recruitment criteria outlined above, which were used to identify suitable children for the project.

Initially, children who were on the school’s behaviour register were considered for inclusion as these were children whose difficulties had warranted attention from educational services, teachers or parents. The SENCO and teacher then identified any other children who were not on the behaviour register but who presented with difficult behaviour or behaviour concerns and might be approached for recruitment. Only parents of children who were aware of their child’s behaviour difficulties (primarily the parents of children on the school behaviour register) or parents aware of the SENCO concerns for their child were invited to take part. No children were included in recruitment whose parents were unaware of their behaviour difficulties.

Once children were identified as having characteristics of BESD, the school was asked to distribute information letters and consent forms to the parents of these children (Appendix J). It was necessary for parents to provide their consent by returning a signed and dated consent form to the school before their child could be considered recruited into the study.

In each school typically developing children were selected from the same class of the confirmed BESD group children (whose parents had provided consent). Selection of the TD children was carried out by class teachers who were asked to identify a handful of children in the same class, of the same gender and of similar language ability as the recruited BESD group child. These were children who had no known difficulties with behaviour and were not on the schools SEN register. Aiming to match groups of children on age, gender and language ability was necessary for creating BESD/TD pairs of children for research enquiries 2 and 3 (this will be described in more detail in these enquiries). The parents of typically developing children were also invited to take part through an information letter and consent form (see Appendix K). Parents of typically developing children were required to sign and date the consent form and return it to the school for their child to be recruited into the study. Consent forms were collected from each school by the researcher. At this point, they were initially grouped into either the BESD or TD group on the basis of identification by the teacher. Children were then assigned a unique ID code and their ID, age, gender and school details were placed onto a project Excel spreadsheet.

7.1.7 *Ethical procedures and permissions*

Ethical permission for the project was granted in April 2011 by Newcastle University. Primary ethical concerns within the project included ensuring written consent from parents was obtained for recruitment to the study, and ensuring confidentiality of data. Written consent was obtained from all parents using an ‘opt-in’ consent form (Appendices J and K). To ensure confidentiality each child recruited was assigned a unique ID code. These ID codes were assigned to video data and LENA audio data for all children and in a raw data spreadsheet and SPSS statistical spreadsheet. Since it was necessary for parents and teachers to complete report measures of children’s behaviour and language, these were not coded by ID number; however, once they were inputted onto the SPSS data spreadsheets, children’s names were changed to their ID codes.

7.2 Methodology: Group Comparisons of Reported Behaviour and Language/Communication Difficulties

7.2.1 *Aims*

The initial enquiry into the language and behaviour of children recruited into the study addressed research hypotheses 1, 2 and 3 outlined in Chapter 6. It included two main aims. First, enquiry 1 was carried out with the aim of investigating differences in reported ability in both domains between the BESD group and the TD group. This includes confirming children's categorisation into the BESD or TD groups, which is defined below, and statistical investigation of group differences in reported behaviour and language. An exploratory research question is outlined in relation to group differences in reported behaviour (p.96). Secondly, this enquiry aimed to explore the relationship between language and behaviour through examination of correlations between scores on both parent-reported language and teacher-reported behaviour. This investigated whether severity of behaviour was related to severity of language and communication difficulty, and whether particular areas of behaviour and language may be related to each other. This part of the enquiry also looked at the proportion of comorbidity, within the children in the sample, of behaviour and language difficulties.

7.2.2 *Design*

A between-groups comparison was used to explore differences in reported behaviour and language abilities between the BESD group and TD group of children.

7.3 Materials

Measurement materials included in this enquiry were identified through the review of commonly used techniques in Chapter 4.

7.3.1 *Strengths and Difficulties Questionnaire (SDQ)*

The SDQ (Goodman, 1997) provides report data on children's behaviour. It is a behavioural screening questionnaire chosen to be included because of its relevance to the project's research domain (behaviour) and applicability to the research population (it may be used with children aged 4–16 years). As was presented in Chapter 4, the SDQ has good reliability and validity, with an internal consistency of .73, an inter-rater correlation mean of 0.34, and test–

retest stability mean score of 0.62. High SDQ scores above the 90th percentile that represent behaviour difficulties are strong predictors of children receiving an independent clinical diagnosis (Goodman, 2001). The SDQ was employed as a means of gathering information about each child's behaviour within a school context; therefore, it was completed by teachers to maintain context relevance to where the children were assessed on their communicative interactions (within school with a peer). It measures behaviour within the domains of emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and pro-social behaviours. Scores are categorised into 'Normal' 'Borderline' or 'Abnormal' in relation to their severity. 'Normal' indicates behaviour is within the normal range and is unlikely to be clinically significant. 'Borderline' indicates difficulties are slightly raised and may reflect clinically significant problems. 'Abnormal' indicates a high substantial risk of clinically significant problems. Table 11 displays the cut-off criteria for SDQ scores in each behaviour domain indicating categorical severity.

SDQ Domain	*Normal*	*Borderline*	*Abnormal*
Total Difficulties	0–11	12–15	16–40
Emotional Symptoms	0–4	5	06–10
Conduct Problems	0–2	3	04–10
Hyperactivity	0–5	6	07–10
Peer Problems	0–3	4	05–10
Pro-social Behaviour	0–10	5	0–4

Table 11: Criteria for SDQ scores indicating categorical severity of behaviour.

7.3.2 *Exploratory research question relating to group differences in reported behaviour*

As a consequence of the child selection criteria presented above (p. 91), it was expected that group differences in behaviour would be found and that SDQ data would therefore confirm children's categorisation into the BESD group. This expectation may be corroborated by examining group differences in severity of behaviour difficulties and reported characteristics of behaviour difficulties.

Exploratory research question: Which characteristics of behaviour are reported as most problematic for children in the BESD group, and therefore show the strongest differences *between groups?* As multiple externalising and internalising behaviour characteristics are frequently reported in children with BESD (described in Chapters 1 and 2), it may be interesting to explore which of the behaviour subscales of the SDQ are most frequently reported by teachers as problematic in the BESD group.

7.3.3 *Children's Communication Checklist-2 (CCC-2)*

The CCC-2 (Bishop, 2003) is a parent or teacher report measure of speech and language developed to identify communication strengths and difficulties in children. As was presented in Chapter 4, the CCC-2 has variable reliability and validity with internal consistency reliability ratings based on Chronbach's alpha ranging from .65 to .80 indicating poor to good reliability, and inter-rater reliability (between parents and teachers), measured in terms of Pearson's intra-class correlation coefficient, ranging from .16 to .52, indicating poor to good agreement between raters (Bishop, 2003). It has been shown to be useful for identifying children who have language impairment or pragmatic impairment and those who may warrant assessment for ASD (Norbury et al., 2004). The CCC-2 was employed in this project as a way of controlling the possible effects language ability might have on outcome measures of communicative interactions, as well as a means of exploring behaviour and language difficulty associations at the reported level. It was deemed an appropriate measure owing to its relevance to the focus of the current research (language and communication), and its applicability to the target population (children aged between 4 and 9 years).

The checklist contains 70 'items' which are statements about children's communication. An adult scores each item on the basis of frequency of occurrence, '0' referring to less than once a week, '1' referring to at least twice a week, '2' to once or twice a day, and '3' to several times (more than twice) a day (or always). These 70 items are divided into 10 subscales relating to different areas of language and communication ability. Each subscale has seven items (five address difficulties and two address strengths). Each subscale produces a raw score, which is then converted into a standard score. The subscales are divided into related areas of language and communication. Subscales, examples of subscale items and their categories are displayed in Table 12.

Subscale	*Description*	*Example*	*Area addressed*
A: Speech	Articulation, intelligibility, fluency	Pronounces words in a babyish way…	Form, content (articulation, phonology, structure, vocabulary and discourse)
B: Syntax	Ability to produce grammatically correct utterances using	Gets mixed up between 'he' and 'she'…	
C: Semantics	The meaning of words, expression of meaning	Makes false starts and gropes for words…	
D: Coherence	Making sense in a conversation	Talks clearly about what s/he plans to do in the future…	
E: Initiation	Appropriate initiations, starting topics about reciprocal interests, talking too much	Talks repetitively about things that no-one is interested in…	Pragmatics
F: Scripted Language	Use of learned language or phrases, unusual prosody	Says things s/he does not fully understand…	
G: Context	Understanding social rules of conversation including humour, sarcasm, politeness	Misses the point of jokes or puns…	
H: Non-verbal communication	Understanding and use of facial and body gestures in communication	Does not look at the person s/he is talking to…	
I: Social Relations	Social relationships with others	Is left out of joint activities by other children…	Behaviours commonly impaired in children with ASD
J: Interests	Specific, restricted interests the child has	Talks about lists of things s/he has memorised…	

Table 12: CCC-2 subscales, examples of subscale items and their associated language/communication domain.

The checklist provides two main composite scores; General Communication Composite (GCC) (an indication of overall language ability) and Social Interaction Deviance (SIDC) (indicating nature of impairment). SIDC score relates to children who have a GCC score below 55, which indicates marked communication impairment. A negative SIDC score shows the child has disproportionate social and pragmatic difficulties in relation to structural language ability (defined in Ch. 1, p. 4). A SIDC above zero indicates the child has difficulty with structural aspects of language. It is recommended that SIDC scores are only considered alongside GCC scores below 55. Alongside these composite scores, the subscale scores may be grouped to report upon language form and content, 'Structural' language characteristics (Scales A–D), 'Pragmatic' language (scales E–H) and 'Social Relations and Interests' (scales I and J). The assessment also provides percentile scores for comparison to other children. The CCC-2 has normative data (Bishop, 2003) which provides means and standard deviations for each subscale and composite scale for comparison to the current sample. Table 13 displays these normative values.

CCC-2 Domain	*UK Normative Mean*	*Standard Deviation*
General Communication Composite (GCC)	80	24
Pragmatic Composite	36.3	9.5
Structural Composite	39.9	9.53
All Subscales	10	3

Table 13: CCC-2 normative mean and standard deviation scores (Bishop, 2003).

7.4 Data Collection Procedure

The Children's Communication Checklist-2 and the Strengths and Difficulties Questionnaire presented above were the primary data used in enquiry 1. Once children had been identified to take part in the project and consents had been obtained, the parents of the children in each group were sent a copy of the CCC-2 along with an information letter detailing how to complete it (Appendix L). Within this letter they were also informed that, should they have difficulty completing the CCC-2, it could be arranged for them to complete the report alongside the researcher in school or over the phone. One parent asked to complete the CCC-2 alongside the researcher in school. Completed CCC-2 assessments were returned to the child's school for collection by the researcher. At the same time, teachers of children in each group were given copies of the SDQ and asked to complete it. These were then collected by the researcher. As class teachers were involved in the initial identification of children for inclusion in the project, they were not blind to group allocation. There is therefore a risk of bias in reporting, and this is a limitation to the study to be addressed in the project's final reflections (Chapter 14).

7.5 Data Preparation

Each CCC-2 and SDQ form was marked by the researcher. Data were quantitatively analysed using SPSS Statistics Software Version 21, and so each child's scores were entered onto an SPSS spreadsheet alongside their corresponding ID code. All overall and subscale scores of each report were included in the spreadsheet.

7.5.1 *Distribution of data*

SDQ and CCC-2 scores were initially tested for homogeneity of variance in order to inform appropriate statistical analysis of data. On the basis of the Shapiro–Wilk statistic for normality, it was found that the behaviour and language data of both the TD and BESD groups of children were normally distributed; therefore, the data would be analysed using parametric statistics. Statistical results of this normality test may be found in Appendix G.

7.6 Data Analysis

Analysis for research enquiry one included three phases:

Phase one: Group comparisons of behaviour difficulties. Using SPSS frequency analysis, the proportion of children from both groups that met criteria for each of the three SDQ behaviour categories, 'Abnormal, 'Borderline' and 'Normal', was explored. An Independent Samples t-test was conducted to investigate statistical significance of differences between groups in SDQ total difficulties scores and SDQ subscale scores, computed using group categorisation as the independent variable and SDQ scores as the dependent variable. This analysis addressed the exploratory research question exploring group differences in reported behaviour outlined above (p. 96).

Phase two: Group comparisons of language and communication difficulties: An Independent Samples t-test was conducted to investigate group differences in children's CCC-2 General

Communication Composite (GCC) scores, Pragmatic and Structural language scores (calculated from the sum of their corresponding subscale scores, as defined in Table 11), and group differences in all individual CCC-2 subscale scores. Group membership was included as the independent variable and General Communication Composite scores (GCC), Pragmatic and Structural Language scores and all independent CCC-2 subscale scores were included as the dependant variable. This analysis addressed research hypothesis 1 outlined in Chapter 6.

Owing to the under-recruited sample size, post hoc power was calculated with the program G*Power version 3.1.9.2 (Faul et al., 2007) to explore whether the study had enough power to detect a difference in reported behaviour and language/communication. Together, phases one and two of analysis relate to the first aim of this research enquiry outlined above (p. 95).

Phase three: Exploring the relationship between reported behaviour and language difficulties. To explore the relationship between reported behaviour and language/communication difficulties, overall scores of each report (CCC-2 GCC scores and SDQ total difficulty scores), as well as the subscales within each report from children in both groups, were analysed using Pearson correlation in SPSS. This addressed research hypotheses 2 and 3 outlined in Chapter 6, and related to the second aim of enquiry one, outlined above (p. 95). In addition, the number of children in each group who were reported to have comorbid behaviour and language difficulties, individual language or behaviour difficulties or no difficulties was explored using a crosstab analysis. This information was indicated by report data. Language difficulties were defined by a General Communication Composite score below the normative mean of 80 provided by Bishop (2003). Behaviour difficulties were defined by SDQ total difficulties scores in the 'Borderline' or 'Abnormal' range.

Chapter 8. Results Enquiry One; Group Comparisons of Behaviour, Language and Communication Difficulties

In this chapter, the results for research enquiry one, which explores group comparisons of teacher-reported behaviour (SDQ) and parent-reported language (CCC-2), are presented. Analysis included three phases, as outlined at the end of Chapter 7, and results are presented in accordance with these phases.

8.1 Phase One Analysis: Group Comparisons of Behaviour Difficulties

It was expected that children in the BESD group would have more problematic behaviour difficulties than those in the TD group, and children's group categorisation would be confirmed by teacher-reported SDQ data. Behaviour assessment using the SDQ was collected for 39 out of the total 40 children (one was missing from the TD group owing to the teacher failing to complete it). The number of children from both groups whose total difficulties scores met each of the three severity categories, 'Abnormal, 'Borderline' and 'Normal', is displayed in Table 14. Criteria for categorical cut-off points may be found in Chapter 7, Table 11, p. 96.

SDQ Behaviour Severity Category	*TD (n = 19)*	*BESD (n = 20)*
Abnormal	0	12
Borderline	2	6
Normal	17	2

Table 14: Number of children from each group who met each SDQ total difficulties score categorisations.

Not surprisingly, as children were selected for group categorisation on the basis of their behaviour difficulties, there are striking group differences in severity of behaviour. Teacher-reported SDQ data further confirm children's allocation to either the TD or the BESD group. The majority (60%) of children in the BESD group had total behaviour difficulties scores in the 'Abnormal' range, while 30% had 'Borderline' difficulties. The 10% of children in the BESD group whose scores were in the 'Normal' range equates to two children; one of these was the child who was not on the school's SEN register and was identified via parental concerns, and another child scored 'Abnormal' only on the pro-social behaviour scale, which does not contribute to (and therefore was not picked up by) the total difficulties score. These two children were kept in the final sample as their difficulties were considered relative to behavioural, emotional and social difficulties. The child who was referred by parental concern was reported to have difficulty with emotion, and this was reflected in their SDQ results, with a score in the 'Abnormal' range for emotional symptoms. The child with an abnormal score on the pro-social scale of the SDQ is therefore indicated as having difficulty with positive social behaviour. As an educational definition of behavioural, emotional and social difficulties was adopted for child identification, it was felt that the emotional and social difficulties observed in these children were applicable to current BESD group inclusion criteria.

As expected, the majority (89%) of TD children had total difficulties scores that fell in the 'Normal' range. The 10% of children in the TD group whose total behaviour difficulties score fell in the 'Borderline' range equates to two children, and this may be evidence of unidentified difficulties.

8.1.1 *Statistical analysis of teacher-reported behaviour*

As multiple tests were carried out (6) by testing the outcome of two groups on six factors, Bonferroni alpha adjustment was applied, α 0.05/6 = 0.008, and so results were considered significant at this 0.008 level. Post hoc power was calculated using this alpha correction. It should be noted that higher scores on the SDQ subscales and total difficulties score (with the exception of the pro-social scale) represents greater difficulty with behaviour. An exploratory research question was included in this analysis, exploring which areas of behaviour were reported as most problematic for children in the BESD group, and showed the strongest differences in behaviour between groups. Table 15 displays the results of statistical analysis of teacher-reported behaviour.

SDQ scale Standard deviation (SD) Range	*Abnormal range*	*TD mean (n=19)*	*BESD mean (n=20)*	*t*	*df*	*p*	*Effect size Cohen's d*	*Post hoc power %*
SDQ Total SD Range	16–40	4.53 (4.26) 0–14	18.35 (7.02) 8–35	7.475	37	.000	-2.38	99
Emotional Symptoms SD Range	6–10	2.11 (1.94) 0–6	2.95 (3.23) 0–10	0.994	37	.328	-0.32	16
Conduct Problems SD Range	4–10	0.68 (1.73) 0–7	4.65 (2.03) 1–9	6.538	37	.000	-2.11	99
Hyperactivity SD Range	7–10	2.05 (2.63) 0–10	7.80 (2.26) 4–10	7.322	37	.000	-2.35	99
Peer Problems SD Range	5–10	0.95 (1.35) 0–4	2.95 (2.01) 0–7	3.627	37	.001	-1.17	94
Pro-social Behaviour SD Range	0–4	9.05 (1.12) 6–10	3.60 (2.95) 0–9	-7.705	37	.000	2.44	100

Table 15: Results of statistical analysis of group differences in teacher-reported behaviour.

Data indicate two key outcomes, the first being that children in the BESD group were rated as having significantly greater behaviour difficulty than children in the TD group with regard to overall behaviour difficulties, conduct problems, hyperactivity, peer problems and pro-social behaviour. Only the emotional symptoms scale was non-significant between groups. These areas of behaviour are each frequently reported problems for children with BESD. Analysis therefore addresses the exploratory research question as to which areas of behaviour are reported as most problematic for children in the BESD group. Secondly, mean scores of the BESD group may be considered in the 'lower abnormal' range as they are relatively close to the score margin between 'Abnormal' and 'Borderline' categories. This is apparent for all scales with the exception of emotional symptoms and peer problems where children score in the 'Normal' range. These low abnormal scores further support that children's difficulties lie within a 'sub-clinical' range, as suggested and defined in Chapter 1 (p. 13). They are likely to be more typical of children with behaviour difficulties within mainstream schools; problems are not severe enough to warrant a clinical diagnosis, yet they are persistent enough to be recorded on school behaviour registers.

Despite children being distinctly different in particular areas of behaviour, the range of SDQ scores is indicative of the existence of overlap of difficulties between groups. Most noticeably, there is a much greater range of SDQ total difficulties scores in the BESD group, which is also reflected in larger standard deviation scores. This suggests children in the BESD group did not *all* have the same degree of difficulty with behaviour, but that there was variability in degree of difficulty, and some children's scores overlap with TD children's scores. Overlap between groups is apparent not only on total difficulties but all subdomain scores. Score ranges from both groups appear to often extend into the 'Borderline' or 'Abnormal' range for degree of difficulty. Therefore, while significant group differences are found in certain areas of behaviour, it is also important to note that there are some children in the TD group scoring high on difficulties, and some children in the BESD group scoring low on difficulties within their group, creating a 'middle ground' area of difficulty.

Where there is a non-significant result for emotional symptoms, $t(37) = 0.994$, $p = .328$, magnitude of effect is smaller than other variables of behaviour ($d = -0.32$) and post hoc power analysis reveals that the power was low at 16% to detect a group difference on this subscale.

8.2 Phase Two Analysis: Group Comparisons of Language and Communication Difficulties

The second phase of the analysis was a group comparison of children's language and communication difficulties using parent-reported CCC-2 scores. It was hypothesised in Chapter 6 that the BESD group of children would score more poorly on language and communication ability than children in the TD group, as measured by parent-reported CCC-2 data (Bishop, 2003). In addition, they would have pragmatic and structural language difficulties, and there would be more than one subdomain of language and communication reported as problematic for these children in the BESD group. Parent-reported language assessment was collected for 35 out of 40 children. Seventeen of the 20 BESD group children had CCC-2 data and18 of the 20 TD group children had CCC-2 data (missing data owing to unreturned CCC-2 forms from parents).

8.2.1 *Statistical analysis of parent-reported language*

As multiple tests (13) were carried out by testing the outcome of two groups on thirteen factors, Bonferroni alpha adjustment was applied, α 0.05/13 = 0.003, and so results were considered significant at this 0.003 level. Post hoc power was calculated using this alpha correction. In contrast to the SDQ assessment, higher scores represent greater language competence. Table 16 displays the outcome of statistical analysis of reported language and communication, and includes descriptive data for each group and standardised data for comparison reported by Bishop (2003).

CCC-2 scale *Standard deviation (SD)* *Range*	*Normative UK mean*	*TD mean (n=18)*	*BESD mean (n=17)*	*t*	*df*	*p*	*Effect size Cohen's d*	*Post hoc power (%)*
GCC SD Range	80 (24)	88.44 (13.41) 61–114	62.47 (27.50) 14–96	-3.513	33	.002	1.20	93
Pragmatic composite SD Range	36.3 (9.50)	45.78 (9.66) 30–67	32.94 (13.02) 11–49	-3.302	33	.002	1.12	89
Structural composite SD Range	39.9 (9.53)	43.78 (8.15) 29–56	29.12 (14.92) 3–49	-3.578	33	.001	1.21	93
Speech SD Range	10 (3)	11.00 (2.72) 6–14	6.59 (4.28) 0–13	-3.656	33	.001	1.13	90
Syntax SD Range	10 (3)	10.11 (3.02) 4–13	6.06 (3.84) 0–12	-3.473	33	.001	1.17	91
Semantics SD Range	10 (3)	10.72 (3.02) 7–16	8.59 (3.75) 1–14	-1.855	33	.073	0.63	43
Coherence SD Range	10 (3)	11.22 (2.79) 6–14	8.06 (3.94) 1–15	-2.749	33	.010	0.93	76
Inappropriate initiation SD Range	10 (3)	11.11 (3.06) 6–17	8.65 (3.25) 4–17	-2.305	33	.028	0.77	59
Stereotyped SD Range	10 (3)	11.22 (2.51) 6–14	8.24 (3.96) 2–14	-2.681	33	.011	0.90	73

Context SD Range	10 (3)	11.78 (3.37) 6–17	8.24 (3.99) 1–16	-2.842	33	.008	0.95	77
Non-verbal SD Range	10 (3)	10.89 (2.63) 6–14	7.12 (3.82) 1–14	-3.416	33	.002	1.15	90
Social SD Range	10 (3)	11.11 (2.47) 5–13	6.12 (3.68) 0–13	-4.730	33	.000	1.60	99
Interests SD Range	10 (3)	11.56 (3.31) 6–17	9.59 (3.77) 4–17	-1.641	33	.110	0.55	35

Table 16: Results of statistical analysis exploring group differences in parent-reported CCC-2 scores.

Parent-reported language data also indicate 2 key outcomes; children in the BESD group were rated as having significantly greater language and communication difficulty than children in the TD group with regard to general language and communication competency (GCC), pragmatic language ability and structural language ability. These group differences in composite scores are also reflected in group differences in the subscales of language and communication; the BESD group were rated as significantly poorer than the TD group in the areas of speech (intelligibility and fluency in speech), syntax (grammatically correct utterances), non-verbal communication (understanding gestures) and social relations (difficulty with social relationships). The research hypotheses outlined above are therefore accepted.

Secondly, normative mean and standard deviation scores provided by Bishop (2003) allow for the comparison of group scores with the general population. In comparison to UK norms, the BESD group were rated as having below-average language and communication and the TD group were rated as having above-average language and communication. Notably large standard deviation of GCC scores in the BESD group relative to the TD group indicates greater variation in ability in the BESD group than in the TD group. However, mean general communication, pragmatic and structural composite scores of the BESD group lie within or around one standard deviation of the normative mean for these composites. This is also apparent in mean scores for the BESD group across the majority of language subscales. Important to note, these 'low-average' scores do not represent disorder or deficit in the BESD group of children; rather, these children are reported to have greater difficulty with language and communication than their typically developing peers.

Observing the different ranges of language scores across the two groups also indicates overlap of difficulties between groups. Despite maximum range values being noticeably greater in the TD group for composite language and communication scores, they remain comparable to the range values in the BESD group. Minimum score values of the BESD group in composite scores are much smaller than those of the TD group, indicating that some children were reported to have very poor language and communication ability in comparison to other children. However, overlap between groups is apparent on all language scales. Therefore, while significant group differences are found in certain areas of language and communication, observation of the ranges of scores indicates that there are some children in the BESD group scoring around average or above average for language and communication ability. This indicates a 'middle ground' area of average ability which is shared by children in both groups.

On the basis of Bonferroni alpha correction, the following CCC-2 scales were considered to be non-significant between groups: Semantics, Coherence, Inappropriate Initiations, Stereotyped language, Context, and Interests. For these scales, corresponding effect sizes and post hoc power indicate magnitude of effect and whether the study was underpowered to detect a difference. Effect sizes (*d*) for these scales range from 0.55 to 0.95. Therefore, these may be considered as all medium to large effect sizes, and they suggest that there is potential for a substantive significant difference between groups on these CCC-2 scales. Post hoc power for these scales ranges from 35% to 76%. The lowest power is associated with the Interests and Semantics scales (35% and 43% respectively). Therefore, the study is notably underpowered on these scales to detect a group difference. The Inappropriate Initiations scale has slightly greater (but still below ideal) power (59%); therefore, the study may also be considered as underpowered for this scale. Stereotyped and Coherence scales had greater power to detect a difference (73% and 76%); however, the application of conservative Bonferroni correction meant that t-test results for these scales were not considered to represent significant group differences. Selecting specific areas of language to test may improve detection of group differences as alpha correction for multiple testing would not be needed.

8.3 Phase Three Analysis: Exploring the Relationship between Reported Behaviour and Language/Communication Difficulties

The third analysis phase of this research enquiry explored the relationship between language and behaviour difficulties. This included two explorations; a Pearson correlation to correlate overall and subscale scores of each report (CCC-2 GCC scores and SDQ total difficulties scores) taken from both groups of children, and a crosstab of the number of children in each group who were reported to have comorbid behaviour and language difficulties, individual language or behaviour difficulties, or no difficulties.

8.3.1 *Pearson correlation of SDQ and CCC-2 scores*

It was hypothesised in Chapter 6 that there will be a relationship between reported behaviour and language difficulty, however the degree of and direction of a correlation between scores would be difficult to predict based on existing data. Out of all the 40 children, 34 (17 in each group) had completed SDQ and CCC-2 data. As reported above, CCC-2 data were missing for five children and SDQ data missing for one child. A Pearson correlation to investigate relationships between reported behaviour and language was therefore carried out on data from these 34 children. The pattern of correlation is shown in Figure 1.

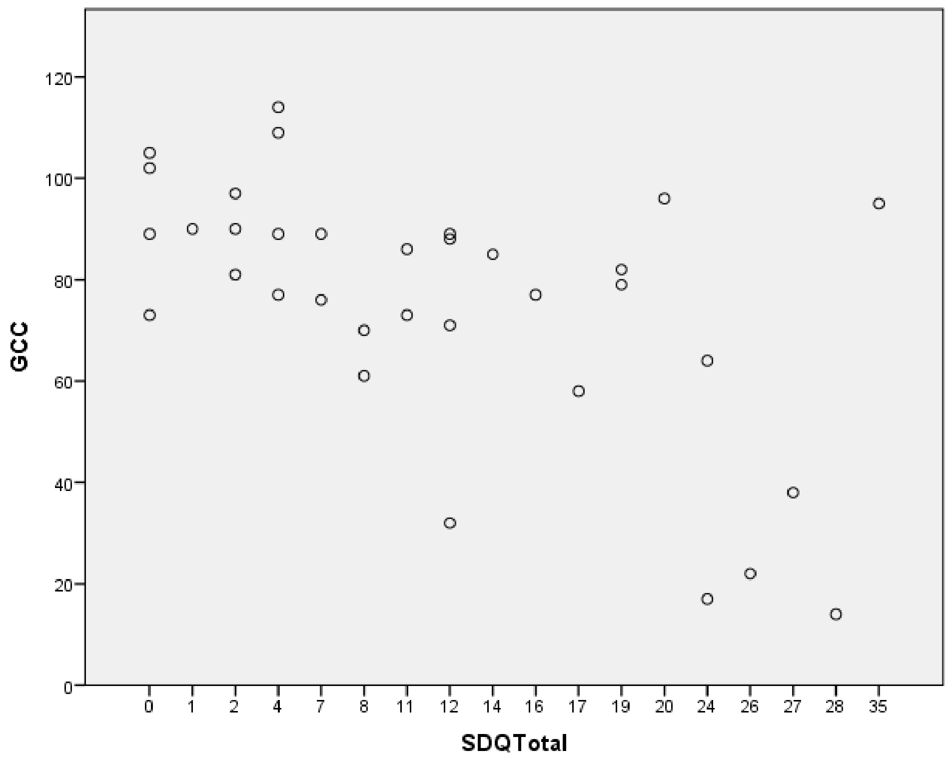

Figure 1: Correlation results of reported behaviour and language scores.

The correlation result showed a significant negative correlation between teacher-reported SDQ total difficulties scores and parent-reported General Communication Composite scores in all children ($r = -.573$, $p = .000$). This indicates that higher scores on the SDQ total difficulties scale (representing poorer behaviour) were associated with lower General Communication Composite language scores on the CCC-2 (representing poorer language and communication ability).

8.3.2 *Correlations of subscales*

It was hypothesised that pragmatic aspects of language (as measured by the CCC-2 report) would be associated with peer problems and pro-social behaviour, behaviour that is externalising in nature (as measured by the SDQ). Subscale factors of language and behaviour from the CCC-2 and SDQ reports were explored for associations with each other using Pearson correlation analysis. CCC-2 language factors included speech, syntax, semantics, coherence, inappropriate initiations, stereotyped language, context, non-verbal language, social relations and interests. SDQ behaviour factors included emotion, conduct, hyperactivity, and peer and pro-social behaviour. As multiple language and behaviour factors were being correlated (50 in total), Bonferroni alpha adjustment was applied, α 0.05/50 = 0.001, and so correlations were considered significant at this 0.001 level. Table 17 reports the correlations between each of the language and behaviour factors along with their significance levels.

Subscale	*Emotion*	*Conduct*	*Hyperactivity*	*Peer*	*Pro-social*
Speech	-.215	.138	-.296	-.373	.228
Sig.	.407	.597	.248	.141	.379
Syntax	-.145	.130	-.423	-.311	.059
Sig.	.578	.619	.090	.224	.822
Semantics	-.314	.249	-.132	-.320	.139
Sig.	.220	.335	.613	.211	.594
Coherence	-.563	.069	-.266	-.667	.244
Sig.	.019	.793	.302	.003	.346
Inappropriate Initiation	-.381	-.034	-.212	-.521	.191
Sig.	.132	.898	.414	.032	.463
Stereotyped Language	-.224	.252	.021	-.485	-.141
Sig.	.386	.329	.937	.048	.589
Context	-.167	.107	-.332	-.237	.010
Sig.	.527	.683	.193	.361	.969
Non-verbal	-.350	.359	-.029	-.467	.045
Sig.	.168	.157	.912	.059	.862
Social Relations	-.583	-272	-.464	-.724	.416
Sig.	.014	.291	.061	**.001***	.097
Interests	-.107	.198	-.300	-.197	.042
Sig.	.682	.453	.242	.449	.874

Table 17: Correlations between CCC-2 and SDQ subscales.

*Significant at the 0.001 level.

Results indicated one significant negative correlation between social relations and peer behaviour problems ($r = -.724$, $p = .001$). Therefore the hypothesis is not supported as no pragmatic subscales of the CCC-2 were found to be related to social behaviour. Negative correlations between behaviour and language indicate that higher scores on SDQ subscales (poorer behaviour) are related to lower scores on corresponding language subscales (poorer language). The social relations subscale refers to the child's social relationships including the child talking about his or her friends and showing interest in what they do. Therefore, it is perhaps to be expected that these children who have poor social relation communication have poorer peer-related behaviour skills. While this finding of only one significant correlation may seem to contradict the correlation between overall behaviour difficulty and language difficulty indicated above (more correlations between subscales might be expected), the application of the more conservative Bonferroni correction has reduced the number of correlations considered to be significant and meaningful.

8.3.3 *Comorbidity of behaviour and language*

Teacher-reported behaviour and parent-reported language were used to investigate the proportion of comorbid behaviour and language difficulties in children from both groups.

As reported above, 17 children from each group had full SDQ and CCC-2 data; the data in this section therefore relate to those 17 children with complete behaviour and language reports. Table 18 shows the percentage of children in each group with comorbid or individual language and behaviour difficulties split across the two groups.

Difficulty	*TD (n=17)*	*BESD (n=17)*
Comorbid behaviour and language difficulties	0	10
Language difficulties only	5	2
Behaviour difficulties only	2	5
No difficulties	10	0

Table 18: Number of children in each group with each type of difficulty.

Most noticeably, proportional patterns of difficulty are identical across groups yet the opposite of each other with regard to type of ability. Ten out of 17 children in the BESD group with full data were reported to have comorbid behaviour and language difficulties, that is, the majority at 59%. Five children from this group were reported to have behaviour difficulty only and two were reported to have language difficulty only; thus all the children in the BESD group were reported to have difficulty with at least one domain, language or behaviour. This is in opposition to the TD group, where no children were reported to have comorbid difficulties and the majority were reported to have no difficulties. However five children in the TD group were unexpectedly reported to have poor language and two children were reported to have behaviour difficulties.

The majority of the five children (4 out of 5) reported to have below-average language scored below average (below the normative subscale mean) on the speech, semantics, and coherence subscales. Therefore their difficulties are with language form and content, including difficulty with articulation and fluency, meaning and their ability to speak clearly so that sentences make sense to others. Three out of five scored below average on syntax and context, and inappropriate initiations. These subscales represent difficulty with the ability to form grammatically appropriate sentences which relates to language form and content, and in addition difficulty with pragmatic language including their understanding of the social rules of conversation and when to initiate conversation. Non-verbal and social language difficulties were found in two of the five children indicating difficulty with understanding gestures and difficulty with social relationships. The two TD group children who were reported to have behaviour difficulties scored in the ‘Borderline’ range for total difficulties. One child scored within the ‘Borderline’ range for emotional symptoms, conduct, peer and pro-social difficulties, and one scored within this range for emotional symptoms and hyperactivity.

Chapter 9. Method Enquiry Two; Group Comparisons of Observed and Coded Behaviour, Language and Communication

9.1 Methodology

9.1.1 Aims

This second research enquiry sought to investigate the relationship between language and behaviour in a naturalistic setting using coding systems, as opposed to the reported data used in enquiry one. The enquiry includes three main aims. Firstly, differences between BESD and TD group children's Observer coding data and LENA data collected during an interactive task (the 'Story in a Box') will be explored. LENA data will address hypothesis 4 outlined in Chapter 6. The second and third aims of this enquiry are much more exploratory and examine relationships between observed behaviour and language/communication. Correlations between observed behaviour and language/communication outcomes will be investigated, with the aim of assessing equality in behaviour and language contribution between children during interaction. This was identified as a gap in research in Chapter 3 (p.43). In addition, observed behaviour and language/communication that is operationally co-occurring or 'simultaneous' (further defined later in the chapter, p.134) will be explored. This exploration arose out of correlations between characteristics of behaviour and language in Chapter 8. These two investigations will be led by exploratory research questions (which could not be informed by previous literature) outlined within this chapter (pp.129, 132). Supplementary aims of the research relating to the utility of the LENA system will also be outlined (p.122).

9.1.2 *Design*

A case-control cross-sectional design was used whereby each child's vocalisations and behaviours were measured during an interactive task when they were paired with a peer partner.

9.2 Materials

Measurement materials included in this enquiry were identified through the review of commonly used techniques in Chapter 4. Behaviour (verbal and non-verbal) was measured using observational coding (Noldus Observer Software). In Chapter 4 it was concluded that existing coding schemes for behaviour were inappropriate for application to the social interaction behaviour of children identified with BESD and TD peers. It was further concluded that evidence of types of behaviours that *could* be observed in children with poor social behaviour and communication was too limited to derive a strong enough hypothesis predicting peer-to-peer interaction behaviour observed in children with BESD. Therefore, a new behaviour coding scheme was developed for the current project, and an exploratory research question was incorporated in place of research hypotheses. Child vocalisations were measured using the LENA ‘Language ENvironment Analysis’ software, introduced in Chapter 4.

9.2.1 *Development of the Noldus Observer behaviour coding scheme*

Noldus Observer software allows for the creation of a manual coding scheme that captures specific behaviours which can be applied to video data. Coding in Observer uses a tiered structure of coding categories, whereby primary codes may delineate a behaviour, and secondary codes can further specify, or ‘modify’, that code, such as type of behaviour, direction or person codes. Observer coding schemes are therefore unique to their creator (the researcher). The software is able to display the video data alongside the coding scheme plotted against a time elapsed scale. Analyses can then be computed to display frequencies of specific behaviours, and also reliability analysis can be carried out to compare several coders to ensure coding schemes generated have reliability and validity; coding categories must be mutually exclusive to each other.

In Chapter 3 it was identified that reviewed studies observing peer interaction focused either on verbal language and communication or on the non-verbal behaviour of children, rather than on both of these together. The consideration of both of these aspects together is important, not only because the current study explores co-occurring behaviour and language/communication difficulties, but also because peer social interaction involves communication, which undoubtedly includes the use of both of these. It may be said that verbal communication is the most obvious tool for the relay of information and communicative exchanges between two or more people. At a fundamental level, it conveys a message the speaker intends to project through the use of speech or vocalisations. However, non-verbal behaviour during social interaction is equally as important as verbal language. It is estimated that the use of non-verbal communication occurs 70–90% of the time (Butt et al., 2011). Research has shown that typically developing children effectively communicate through non-linguistic communicative behaviours such as eye contact, social referencing and gestures, long before they produce verbal language (Bates, Camaioni and Volterra, 1975).

Therefore, deviations from these ‘typical’ behaviours may represent difficulties with non-verbal social communication.

The development of a new behaviour coding scheme that incorporated verbal and non-verbal behaviour began by considering common characteristics of outcomes of studies exploring peer interaction behaviour (Ch. 3, literature review 2), behaviour and language coding systems (Ch. 4, literature reviews 3 and 4) as well as evidence of behaviour and language difficulties in children with BESD (Ch. 3, literature review 1), and educational definitions of BESD (Ch. 2). In review of peer interaction research, the existence of scaffolding and synchronising techniques was suggested, and this involved behaviours such as joint attention initiations, responsiveness in conversations and the use of questions. These behaviours were also featured in reviewed coding schemes. Coding schemes for language also observed durations of speech, speech fluency and utterance formulation, and verbosity. Educational definitions of BESD and evidence of frequently reported behaviour and language difficulties in children with BESD indicated a dominance of problematic externalising behaviours including aggression, hyperactivity and attention difficulties, immature social skills, peer-related difficulties and pro-social behaviour problems, and pragmatic and structural language difficulties. Furthermore, as the LENA system will be incorporated into the current study to code children’s vocalisations, awareness of what the LENA system is *unable* to code was also an intrinsic part of coding scheme development. For example, the LENA system is able to provide a vocalisation count for each child, but it cannot specify the nature of that vocalisation, such as the use of a question. Observational codes could, therefore, be used to cross-validate LENA codes.

With these characteristics in mind, trial videos of paired children completing the interactive task the ‘Story in a Box’ were observed. This trial phase is discussed later in the chapter in relation to the development of the task (p.123). Reflective observation of the videos allowed for the identification of frequently occurring non-verbal and verbal behaviours that children used during peer interaction, with particular attention paid to the characteristics outlined above. Frequently occurring verbal and non-verbal behaviours were chosen for inclusion in the coding scheme as this allowed for more accurate and reliable measurement of behaviour and for group differences to be detected. Typically, coding categories adopt a hierarchical structure of primary and secondary codes which Noldus Observer allows for. This also reflects the complexity of children’s behaviour interactions. Two primary tiers of codes were decided upon, which reflected commonalities between the four literature reviews in the current project. In addition, some of these codes supported LENA codes by further specifying the natures of vocalisations. These two tiers were verbal and non-verbal codes (e.g. speech monologue, joint attention initiation). Two secondary tiers of codes were then added to further specify these. These secondary tiers included: the direction of non-verbal communicative interaction (to the adult or peer) and the form of verbal interaction (talking over (an interruption in another's speech) or the use of a question).

In the non-verbal category, primary behaviours included:

- Joint attention initiation.
- Purposeful referencing.
- Impulsive behaviour.

Joint attention initiation and purposeful referencing may be modified by secondary codes specifying the direction of this behaviour 'to adult' or 'to peer' or 'to adult and peer'.

In the verbal category, primary behaviours included:

- Speech monologue.
- Uninhibited vocalisations.
- Self-centred speech.
- Question as a conversational turn.

Examples of four codes from the coding scheme (two non-verbal and two verbal) including their definitional descriptions and how they are applied are displayed in Table 19. A full list of behaviour codes and descriptions may be found in Appendix B.

Behaviour code	*Description*	*Example*	*Frequency count*
Joint attention initiation	The child must be initiating joint attention with another person by drawing their attention to an object, either by showing the object, placing a picture in front of another person, or pointing to an object. The child must also be looking at the person they are engaging in joint attention with, or looking between the object and person.	Child points to a picture while looking between the adult and picture	One
Impulsive behaviour	Behaviours that are less controlled such as *quick* snatching, grabbing, throwing objects, or aggressive behaviours. They may occur during engagement with another individual or while the child is on their own.	Child snatches a picture from their peers hands	One
Speech monologue	Episodes of speech made by a child which last longer than 5 seconds (in accordance with LENA definition of speech monologues)		
Self-centred speech	Speech statements that are self-directed and have a quality of impulsiveness, lack of inhibition or represent reduced awareness from the child for other events (verbal or non-verbal) occurring around them.	'I want it' 'Give that to me'	Two

Table 19: Examples of verbal and non-verbal codes included in the behaviour coding scheme.

9.2.2 *Reliability testing of the coding scheme*

The coding scheme was tested for inter-rater and intra-rater reliability using a randomly selected 20% of video data taken from development trials of the 'Story in a Box' task, which were completed in response to lack of appropriate existing interaction tasks for use in the current study. Details of trials of the 'Story in a Box' task may be found in Appendix E. Inter-rater reliability between two independent coders was conducted by the primary project researcher and Professor Helen McConachie from Newcastle University, whose affiliation to the project was as second supervisor. As the primary researcher was present at the recordings of trials of the 'Story in a Box' task, they were not blind to children's group allocation throughout reliability testing. Professor McConachie, however, was blind to group allocation of children throughout reliability testing. Both coders coded the same 20% of videos and the same time-points of each video independently from each other. Prior to inter-rater reliability testing, the primary researcher coded all video data from trials of the 'Story in a Box' in order to establish a reliable baseline of coding and clear descriptions of coding criteria. As stated above, inter-rater reliability testing then allowed for 20% of these videos to be coded again. This acted as a second coding time-point by the primary researcher, which took place approximately two months after the baseline coding. Intra-rater reliability was then calculated on the basis of agreement between baseline coding and this second time-point coding.

Proportion of agreement was calculated using SPSS Kappa reliability coefficient and this was calculated for each code. These coefficients are presented in Table 20. Codes were accepted for inclusion in the final coding scheme if their intra-rater and inter-rater agreements were greater than 0.6. This was guided by Landis and Koch (1977), who report that Kappa statistics above 0.6 represent above moderate agreement. This guidance is also frequently referenced within research literature.

Code	*Intra-rater reliability (Kappa)*	*Inter-rater reliability (Kappa)*
Overall Coding Scheme	0.86	0.67
Joint Attention Initiation	0.74	0.64
Purposeful Referencing	0.64	0.22
Impulsive Behaviour	0.86	0.73
Speech Monologue	0.85	0.62
Uninhibited Vocalisations	0.64	0.61
Self-centred Speech	0.86	0.76
Questions as a CT*	0.74	0.73

Table 20: Intra-rater and inter-rater Kappa reliability coefficients for the behaviour coding scheme.

*CT- Conversational turn

As Table 20 shows, the overall coding scheme had above-moderate inter-rater reliability. One code, purposeful referencing, was not reliable, with an inter-rater Kappa coefficient of 0.22, and so was dropped from the final coding scheme.

9.2.3 *Development of LENA coding procedures*

The LENA system was first introduced in Chapter 4. LENA coding procedures used in the current study were based upon the four key reports about a child's language environment that the LENA system reports. These four reports include key child vocalisation count, adult word count, conversational turn count (between adult and key child) and audio environment information (TV and electronic media). 'Key child' refers to the child whose vocalisations are being measured; this is the child wearing the LENA Digital Language Processor (DLP). As children's language and communication would be assessed using LENA in a quiet room where there was no electronic audio present, the audio environment code was eliminated from the current project's LENA coding scheme. Adult word count was also omitted from the final LENA coding scheme as the main focus of investigation was the children's vocalisations rather than the adult's. In addition to the coding scheme, it was felt that the proportion of overlapping noise that occurred within each child's audio, as provided by LENA's additional ADEX analysis (Ch. 4, p. 64), might be interesting to include in the research, as this represents co-occurring or 'overlapping' audio, and this overlaps between speakers. This code was therefore included in the LENA coding as a measure of whether children spoke at the same time as each other (perhaps an indication of poorer pragmatic language, difficulties with turn taking or inappropriate initiations). A further code provided by ADEX was children's conversational turn initiations and responses. This code enables the identification of which speakers the turns were between, and who initiated the turn and responded to the turn. This was included in the final LENA coding as it was felt this characteristic was representative of effective communicative behaviour. The final LENA coding system included the following codes:

- Key child vocalisation counts (CV).
- Conversational turn counts (CT, between 'key child' and adult).
- Conversational turn initiations and responses (made by the 'key child').
- Proportion of overlapping noise (OLN).

Examples of two of these codes including their descriptions as defined by the LENA foundation and how they are applied are displayed in Table 21. A full list of codes and descriptions may be found in Appendix D.

LENA Code	*Description*	*Example vocalisation*	*Frequency count*
Key child vocalisation count	Words, babbles, and pre-speech communicative sounds such as squeals or growls	'Can I have that?'	Four
Conversational turn count	A 'key child' (with the DLP) vocalises and an adult responds, or an adult speaks and a child responds	Child: 'What's that?' Adult: 'A book'	One

Table 21: Descriptions and examples of two LENA codes.

9.2.4 *Supplementary research aims relating to the LENA system*

As stated in the introductory aims of this second research enquiry, supplementary aims relating to the LENA system are included here in place of research hypotheses. This is because the recruited children of primary school age with BESD represent an unexplored sample population relative to those typically explored in LENA research.

Supplementary research aim 1: As the LENA system has not been previously used in a research context with older children aged 4–9 years, the current study aims to ascertain the utility of LENA as an assessment for the language of children of this age. This will involve exploring whether the audio remains clear and data can still be processed correctly by the system for the recruited sample of older children.

Supplementary research aim 2: The LENA system is yet to be used with children who present with behavioural, emotional and social difficulties. The second supplementary research aim is to ascertain whether LENA data can still be processed and the audio remains clear when the software is used with this sample of children. Furthermore, any practical issues that arise during the use of LENA will also be descriptively noted.

9.2.5 *Development of the 'Story in a Box' communicative interaction task*

In order to observe the behaviour, language and communication of children it was necessary to attempt to elicit observable, naturalistic communicative interaction in the form of verbal and non-verbal behaviour. In addition, it was inherent to the project that interaction occurred between peers, not between children and an adult, as frequently observed within literature review 3 of behaviour coding schemes (Ch. 4). Therefore, an appropriate task may include an adult present as a facilitator, but not as a leader of the interaction. To elicit interaction for measurement of behaviour and language, interactive tasks were explored and trialled with children of different ages to gain an idea of which type of tasks worked best at elicitation and which would best suit the project methodology and additional report measures. These exploratory trials are detailed in Appendix C. It was concluded that none of the trialled tasks, or tasks used in each of the studies included in literature review 3, was suited to the current research context. As an example, two of the trialled tasks were 'barrier' tasks whereby children must use their communication skills in order to complete the task. This was problematic as it was difficult to stop children standing up to look over the barrier. Furthermore, such tasks did not engage the children for long enough to reliably measure behaviour, and they did not elicit both verbal and non-verbal behaviour.

In response to these limitations a new interaction task, the 'Story in a Box', was developed. This task allowed for the measurement of behaviours specified within the coding scheme and elicited communicative interaction behaviours from children to a degree where they could be accurately measured. Two of the 'Story in a Box' tasks were created for methodological purposes. Primarily this was because task completion time for one 'Story in a Box' task was too short, which would prevent the LENA DLP from recording a minimum of ten minutes' audio (necessary to provide LENA data). Further methodological issues which led to the creation of a second 'Story in a Box' task, however, are described in exploratory trials (Appendix E). The structure of each of the two tasks was the same; they only differed by story and narrative. One task was named 'The Prince and Princess' (box one) and the second 'The Sunken Pirate Ship' (box two). Image 1 displays the structure of the 'Story in a Box' task 'The Prince and Princess'.

Image 1: Structure of The Prince and Princess 'Story in a Box' task.

The 'Story in a Box' task is based around the idea of interactive storytelling involving problem solving between the children. The aim of the task is for children to be introduced to a story involving a main character and a problem that needs to be solved. For example, one of the stories involved a 'Prince and Princess'. The Prince needs to rescue his Princess from a tower. The children complete the box task in pairs by solving problems at different stages of the story. It was considered important to create a degree of suspense and wonder to maintain the children's engagement with the task; therefore, different-sized boxes which could fit inside each other were included to create this (four in total). Each box represents a new problem for the children to solve in order to move onto the next box. A touch–feel aspect was incorporated by including texture in the form of shredded paper inside each box. To generate interaction, problem solving was introduced by giving the children different options to choose in the form of picture cards which would help move the character through the story. Picture cards were hidden among the shredded paper inside each box. Children can then be told to take turns in choosing cards that may help solve a problem, for example, 'Which object would help the Prince get into the castle?' Only one picture card within each box is the correct object; other objects are 'distractors' or incorrect objects. Distractors are objects that provide an opportunity for children to use their imagination; they are not necessarily the correct object, yet children may like to guess how they would be useful. Incorrect objects are those which would not be useful in solving the problem. Children decided between them whether their chosen object could be useful. If they decided not, another object was chosen. Embedded within its problem-solving nature, the task also incorporates an element of competition as young children may compete to be the one who solves the problem. This form of interaction could therefore tap into the common BESD behaviours of some of the children. Full 'Story in a Box' task procedure and story narratives are described in Appendix F.

9.3 Participants

All 40 children recruited into the study were included in this enquiry. In contrast to group comparisons in enquiry one, children from each group were paired together during observations of behaviour and language/communication. Pairs of children included one child from the TD group and one child from the BESD group, creating 20 pairs of children. Further participant details were presented in Chapter 7, including pair numbers, gender and age of each child in each pair (Table 8, p. 90).

9.3.1 *Pairing children for observations of behaviour and language/communication during peer interaction*

Each child in the BESD group was paired for observations of behaviour and language/communication with a child from the typically developing group. Pairing aimed to match children from each group on gender, age and language ability (above or below the average for the whole sample, defined below) according to Children's Communication Checklist-2 (CCC-2) scores, and on cognitive ability according to their scores on the Ravens Coloured Progressive Matrices (RCPM) (Raven, 2003). This matching procedure was included to control for variable effects of gender, age, language ability and cognitive processing on communicative interaction. As stated in Chapter 7 under recruitment of children, the BESD group children were identified first, and then the TD group children were selected from the same class. Therefore matching children on language and cognitive ability occurred after recruitment had taken place. Children were matched on age primarily by being in the same class as each other. If no typically developing child from the same class matched the BESD group child on other measures (cognitive and language ability), another typically developing child (who had consented) from the class above or below was chosen as long as their age was within 6 months of that of the BESD group child (this was only necessary for one pair of children). As stated above, the ages and gender of each pair are presented in characteristics of the children in Table 8, Chapter 7 (p. 90). From Table 8 in Chapter 7 it is clear to see that not all pairs were able to be matched on gender and there were two male/female pairs. This was due to one school misunderstanding matching criteria and the class teacher instead recruited two TD females to be paired with two BESD group males.

9.3.2 *Matching children on language and communication ability*

Aiming to match children on language ability was important in order to control for the effects of language competency on communicative interaction behaviour. This meant that interaction outcomes could be differentiated by language competency. Therefore, any differences between paired children in observational outcomes are most likely to represent the influence of additional and co-occurring behaviour problems, as behaviour difficulty is the only differentiating characteristic between them. Language and communication ability was used as a secondary matching criterion to age and gender as language report data were collected after recruitment of children. It was an aim of the research that children would be matched on language and communication ability using parent-reported CCC-2 data. As stated above, matching children on language occurred after the children had been recruited, with the BESD group recruited first, then the TD group recruited from the same class.

A median cut-off technique for matching children on language and communication ability was used, based on General Communication Composite (GCC) scores of the whole sample. This enabled children to be categorised into (1) those whose language may be considered as being within typical limits, and therefore ‘average to above average’ for their class, or (2) those whose language may be considered ‘below average’ for their class. Scores below the 50th percentile indicated below-average language, and scores above the 50th percentile indicated language ability within typical limits. This median cut-off technique, rather than a stricter cut-off technique, was used in order to be most appropriate to the recruited sample of children, those drawn from a population of children attending mainstream schools without clinical diagnosis of behaviour disorder. Therefore, children who may have general language difficulties were more likely to be captured by a median cut-off than by stricter cut-off criteria such as upper and lower quartiles of scores. Figure 2 displays the proportion of children from each group (BESD/TD) scoring above or below the 50th percentile on the GCC.

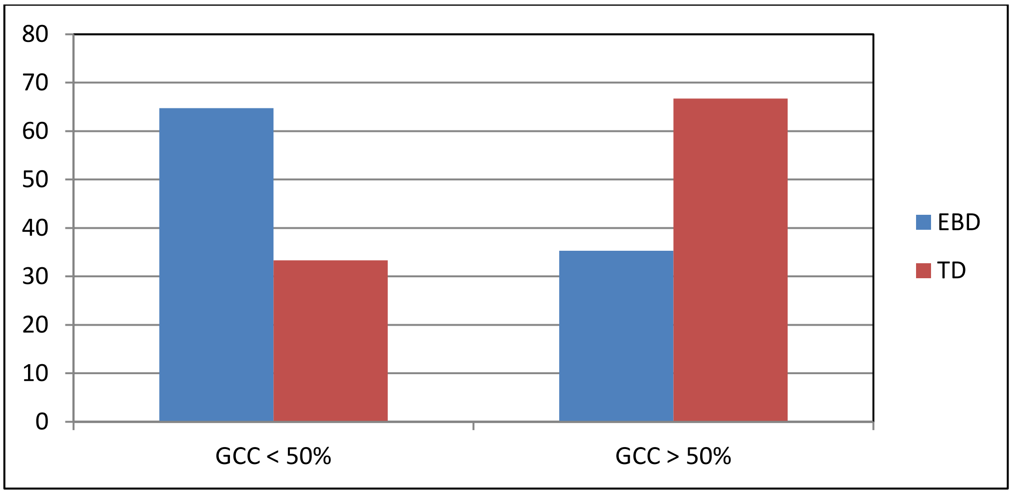

Figure 2: Proportion of BESD and TD group children scoring above the 50th percentile and below the 50th percentile on the General Communication Composite (GCC).

Pairs of children were considered to be matched on language and communication ability if their scores fell in the same percentile half (< 50th % or > 50th %), or if they fell marginally either side of the 50th percentile but were within one GCC normative standard deviation of each other.

As Figure 2 shows, the majority but not all of children were able to be matched on language and communication ability. In total, 35 out of 40 CCC-2 language assessments were returned by parents. Language/communication ability (> 50th percentile or < 50th percentile) and matched status of each of the 20 pairs of children are presented in Table 22.

	GCC score for each child in each pair: above (>) or below (<) 50th percentile or data missing*		
Pair	*BESD group child*	*TD group child*	*Matched status*
1	Missing	> 50th %	Unknown
2	< 50th %	> 50th %	No
3	< 50th %	< 50th %	Yes
4	> 50th %	> 50th %	Yes
5	< 50th %	< 50th %	Yes
6	< 50th %	< 50th %	Yes
7	> 50th %	> 50th %	Yes
8	Missing	Missing	Unknown
9	< 50th %	> 50th %	No
10	< 50th %	< 50th %	Yes
11	Missing	< 50th %	Unknown
12	> 50th %	> 50th %	Yes
13	> 50th %	> 50th %	Yes
14	< 50th %	Missing	Unknown
15	< 50th %	> 50th %	No
16	< 50th %	> 50th %	No
17	< 50th %	> 50th %	No
18	< 50th %	< 50th %	Yes
19	> 50th %	> 50th %	Yes
20	> 50th %	> 50th %	Yes

Table 22: Language and communication ability (above > or below < 50th percentile %) and matched status of each pair of children.

*General communication composite.

Table 22 shows that 11 of the 20 pairs of children were matched on language ability by their scores falling in the same percentile half. Matching all pairs was difficult for several reasons: children were matched after they had been recruited (therefore decreasing the likelihood that children would be matched), parents failing to return language assessments (in the case of five children); the school misunderstanding matching criteria and recruiting boy/girl pairs who had different language and communication abilities (in the case of two pairs of children); or the delayed return of language assessment from a parent, meaning one pair of children were observed in interaction before language assessment was returned (to keep in line with agreed school timetable and project timescales). This pair was kept in the final sample in order to gain primary outcome data and in light of recruitment difficulties, school attrition, and project timescales.

9.3.3 *Matching children on cognitive ability*

As with language ability, matching children on cognitive ability was a secondary criterion to age and gender as assessment was completed after children were recruited into the study. As was discussed in Chapter 5, underlying cognitive processes of children may impact on children's behaviour and language and subsequently their ability to engage appropriately in communicative interaction. Exploration of the cognitive ability of children in both groups was therefore necessary to control for variability in cognitive functioning upon key observational outcomes. Measurement of cognitive ability was completed using the Ravens Coloured Progressive Matrices (Raven, 2003).

9.3.4 *Raven's Coloured Progressive Matrices (RCPM)*

The RCPM (Raven, 2003) is a test designed to measure cognitive functioning by measuring 'eductive' ability; the ability to make 'meaning out of confusion' using non-verbal representation (Raven, 2000). The test includes a series of diagrams with a part missing. Those completing the task are asked to select the correct missing part to complete the diagram. RCPM has a test–retest reliability of .80 (Raven, Raven and Court, 1998) and internal consistency rates have been reported of between .76 and .88 (Cotton et al., 2005).

9.3.5 *Matching procedure for cognitive ability*

The RCPM assessment was carried out by an adult with the children during school at a quiet desk away from any distraction. The assessment took approximately 10–15 minutes to complete with each child, and all 40 children completed the assessment. For children to be matched on cognitive ability, their scores needed to be within the same qualitative descriptive category (e.g. average, low average, high average) or within two standard scores of each other. Table 23 displays the descriptive cognitive ability of all pairs and shows each pair of children were successfully matched on cognitive ability.

	Raven's descriptive category of cognitive ability			
Pair number	*BESD group*	*Gender*	*TD group*	*Gender*
1	Borderline	M	Low Average	M
2	High Average	F	High Average	F
3	Low Average	M	Average	M
4	High Average	M	Average	M
5	Average	M	Average	M
6	Low Average	M	Average	M
7	Low Average	M	Average	M
8	High Average	M	High Average	M
9	Average	F	Average	F
10	Low Average	M	Low Average	M
11	Low Average	M	Low Average	M
12	Low Average	M	Low Average	M
13	Low Average	M	Low Average	M
14	Low Average	M	Borderline	M
15	Low Average	M	Average	M
16	Average	M	Average	F
17	Average	M	Average	F
18	Average	F	High Average	F
19	Low Average	M	Average	M
20	Low Average	M	Average	M

Table 23: Descriptive categories of cognitive ability for each child in each pair based on corresponding Raven's Coloured Progressive Matrices scores (Raven, 2003).

9.4 Procedure for Data Collection Relating to Observed Behaviour and Language/Communication

Behaviour and language used by children during communicative interaction were observed as the children took part in two interactive 'Story in a Box' tasks as outlined above. This involved the application of the behaviour coding scheme and the LENA coding software outlined above. Prior to the 'Story in a 'Box' sessions with the children, the LENA software was installed onto a portable laptop and this was present at each session in order for the LENA Digital Language Processor (DLP) data to be uploaded between each recording. The

DLP with its USB connector (to upload data) and two specially designed LENA T-shirts, which held the DLP, were also present at each trial. One T-shirt was a small size, designed to fit children 4–5 years, the other a medium designed to fit older children of 6–7 years.

Paired children were asked to sit at opposite sides of the table and the ‘Story in a Box’ task was placed in front of them. At this point the researcher was aware of each child’s name and which group they were in as a result of the pairing procedure. Each child in each pair wore throughout the task a LENA DLP, which was situated within the pocket of their LENA T-shirt. The LENA DLP was switched on and began recording at the start of the task, before the task was introduced by the researcher. Children’s participation was video recorded using a JVC Hybrid Everio video camera, which was placed on a tripod approximately three metres away from the children in order to clearly capture their interaction during the task. Recording began after the children had been fitted with their LENA DLP and before the researcher introduced the task. Upon completion of both ‘Story in a Box’ tasks, the video camera and the LENA DLP devices stopped recording.

9.5 Data Preparation

9.5.1 *Distribution of data*

LENA and Observer coding scores were tested for homogeneity of variance in order to inform appropriate statistical analysis of data. On the basis of the Shapiro–Wilk statistic for normality, it was found that LENA and Observer data taken from both the TD and BESD groups of children were skewed (with the exception of two observational variables) and not normally distributed; therefore, the data would be analysed using non-parametric statistics. The statistical results of this normality test may be found in Appendix G.

9.5.2 *Observational coding data*

Observational video data were collected for all 40 participants; therefore all 20 pairs of children were included in the analysis of observational data. Video data of each pair of children completing the two ‘Story in a Box’ tasks were uploaded onto Noldus Observer software. The verbal and non-verbal behaviour coding scheme outlined above (and in Appendix B) was applied to each child in each video. In summary, the verbal and non-verbal behaviour coded characteristics included in the analysis were:

- Joint attention initiations (JAI), subdivided into whether the recipient was peer, or adult.
- Impulsive behaviour.
- Speech monologues (Mono) (plus whether these were in the form of ‘talking over’ another person).
- Self-centred speech (SCS) (plus ‘talking over’).
- Uninhibited vocalisations (UV) (plus ‘talking over’).
- Questions used as a conversational turn (plus ‘talking over’).

Videos were assigned the same unique IDs given to each child for later identification. Each video was coded by the researcher at the end of all video data collection. Children were not identified in each video as to whether they were in the BESD group or TD group. However, as the researcher carried out the interaction task with children, it was likely that some children were identifiable by memory as to which group they were in. Therefore, there is a risk of coder bias, a limitation to the study that is addressed in the final study reflections (Ch. 14). To standardise data analysis between methodologies (LENA and Observer) the same time segments as those coded in Transcriber (minutes 2–5 and 7–11) were coded from each video. Each video was coded twice, once to focus on one child and again to focus on the other. This was to ensure full attention was placed on coding the language and behaviours of each child. Frequencies of each behaviour code were counted and totals for each child were entered into SPSS alongside their corresponding ID for analysis.

9.5.3 *Exploratory research questions relating to observed interaction behaviour*

As outlined at the start of the chapter, exploratory research questions guided the exploration of observed behaviour, language and communication, as these were unable to be informed by existing literature.

Exploratory research question: Are there differences in the frequency of coded behaviours during peer interaction between children with behavioural, emotional and social difficulties and typically developing children? In literature reviews 2, 3 and 4 (Chs 3 and 4) it was concluded that existing research evidence was not sufficient to derive hypotheses about predicated observed peer interaction behaviour and language of children with BESD in comparison to typically developing children. Therefore, within the current project, group differences in observed behaviour and language during interaction will be explored.

Exploratory research question: Do correlations exist between observed variables within peer dyads, indicating equality or inequality in observed behaviour and language between peers, and better coherence of interaction behaviour between them? In Chapter 3 (p. 43) it was questioned whether children make equal behavioural contributions in peer interaction, as equality and inequality in interaction is unexplored by existing literature. Equality in interaction may improve overall coherence of interaction between peers. This is important to consider in relation to the classroom context where dynamics of interaction may impact on classroom management and co-operative learning between children. Quality and coherence of interaction within peer dyads remain unexplored.

9.5.4 *LENA data*

LENA data were collected for 38 out of the 40 children. Two LENA data files were missing from the typically developing group (one male in pair 6 listed in Table 8, p. 90, and one female in pair 8) owing to technical errors during the use of the LENA system, which deleted these files. Therefore 18 out of 20 pairs of children were included in the analysis of LENA data. To recap, the key vocalisation characteristics that were included in vocalisation coding analysis were:

- Key child vocalisation counts (CV).
- Conversational turn counts (CT).
- Conversational turn initiations and responses.
- Proportion of overlapping noise (OLN).

The LENA DLP provided automatic count data for child vocalisations and conversational turns for each child's audio recording and the accompanying analysis ADEX provided conversational turn initiation and response data and overlapping noise data.

Each audio file differed in length for each child (according to when their DLP device was started/stopped) and between pairs (owing to task completion time); therefore, analysis needed to be standardised across each child in order for the same amount of time to be analysed for each child. To standardise analysis for each child, it was noted that the average length of recording was 12 minutes, during which each of the two 'Story in a Box' tasks were introduced and completed. Therefore, each audio could be divided into sections for analysis; this ensured the same proportion of time was analysed for box tasks one and two, and each child was coded completing both box tasks. Segmentation of the audio file was as follows.

The first minute of each recording was eliminated for analysis as this was when the first task was being verbally introduced to the children. The following four minutes (minutes 1–5) were included in analysis to capture behaviour occurring during box task one. Minutes 5–7 were then eliminated for analysis as this period of time covered transition to the second box task and another verbal introduction. Four minutes of the second box task were then included in the analysis (minutes 7–11) to capture children's behaviour during this task and also match the analysis time of box task one. Finally, the last minute (11–12) was eliminated for analysis as this captured the end of the task. This pattern of analysis was the same for each pair of children. This adjustment to the analysis indicated that the LENA system was unable to select out parts of audio at the minute segment level and provide automatic count data which may be used for individual assessment. The smallest segmentation time that LENA can provide data for is five minutes, and so it was necessary to use another program, Transcriber (Boudahmane et al., 1998), to analyse data at the one-minute segment level.

Transcriber software was employed in conjunction with LENA's export data function to transcribe and analyse each audio file minute by minute. As the LENA system provides automatic exportation of all its data codes into Transcriber, an audio file can be viewed with its assigned LENA and ADEX codes at the minute segment level. Codes of interest (conversational turn initiation and response, vocalisation, overlapping noise, uncertain segments and vegetative fixed signal) that occurred within minutes 2–5 and 7–11 of each child's audio were manually counted and total frequencies were entered into SPSS alongside the child's corresponding ID for analysis. The LENA system's compatibility with Transcriber software, that is its ability to export LENA data codes to Transcriber, is helpful in that vocalisation codes are presented along a time-scale and only require frequency counting.

9.5.5 *Simultaneous behaviour and language data*

LENA, SDQ, or CCC-2 data were missing in pairs 1, 6, 7, 8 and 14 listed in Table 8 (p. 90) therefore the exploration of simultaneous behaviour and language included only the pairs of children who had full LENA, SDQ, CCC-2 and observational data (n = 15). Observational video data of these pairs were manually reviewed to provide an exploratory analysis of behaviour and language that children used together, that is, behaviour and language events that occurred at the same time-point, or events that immediately preceded or followed the other. Possible behaviour/language code 'pairings' using the codes in the behaviour coding scheme were identified through manual observation and it was explored how frequently each of these pairings occurred within and between groups. For the purpose of the current study, paired language and behaviour codes were described as ‘simultaneous’ language and behaviour events.

9.5.6 *Defining simultaneous behaviour and language events*

Using each of the coding categories (four for verbal and two for non-verbal behaviour) it was possible that eight combinations of language and behaviour codes could occur together, at the same time-point or immediately preceding or following each other. For example, a ‘speech monologue’ could occur with a ‘joint attention initiation’ event. To be included in the analysis, simultaneous observed behaviours must be cross-category (i.e. one verbal and one non-verbal behaviour). Segmented proportions of each video were included in this analysis (minutes 2–5 and 7–11), the same segments as those which were applied in the observational coding analysis. Behaviours that occurred within *3 seconds* of each other were considered to be occurring together and a ‘pair’. This rule was guided by the existing coding scheme boundaries: if the same behaviour is coded twice in a row, a two second pause between the events must occur to differentiate between them. Cross-category codes, however, may occur closer to each other than this, as observed. The boundary of 3 seconds allows for this, while also allowing leeway for behaviours to start and end, and for their codes to be assigned within these 3 seconds.

9.5.7 *Exploratory research questions relating to simultaneous behaviour and language events*

As outlined at the start of the chapter, exploratory research questions guided the exploration of observed simultaneous behaviour and language.

Exploratory research question: *Are behaviour and language used together (simultaneously) by children providing ‘mutual operational reinforcement’ to each other?* The term ‘mutual operational reinforcement’ has been created here for the purpose of the current project in order to describe reciprocal supportive acts of behaviour and language that operate for the same functional purpose. That is, used together they enhance the overall functional aim of behaviour. For example, a child may snatch a toy and at the same time say ‘I want it’. Thus it could be said that the behaviour and language are providing mutual reinforcement to each other in order for the child to obtain the toy. If a relationship between particular *types* of behaviour and language exists (as indicated by correlation results in Chapter 8), shared characteristics of behaviour and language may provide operational reinforcement to each other.

Exploratory research question: Does behaviour and language competency influence the use of simultaneous behaviour and language for operational purpose? It is unknown whether children with behaviour and language difficulties will be more likely to use simultaneous behaviour and language for operational reinforcement. Perhaps there is a greater need for each domain to support the other when difficulties in both domains are present. Alternatively, children with strengths in both behaviour and language may be less likely to use behaviour and language together, as there is less demand for reinforcement from opposing domains.

9.6 Data Analysis

Data analysis for research enquiry two included four phases, outlined below.

Phase one. Using SPSS, a Wilcoxon matched-pair signed-rank test was computed on ten observed behaviour variables (where data was skewed) and a Paired t-test was computed on two variables (where data was normally distributed) to examine group differences in observed behaviour. This analysis addresses the exploratory research question outlined above (p. 132) relating to observed interaction behaviour.

Phase two. Using SPSS, a Wilcoxon matched-pair signed-rank test was computed to investigate differences in the LENA outcomes listed above between the two groups of children. This analysis addresses research hypothesis 4 outlined in Chapter 6.

Together these two phases of analysis address the primary aim of this enquiry, to explore group differences in behaviour and language observed in a naturalistic setting. A non-parametric-related samples test (and Paired t-test) was used as children were paired during assessment of interaction behaviour; therefore, the language and behaviour of each child had the potential to influence their partner's language and behaviour. Owing to the under-recruited sample size, post hoc power was calculated with the program G*Power version 3.1.9.2 (Faul et al., 2007) to explore whether the study had enough power to detect a difference in observed language and behaviour. Effect sizes were also included in analysis to determine substantive significance (the magnitude of effect) of outcomes.

The next two phases of analysis address exploratory research questions outlined above which relate to relationships between observed behaviour and language (p.132) and simultaneous behavior and language (p.135).

Phase three. A non-parametric Spearman correlation was conducted to indicate interaction relationships between observed behaviour and language/communication variables between paired children (based on LENA and Observer scores). This addresses the secondary aim of this enquiry, exploring equality in observed behaviour and language between paired children during interaction (p.115).

Phase four. Frequencies of simultaneous behaviour and language events were tabulated and examples of the most frequently used events from each group were manually transcribed and qualitatively explored to investigate group differences in simultaneous behaviour and language. In order to speculate upon the possible operational aspects of their associations, the language and behaviour characteristics of the children using these simultaneous behaviour and language events were descriptively explored using report data from the CCC-2 and SDQ. As pairs of children in this enquiry were matched on language ability, descriptive interpretation of their language ability was based on the group General Communication Composite mean score which was 62.47 with a standard deviation score of 27.50. This enabled within-group comparisons to be made. This fourth phase of analysis addresses the third aim of this enquiry, exploring observed behaviour and language that is operationally co-occurring or 'simultaneous' (p.115).

Chapter 10. Results Enquiry Two; Group Comparisons of Observed and Coded Behaviour, Language and Communication

This chapter presents the results of research enquiry two, which investigated the relationship between behaviour, language and communication in a naturalistic setting using coding systems (Noldus Observer and LENA), as opposed to the reported data used in enquiry one. Analysis included four phases outlined at the end of Chapter 9, and data are presented in accordance with these phases.

10.1 Phase One Analysis: Verbal and Non-verbal Behaviour Analysis Using Observational Coding

An exploratory research question was included in this part of the analysis, which explored whether there were differences in the frequency of coded behaviours during peer interaction between children with behavioural, emotional and social difficulties and typically developing children. The verbal and non-verbal behaviour coded characteristics analysed were:

- Joint attention initiations (JAI).
- Joint attention initiations to adult.
- Joint attention initiations to peer.
- Impulsive behaviour.
- Speech monologues (Mono) (plus whether these were in the form of 'talking over').
- Self-centred speech (SCS) (plus 'talking over').
- Uninhibited vocalisations (UV) (plus 'talking over').
- Questions used as a conversational turn (plus 'talking over').

10.1.1 *Statistical analysis of observed behaviour*

Pairs of children with full observational data were included in the analysis (n = 20). As multiple tests were computed (12), a Bonferroni correction was applied (0.05/12 = 0.004). Therefore, results were considered significant at this 0.004 level. Post hoc power was calculated using this alpha correction. Results are presented in Table 24. The t-statistic is reported on variables analysed using parametric tests.

Coded behaviour *Range*	*TD (n=20) Mean Standard deviation (SD)*	*BESD (n=20) Mean Standard deviation (SD)*	*t*	*Sig.*	*Effect size Cohen's d*	*Post hoc power %*
JAI* Range	7.80 (4.06) 1–15	8.25 (5.30) 0–19	0.70	0.50	-0.09	6
JAI to adult Range	6.05 (4.89) 0–14	7.00 (4.33) 0–16	1.20	0.25	0.21	14
JAI to peer Range	1.20 (2.22) 0–9	1.10 (1.02) 0–3		0.40	0.06	5
Impulsive behaviour Range	1.50 (3.04) 0–10	3.30 (5.00) 0–17		0.02	-0.44	44
Speech monologue Range	0.75 (1.41) 0–6	1.05 (1.50) 0–5		0.37	-0.21	14
Mono.** talking over Range	0.50 (0.22) 0–1	0.20 (0.52) 0–2		0.26	0.75	87
SCS*** Range	1.50 (2.20) 0–8	2.40 (2.11) 0–7		0.23	-0.42	41
SCS talking over Range	0.50 (1.00) 0–4	0.45 (0.80) 0–2		0.92	0.05	5
UV**** Range	1.80 (2.40) 0– 0–6	2.50 (3.72) 0–16		0.53	-0.22	14
UV talking over Range	0.25 (0.64) 0–2	0.55 (0.99) 0–4		0.33	-0.35	30
Question (Q) Range	1.10 (1.50) 0–6	2.55 (3.00) 0–12		0.05	-0.61	71
Q talking over Range	0.40 (0.69) 0–2	0.30 (0.33) 0–3		0.49	0.19	12

Table 24: Group comparisons of verbal and non-verbal coded behaviour.

*JAI – Joint attention initiation. **Mono – Monologue. ***SCS – Self-centred speech. ****UV –Uninhibited vocalisation.

Under a Bonferroni correction, and in answer to the exploratory research question outlined above, no significant differences were found between groups on coded behaviour variables. The magnitude of effects, as reported by Cohen's *d* effect sizes, are in the majority small, but medium-to-large for Impulsive behaviour (d = .044), Speech monologues in the form of talking over (d = 0.75), Self-centred speech (d = 0.42), and Questions (d = 0.61), thus indicating greater substantive significance on these variables. Their corresponding power statistics are 44%, 87%, 41% and 71% respectively, and so Impulsive behaviour and Self-centred speech are underpowered. However, Speech monologues and Questions are more highly powered in detecting an effect. In a larger sample size power would be increased; therefore it is likely that a significant difference between groups would be found.

The frequency count range of each variable indicates considerable overlap between groups in terms of usage of these behaviour variables. This further supports the results of the statistical analysis that groups do not appear to be distinctly different from each other in observed behaviour. Interestingly, however, ranges are noticeably greater in the BESD group for uninhibited vocalisations and the use of questions as a conversational turn. This suggests there was a trend towards children in the BESD group using more of these vocalisations than children in the TD group.

10.2 Phase Two Analysis: Vocalisation Analysis Using the LENA Software

On the basis of evidence from existing literature, it was hypothesised that children with BESD may vocalise more but engage in fewer conversational turns during peer interaction than their TD peers. The LENA reports which were included in vocalisation analysis were:

- Key child vocalisation counts (CV).
- Conversational turn counts (CT).
- Conversational turn initiations and responses.
- Proportion of overlapping noise (OLN).

10.2.1 *Statistical analysis of LENA data*

Pairs of children with full LENA data were included in this analysis (n = 18). As multiple tests were computed (5) on LENA variables, a Bonferroni correction was applied (0.05/5 = 0.01). Therefore, results were considered significant at this 0.01 level. Results are displayed in Table 25.

LENA Variable	*TD (n=18)*	*BESD (n=18)*	*Sig.*	*Effect size Cohen's d*	*Post hoc power %*
	Mean (SD)	*Mean (SD)*			
CV* Range	74.39 (38.50) 35–195	79.42 (27.00) 26–132	0.41	-0.15	9
CT* Range	33.11 (14.10) 16–57	34.35 (8.70) 16–50	0.72	-.011	5
CT initiations Range	15.39 (10.45) 5–51	16.85 (7.11) 0–30	0.23	-0.16	9
CT responses Range	8.67 (5.54) 0–18	8.45 (5.35) 2–22	0.74	0.04	5
OLN* Range	88.78 (37.05) 40–157	83.55 (28.30) 41–138	0.33	0.16	9

Table 25: Group comparisons on key LENA outcomes.

*CV – Child vocalisations, CT – Conversational turns, OLN – Overlapping noise.

Results show no significant differences between groups on key LENA vocalisation variables. Therefore, the research hypothesis is rejected. The magnitude of effect, as reported by Cohen's *d* effect sizes, is also very small across all variables, and so results do not have substantive significance. Post hoc power analysis indicated power statistics of 5% and 9% for each variable; therefore, the study was highly underpowered in detecting an effect.

The frequency count range of each variable indicates considerable overlap between groups in terms of usage of these vocalisation characteristics. This further supports the results of the statistical analysis; although ranges are often greater in the TD group of children, groups do not appear to be distinctly different from each other in the degree to which they used these types of vocalisations during the interactive task.

10.3 Phase Three Analysis: Correlations of Behaviour and Language between Pairs of Children

In this phase of the analysis an exploratory research question was included exploring whether correlations exist between observed variables within peer dyads, indicating equality or inequality in observed behaviour and language between peers, and greater coherence of interaction behaviour between them. Children with full LENA and Noldus Observer data were included in this analysis (n = 18). The number of correlations that could occur between codes was 60 (five LENA codes and 12 behaviour codes). Therefore, to adjust for multiple testing, a Bonferroni correction was applied (0.05/60 = 0.000). Correlations were considered significant at this alpha level.

Significant correlations were found for LENA data for child vocalisation counts (r = .750, p = .000), conversational turn responses (r = .812, p = .000) and proportion of overlapping noise (r = .856, p = .000). This suggests that paired children were contributing equally to vocal interaction with each other; children were matching their peer's level of verbal contribution. Correlations between pairs on conversational turn counts and conversational turn initiations were not statistically significant. This suggests that paired children were unequally engaging in or initiating conversational turns with their partner.

Correlations of coded behaviours between pairs of children indicated a significant correlation for joint attention initiations overall (r = .846, p = .000). Correlations for joint attention initiations directed to the adult and peer, impulsive behaviour, self-centred speech, uninhibited vocalisations and speech monologues were non-significant. However, this result suggests that paired children were equally initiating joint attention, which could be suggestive of children matching their own actions to those of their peer. Therefore, in answer to the exploratory research question outlined above, some correlations do exist between observed variables within peer dyads, suggesting equality between children in contribution to interaction using these variables.

10.4 Phase Four Analysis: Exploring Simultaneous Behaviour and Language

An exploratory research question was included in relation to explorations of simultaneous behaviour and language. This questioned whether behaviour and language used together (simultaneously) by children provided 'mutual operational reinforcement' (defined in Chapter 9, p. 135). 15 pairs of children who had full LENA, SDQ, CCC-2 and observational data were included in this exploration (excluding pairs 1, 6, 7, 8 and 14 who had missing data). Simultaneous behaviour and language events from each group of children are presented here first, followed by the characteristics of the children using them.

Table 26 shows the frequencies of each of the eight possible simultaneously occurring language and behaviour codes as observed in the complete video observations of the BESD and TD groups of children.

	Monologue		Self-centred speech		Uninhibited vocalisation		Question as CT*	
Group	BESD	TD	BESD	TD	BESD	TD	BESD	TD
Joint Attention Initiation	2	0	7	1	2	1	4	5
Impulsive Behaviour	0	0	8	2	4	0	2	0

Table 26: Frequencies of simultaneous behaviour and language events in the BESD and TD groups.

*CT - Conversational turn

In the BESD group of children, language and behaviour characteristics (codes) occurred together on a total of 29 occasions. In contrast, in the TD group of children, language and behaviour characteristics occurred together on a total of only 9 occasions.

Most noticeably, the data shows interesting group differences at the narrative level where the BESD group children are observed to use language in combination with behaviour more frequently than their TD peers, primarily speech that is self-centred in nature. The two most frequently occurring simultaneous language and behaviour events used by children in the BESD group were ‘self-centred speech and impulsive behaviour’, and ‘self-centred speech and joint attention initiations’ (JAI). In comparison, the most frequently occurring events used by the children in the TD group were ‘question used as a conversational turn’ alongside ‘joint attention initiations’. On four occasions, this combination was also used by children from the BESD group. On the whole, TD and BESD group children appear to be using language and behaviour together for different purposes. These simultaneous events are transcribed below for further clarification of this.

Transcription includes the time at which the simultaneous event occurred during the child's completion of the 'Story in a Box' task. This also confirms that the language and behaviour events met the time boundary criteria of being simultaneous, occurring within 3 seconds of each other (described in Chapter 9). The two most common simultaneous language and behaviour events made by the children from the BESD group are presented first in Tables 27 and 28, followed by question and joint attention initiation combinations made by the TD group in Table 29. For direct comparison, Table 29 also includes transcription of the children from the BESD group that used this combination.

Time (secs)	*Self-centred speech transcription*	*Time (secs)*	*Nature of impulsive behaviour*
451.95	I'll start *(talking over adult)*	452.18	Grabs box towards him
212.20	Let me look inside there	213.74	Grabs lid of box and tries to open it
292.79	I wanna do it *(talking over adult)*	291.99	Grabs box towards him
642.14	Let me see! *(talking over peer)*	643.18	Grabs box and picture card off peer
76.97	My turn first *(talking over adult)*	78.20	Grabs picture card towards him
432.62	Let me see let me me me me me me … *(talking over adult)*	435.60	Grabs picture card towards him
491.87	I seaweed him!	492.56	Grabs picture card and throws into the box
198.85	I'll start	199.68	Grabs box towards him

Table 27: Simultaneous self-centred speech and impulsive behaviour events made by children in the BESD group.

Table 27 shows that the nature of impulsive behaviour that occurred together with self-centred speech was the same across each of these simultaneous events, involving the child grabbing part of the task. The self-centred speech utterances were each about the child's self-engagement with the task. Together, this coupling of language and behaviour allows the child maximum task engagement, yet could be disruptive to the coherence of operation of the task and to the engagement of the child's peer with the task.

Time (secs)	*Self-centred speech transcription*	*Time (secs)*	*Nature of joint attention initiation*
601.19	I found it! *(talking over other child)*	603.29	Shows picture card to adult
602.84	No Tom! I like the name Tom!	603.63	Shows picture card to adult
209.50	I know nooo I got one!	212.15	Shows picture card to adult
232.95	I still have mine!	233.43	Shows picture card to adult
210.40	Me got the ladder	211.41	Shows picture card to peer
515.34	I got the treasure map!	516.60	Shows picture card to adult
627.30	I've, look I've found the sword!	629.25	Shows picture card to adult

Table 28: Simultaneous self-centred speech and joint attention initiation events made by children in the BESD group.

Table 28 shows that the joint attention initiations made in this coupling of self-centred speech and joint attention were all the same in nature, involving the child showing a picture card to the adult and, in one example, to their peer. Self-centred speech utterances were again allowing the child to become self-engaged with the task. However, some of these examples appear also to involve a degree of competitiveness since they are related to solving the presented problem, for example 'I found it!', 'Me got the ladder', 'I got the treasure map' and 'I've found the sword'. Each of these remarks is object-related and not just about task participation.

Child Group	*Time*	*Nature of joint attention initiation*	*Time*	*Question used as a conversational turn*
TD	72.98	Shows adult picture card and points to it	473.47	Why's he putting them on his head?
TD	983.76	Shows adult picture card	99.13	What's that?
TD	188.63	Shows peer picture card	119.02	Is that a hammer?
TD	280.68	Shows adult picture card	279.17	What is that?
TD	536.21	Shows adult picture card	534.93	What is that?
BESD	199.71	Shows adult picture card	117.51	What are these?
BESD	642.58	Shows peer picture card	644.13	Do you think the octopus?
BESD	576.06	Shows adult one of the boxes	575.55	What about this box?
BESD	575.09	Shows peer one of the boxes	573.36	What about that little teeny box?

Table 29: Simultaneous joint attention initiation and questions used as a conversational turn events made by children from the TD group and children from the BESD group.

Table 29 shows that joint attention initiations made by children from both groups involved showing part of the task to an adult or peer. Questions used alongside these are all task-related and children who are using them gain further information about a concrete object. Three of the examples from the BESD group children involve the child asking the opinion of the adult or peer: 'Do you think the octopus?', 'What about this box?', and 'What about that little teeny box?' The BESD group children are therefore using questions to establish other people's thoughts, rather than to gain further information about an object.

The above transcriptions answer the exploratory research question outlined above, showing that behaviour and language that are used simultaneously are most likely to be functionally beneficial to each other: they provide 'mutual operational reinforcement'. In the above examples, children from the BESD group use language and behaviour together, a use which on the whole appears to have a different function from that of children in the TD group. The BESD group of children used language and behaviour together for self-engagement in the task. In comparison, the TD children used language and behaviour together for informative purposes. Despite these differences in their use, the behaviour and language that are coupled together by both BESD group and TD group children complement and reinforce each other.

10.4.1 *Characteristics of children displaying simultaneous behaviour and language*

A further exploratory research question asked whether behaviour and language competency influenced the use of simultaneous behaviour and language for operational purpose. Using behaviour and report data from enquiry one, the characteristics of children displaying simultaneous behaviour and language were explored. Importantly, not all children from the BESD/TD groups used simultaneous events. Ten children from the BESD group used simultaneous events and two children from the TD group used simultaneous events. Therefore, profiling the children who did use simultaneous events will also reveal how representative of their group as a whole they are, and confirm whether they possess certain behaviour and language characteristics that may make it more likely that they will use simultaneous language and behaviour.

10.4.2 *Characteristics of children in the BESD group*

Five children from the BESD group used 'self-centred speech with impulsive behaviour'. Figure 3 presents the teacher-reported SDQ total difficulties score and subscale scores for these children.

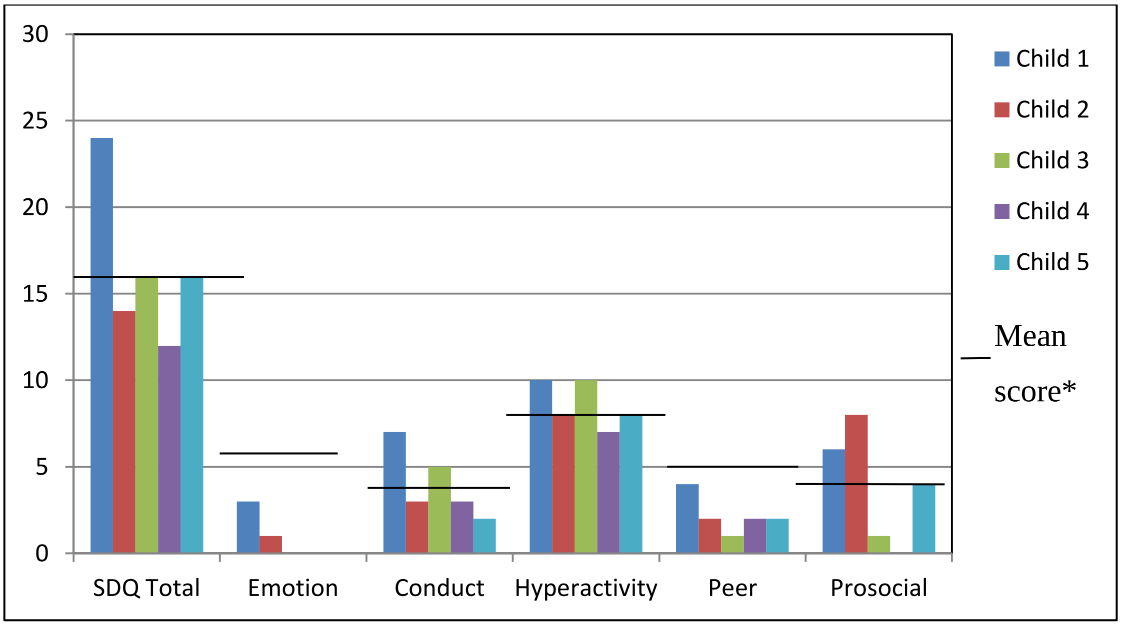

Figure 3: Teacher-reported SDQ scores of the children from the BESD group who used 'Self-centred speech' and Impulsive behaviour simultaneously.

*Scores above these lines are in the SDQ 'Abnormal' range, with the exception of the pro-social subscale, where scores below this point are in the 'Abnormal' range.

Figure 3 shows that children each scored high on hyperactivity, two scoring exactly at the abnormal cut-off point of 7 and three scoring within the ‘Abnormal’ range for hyperactivity (7–10). These scores are similar to the BESD group mean for hyperactivity (7.65) and so these children do not differ significantly from the rest of their BESD group peers with regard to their degree of hyperactive behaviour. Two children scored within the ‘Abnormal’ range for conduct problems (4–10), which is in accordance with the BESD group mean for conduct problems (4.45). The standard deviation of the conduct subscale in the overall BESD group was 2.28; therefore, two other children who scored below the conduct group mean (score of 3) are still representative of the BESD group as a whole.

The graph also shows that the total behaviour difficulty scores of the children are (in three cases) equal to or above the ‘Abnormal’ cut-off point, or fall within 1 standard deviation (BESD group SD = 8.70) below the BESD group mean (16). Therefore, again, these children seem to be similar in terms of severity of total behaviour difficulties to the overall BESD group. In comparison, the TD children who used simultaneous language and behaviour both scored within the ‘normal’ range for total behaviour difficulties (0–11) and all SDQ subscales.

Parent-reported CCC-2 language scores of the BESD group children who combined self-centred speech with impulsive behaviour are presented in Figure 4. In contrast to SDQ scores, low scores here represent fewer language problems.

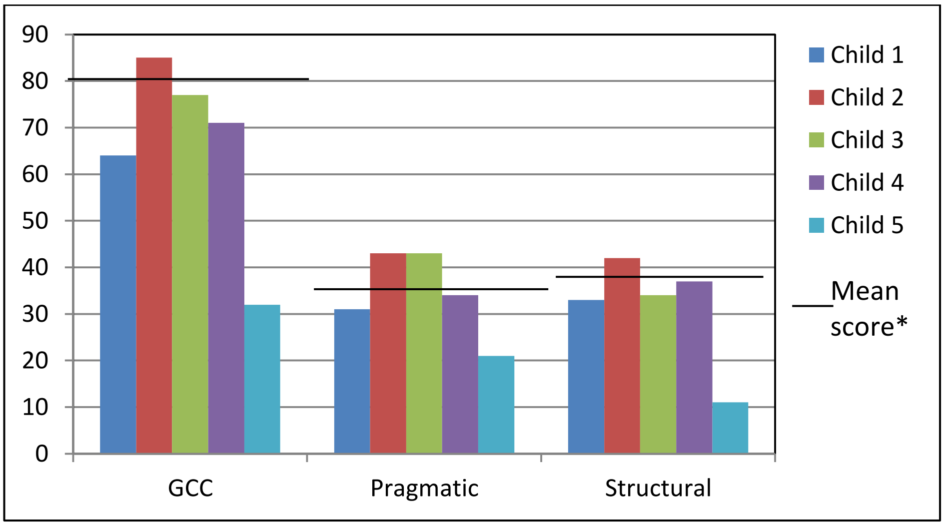

Figure 4: Parent-reported General Communication Composite (GCC), Pragmatic and Structural language scores of children in the BESD group who used self-centred speech and impulsive behaviour simultaneously.

*Scores below this line indicate ability below the normative mean (Bishop, 2003).

With the exception of child 2, these children all scored below the 50th percentile on GCC ability. Compared to the BESD group as a whole these language scores are similar, as the GCC group mean was 62.47 with a standard deviation of 27.50.Three children scored below the UK normative mean score for pragmatic language (36.3) and two scored above this mean; however, these scores are representative of the overall BESD group as the group pragmatic mean was 32.94, with a standard deviation of 13.02. Only one child scored just above the normative structural mean of 39.9, and this score in comparison to the group is relatively high as the group structural mean was 29.12. Therefore, the three children who scored below the structural mean were more typical of the overall BESD group. Child 5, however, has poor scores on all composites. As their GCC score was below 55, which shows marked communication difficulty, SIDC score can be used to indicate type of impairment. Their SIDC score was 13, indicating difficulty with structural language.

Five children from the BESD group also used 'self-centred speech with joint attention initiations'. Teacher-reported SDQ scores for these children are presented in Figure 5.

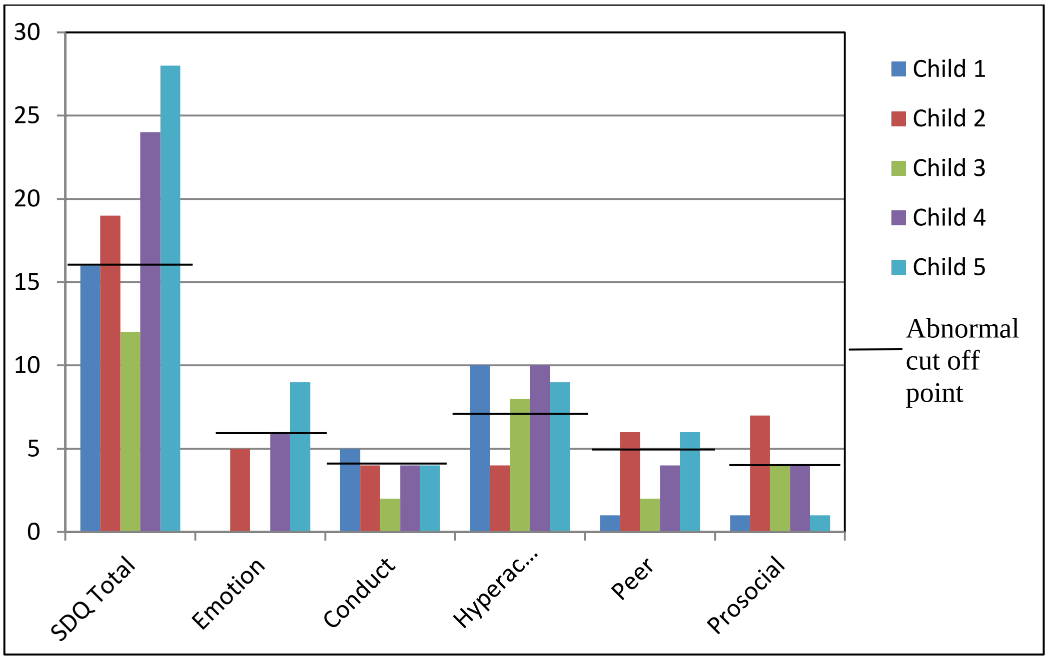

Figure 5: Teacher-reported SDQ scores of the five children from the BESD group who used self-centred speech and joint attention initiations simultaneously.

Figure 5 shows that these children have a similar behaviour profile to those children who combined self-centred speech with impulsive behaviour. With the exception of one child, they each score within the ‘Abnormal’ range for hyperactivity. Yet these children score noticeably higher for emotional symptoms, peer problems and pro-social difficulties. This inflates their total difficulties scores, which are higher than those for the children who used self-centred speech and impulsive behaviour, showing that the overall degree of their behaviour problems is more severe. These scores are similar to the overall BESD group means for total difficulties (16), hyperactivity (7.65) and conduct problems (4.45), and so, as before, these children do not differ significantly from the rest of their BESD group peers with regard to these characteristics. However, their emotional symptoms scores and peer problem scores are greater than the total BESD group means for these scales (2.75 and 2.75 respectfully). These children combining self-centred speech with joint attention initiations therefore have slightly greater behaviour difficulties than their other BESD group peers using simultaneous language and behaviour (greater degree of severity and more types of problems), and stand out from the BESD group as a whole since they have greater emotional and peer behaviour difficulties.

To allow comparison of the language ability of the five children who combined self-centred speech with joint attention initiation to that of the children who used self-centred speech with impulsive behaviour, parent-reported CCC-2 language scores of these five BESD group children are presented in Figure 6.

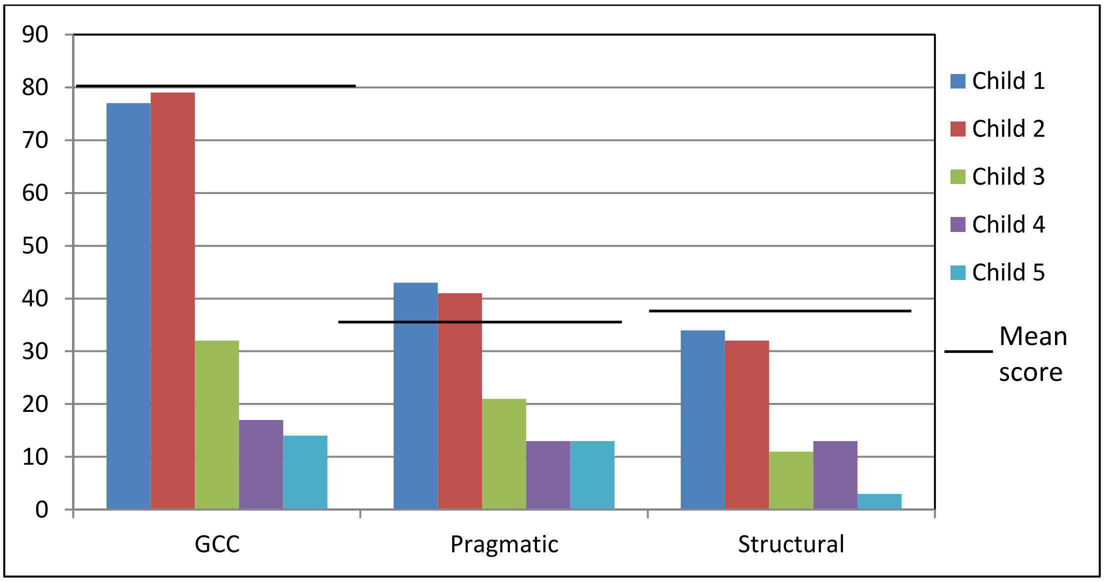

Figure 6: Parent-reported General Communication Composite (GCC), Pragmatic and Structural language scores of the five children in the BESD group who used self-centred speech and joint attention initiations simultaneously.

Figure 6 shows that those children combining self-centred speech with joint attention initiations all scored below the 50th percentile on the general communication composite and structural language composite. With the exception of child one and child two, they also scored below the 50th percentile on the pragmatic language composite. In comparison to those of their peers who used self-centred speech and impulsive behaviour, their overall general communication scores are poorer, as their peers all scored above 60 on GCC, whereas only two of these children scored above 60, and three scored noticeably lower, around 30 and below. Their pragmatic scores are also lower, as their peers using self-centred speech and impulsive behaviour each scored above 30 on this scale, whereas only two of these children scored above 30 and three scored much lower, with scores below 20. The same pattern occurs for structural language ability, where, in comparison to their peers who each scored above 30 on this scale, only two of these children matched this and three scored noticeably lower, with scores of around 10 or below.

These children are not only different from the other BESD group children displaying simultaneous language and behaviour (self-centred speech with impulsive behaviour) owing to their poorer language ability, but the majority also differ from the BESD group as a whole. The BESD group mean for the GCC was 62.47 with a standard deviation of 27.50, and so three of these children scored below one standard deviation of the group mean. The BESD group pragmatic composite mean was 32.94, with a standard deviation of 13.02, and so three of these children scored below one standard deviation of the group mean. This pattern is the same for structural language, as the BESD group structural composite mean was 29.12, with a standard deviation of 14.92; therefore, again, three of these children scored well below one standard deviation of the group mean. The three children in this group who have these low scores on general communication, pragmatic and structural language represent children in the BESD group who have the poorest language ability.

10.4.3 *Summary of BESD group findings*

Exploratory analysis of the behaviour and language ability of children in the BESD group who have used simultaneous language and behaviour has indicated variability in the degree of behaviour and language difficulties between those children who frequently used self-centred speech with impulsive behaviour and those who frequently used self-centred speech with joint attention initiations. However, nine children from the BESD group who used behaviour and language simultaneously had comorbid behaviour and language difficulties as indicated by their CCC-2 and SDQ scores. The one child who did not have comorbid difficulties had behaviour difficulties only in the borderline range of severity and in the form of conduct and hyperactivity problems. The BESD group children using language and behaviour simultaneously therefore represented the majority of children (9/10) from the final sample with co-occurring language and behaviour difficulties. This addresses the exploratory research question outlined above and suggests poorer behaviour and language competency may influence the use of simultaneous behaviour and language.

10.4.4 *Comparison between the characteristics of children in the Typically Developing and BESD groups*

In the TD group, questions and joint attention initiations were used together by two children, who were both reported to have no language or behaviour difficulties. This combination of behaviour and language was also used by two children from the BESD group. For group comparison, and to explore whether degree of language difficulties may influence the type of simultaneous language and behaviour employed, the language abilities of the children from the TD and BESD group who combined language and behaviour in the form of questions and joint attention initiation are presented in Figure 7.

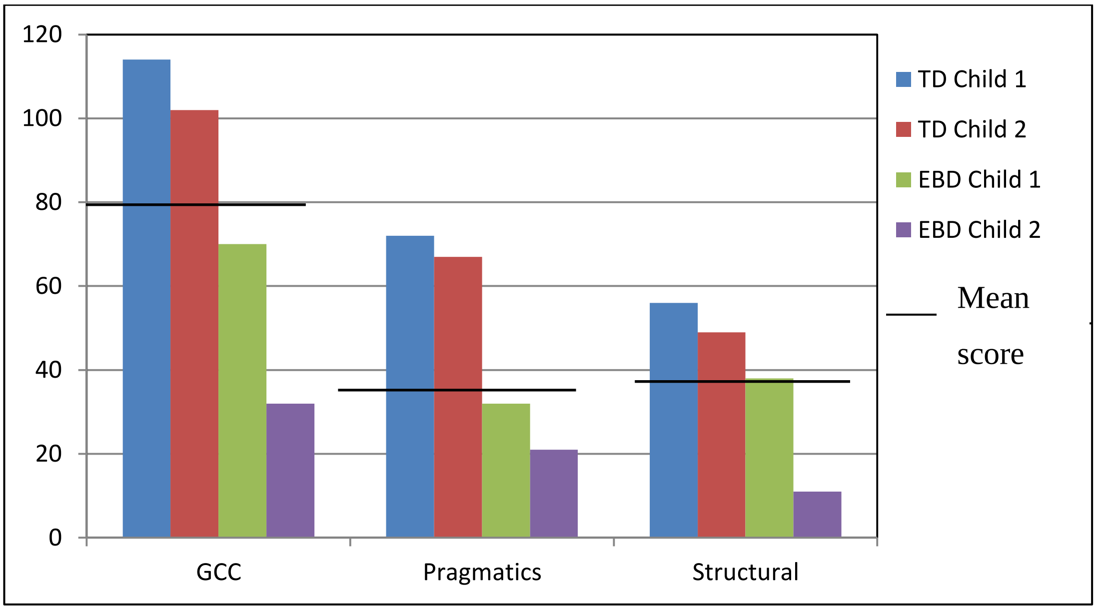

Figure 7: General Communication Composite, Pragmatic and Structural language scores of TD and BESD group children who used questions alongside joint attention initiations.

The most noticeable difference between the language of TD and BESD group children is greater language competency in the TD children. Both TD children scored above the 50th percentile on general communication composite, pragmatic and structural language ability. One of these TD group children held the highest GCC score of the total group (TD + BESD combined) (GCC = 114) and the other held the fourth highest (GCC = 102). Their scores on GCC, Pragmatic and Structural language are also higher than the TD group means (88.44, 45.78 and 43.78 respectively).

In contrast, the two BESD group children who combined questions and joint attention scored below the 50th percentile on GCC, Pragmatic and Structural language. In terms of the BESD group as a whole, one child (BESD group child 1) has similar language ability to that of the majority of the rest of the group (BESD group means for GCC = 62.47, Pragmatic language = 32.94, and Structural language = 29.12). BESD group child 2 has poorer language, with scores falling below one standard deviation of the group mean on GCC, Pragmatic and Structural language scales. Their GCC score falls below 55, indicating a marked language and communication impairment. Their corresponding SIDC score is above zero, thus indicating primary difficulties in structural but not pragmatic language.

These results indicate that children with both above- and below-average language and communication incorporate simultaneous language and behaviour during social interaction. In addition, it was shown that this is effectively communicative in nature through the use of questions and behavioural joint attention. It is interesting to note that only two children from the TD group and two from the BESD group displayed this combination of language and behaviour. Not only did the BESD group of children incorporate simultaneous language and behaviour more frequently, but more children from this group displayed simultaneous events than children from the TD group. This again supports the suggestion above that poorer behaviour and language competency influences the use of simultaneous behaviour and language.

Chapter 11. Enquiry Three; Descriptive Exploration of Interaction in a Series of Case Studies of Peer Dyads

11.1 Methodology

11.1.1 *Aims*

A third research enquiry was undertaken to investigate the impacts of behaviour and language competency on quality and style of peer interaction. This enquiry involved an exploration of peer interaction in six case studies of pairs of children who took part in the interaction task, the 'Story in a Box'. The primary aim of this enquiry was to explore differences in verbal and non-verbal interaction quality and style between different pairs of children, and in addition to investigate whether reported behaviour and language ability within paired children influenced interaction quality and style. Exploratory research questions are included in this enquiry in relation to this primary aim, outlined immediately below and within this chapter (p.157).

11.1.2 *Initial exploratory research question*

Exploratory research question: Are some pairs of children more equal in observed behaviour and language than others, thus indicating greater coherence in interaction contribution between them? Research enquiry two indicated that correlations existed within peer dyads for some observed behaviour and language variables; however, it did not explore variability between pairs of children in correlated observation variables.

11.2 Design

A case study design was employed which included two arms of investigation: identification of child dyads for case studies, and a descriptive exploration of behaviour and language profiles of the selected dyads, as reported by the children's SDQ and CCC-2 scores.

11.3 Identifying Dyads for Case Studies

Dyads for case study were selected from pairs of children included in enquiry two. Children with full LENA, Observational coding, CCC-2 and SDQ data were included in the selection phase (n=15). LENA data were missing for two children as reported in research enquiry two, Chapter 9, p. 133. SDQ data were missing for one child and CCC-2 data were missing for three children (as reported in research enquiry one, Ch. 8, pp. 102, 106).

11.3.1 *Initial data preparation*

Phase three of research enquiry two (p. 141) indicated significant paired correlations for particular vocalisation and behaviour characteristics. These were child vocalisation counts ($r = .750$, $p = .000$), conversational turn responses ($r = .812$, $p = .000$), proportion of overlapping noise ($r=.856$, $p=.000$), and joint attention initiations overall ($r = .846$, $p = .000$).This established that some children within pairs were more equal to each other in the amount they verbally or non-verbally contributed to interaction, and in comparison some children within pairs were less equal in their contributions (indicating that one child was more actively involved/more dominant than their peer).

As a result of this analysis, case studies of pairs of children at the extremities of equality and inequality were chosen for the analysis: those pairs who were most equal in their interaction and those who were least equal in their interaction. The selection of these contrasting pairs of children aimed to allow for the detection of differences in the behaviour and language profiles of the children that may contribute to differences in interaction equality. As was stated in Chapter 9, exploring interaction equality and inequality between children, and therefore the overall coherence of their interaction, may have implications for classroom management and co-operative learning between children.

Frequency of child vocalisations and joint attention initiations were chosen as two primary variables on which to measure degree of equality of interaction within pairs of children as these factors are primary outcomes from LENA and Observer coding data. These two categories were also chosen because they are distinct from each other in that one is language-based and one is primarily behaviour-based, thus offering the opportunity to explore children who are more/less equal in both domains. In order to establish which of the 15 pairs of children were most equal in these characteristics, the degree of difference values between paired children on child vocalisation counts and joint attention initiations were calculated. Smaller difference values were used to identify children who were most equal in these characteristics, and larger difference values were used to identify children who were most unequal in these characteristics. Difference values were plotted onto a graph in order to clearly identify the most equal and less equal pairs of children. Pairs at the extremes of equality and inequality were used as final case studies to be reported on in this enquiry. There were three clear pairs indicating more equal interaction and three indicating less equal interaction. These six pairs are highlighted in Figure 8, which displays difference values on child vocalisations and joint attention initiations for each pair of children.

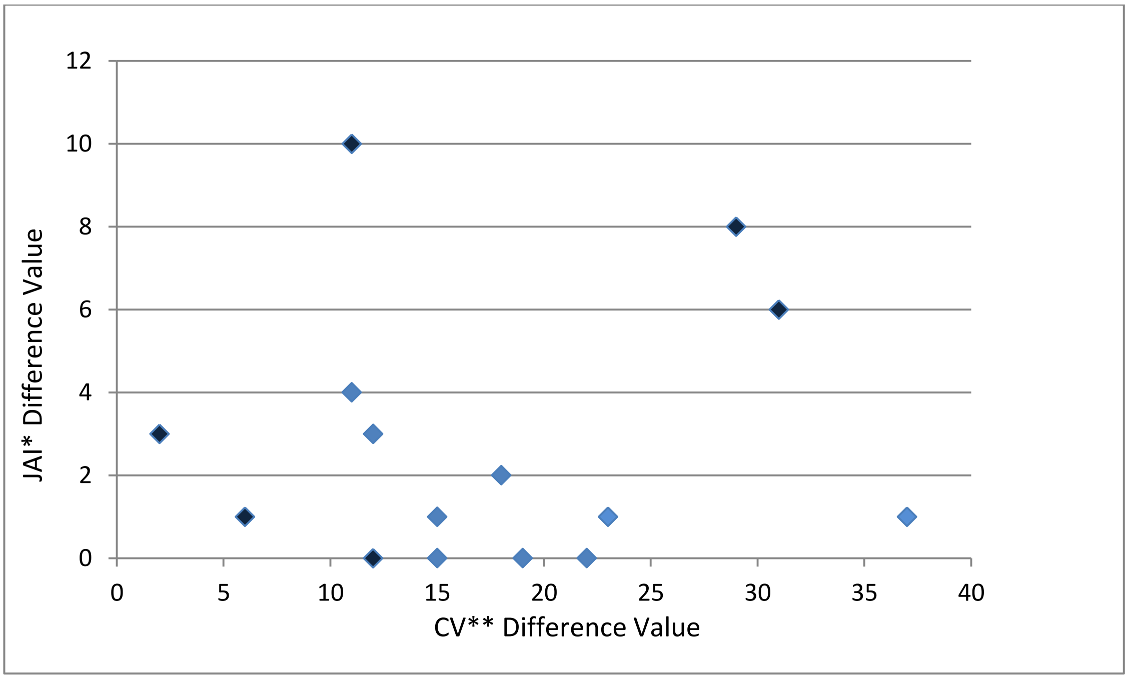

Figure 8: JAI* and CV** frequency differences between children in BESD/TD pairs, and six most extreme pairs selected for interaction analysis, highlighted in darker blue.

*Joint attention initiation score as taken from LENA data, **Child vocalisation score as taken from LENA data.

11.3.2 *Case study participants*

Six pairs of children were included in this series of case studies. These were pairs 3, 4, 7, 9, 12, and 17 as listed in Table 8, p. 90. For research purposes, pairs of children were assigned, in terms of their interaction style, to two different 'clusters': the three most equal pairs of children are considered a 'high-coherent' cluster, and the most unequal pairs of children a 'low-coherent' cluster. Table 30 displays the age and gender of each of the pairs of children.

High-coherent cluster pair	*BESD group child*		*TD group child*	
	Gender	Age	Gender	Age
1	M	7	F	6
2	M	6	M	6
3	M	6	M	6
Low-coherent cluster pair				
1	M	6	M	6
2	M	5	M	5
3	M	4	M	4

Table 30: Characteristics of the children in each case study within each cluster.

11.4 Exploratory Research Questions Relating to the Influence of Behaviour and Language Competency on Coherence of Peer Interaction

Exploratory research question: Is behaviour and language/communication competency related to behavioural equality and coherence of interaction? In Chapter 3, literature review 2, it was concluded that existing literature was unable to indicate whether variability in behaviour equality during social interaction is influenced by behaviour and language abilities of children. In addition, the extent to which *co-occurring* behaviour and language difficulties influence peer interaction is also unknown since existing research focuses on behaviour difficulties or language difficulties separately (Chapter 3, p.36).

Exploratory research question: Are behaviour and language characteristics and strategies of social interaction related to coherence of interaction? It was suggested in Chapter 3, literature review 2, that more competent peers may scaffold interaction and influence responsiveness of peers with language difficulties during interaction. It is unknown whether strategies for interaction such as scaffolding can enhance and improve the *overall coherence* of interaction.

11.5 Data Analysis

For each case study, two types of analysis were included:

Analysis 1: Teacher-reported behaviour and parent-reported language data taken from the SDQ and CCC-2 results are presented for each child within the pair, followed by a descriptive interpretation. This relates to the secondary aim of this enquiry as outlined above, and to exploratory research questions relating to behaviour and language competency influencing coherence of interaction.

Analysis 2: Manual transcription of interaction: Children's interactions are manually transcribed by reviewing videos of peer-to-peer interactions for each case study of children completing the 'Story in a Box' task and applying the following methods:

- Recording the time a verbal or non-verbal event occurred.
- Noting the individual who carried out the event (adult, BESD/TD group child).
- Transcribing spoken words or describing behaviour.
- Categorically coding the event.

Categorical codes used to describe events are verbal and non-verbal primary, secondary and form or direction (e.g. 'talking over', 'to peer') codes included in the behaviour coding scheme used in research enquiry 2 and detailed in Appendix B. LENA vocalisation codes of conversational turn initiations and responses are also applied to video data (enquiry 2, Appendix D). Further descriptive elements are applied to categorical codes to provide greater detail about the form of the event in relation to peer-to-peer interaction. These include:

- Information giving.
- Displays of agreement.
- Displays of disagreement.
- Task-related turn taking.
- Dominance.

These additional descriptions were chosen as they were observed (yet were not coded) in enquiry 2, and were considered by the researcher to be potentially influential in terms of the quality and coherence of peer interaction, and therefore important for descriptive interpretation.

Coded interaction between paired children is presented in table format, followed by a descriptive interpretation. To standardise analysis of conversation and behaviour between pairs, the same segment of interaction was transcribed for each pair of children completing the first round of the ‘Story in a Box’ Prince and Princess task. The segment that was coded did not include the introduction to the task by the researcher. This second phase of analysis relates to the primary aim of this enquiry as outlined above, and to exploratory research questions exploring the competency and coherence of peer interaction.

Chapter 12. Results Enquiry Three; Descriptive Exploration of Interaction in a Series of Case Studies of Peer Dyads

In this chapter, the results of research enquiry three are presented. Enquiry three sought to explore relationships between peer interaction and behaviour and language ability in six case studies of paired children. To recap, these six case studies were divided into two clusters representing interaction equality: ‘high-coherent’ and ‘low-coherent’. ‘High-coherent’ pairs of children were those who were more equal in child vocalisation counts and use of joint attention initiations, and ‘low-coherent’ pairs were those who were less equal in their use of these behaviours.

Exploratory research questions that were outlined in Chapter 11 are addressed in this chapter, exploring whether behaviour and language/communication competency is related to behavioural equality and coherence of interaction, and whether competency and strategies of social interaction are related to coherence of interaction. These will be addressed in case study conclusions.

12.1 Case Study One: ‘High-coherent’ Pair 1

The first pair of children within the ‘high-coherent’ cluster included one male from the BESD group and one female from the TD group.

SDQ and CCC-2 scores for each child in this pair are displayed in Tables 31 and 33. Score criteria for categorical severity of behaviour for the SDQ and normative mean scores for language and communication measured by the CCC-2 are also presented here in Tables 32 and 34 for comparison. These will be referred back to in succeeding case studies.

Group	*SDQ Total*	*Emotional Symptoms*	*Conduct Problems*	*Hyperactivity*	*Peer Problems*	*Pro-social Behaviour*
TD	7	4	0	3	0	8
BESD	27	7	7	10	3	2

Table 31: SDQ scores of the two children in ‘high-coherent’ pair 1.

SDQ scale	*Normal*	*Borderline*	*Abnormal*
Total Difficulties	0–11	12–15	16–40
Emotional Symptoms	0–4	5	06–10
Conduct Problems	0–2	3	04–10
Hyperactivity	0–5	6	07–10
Peer Problems	0–3	4	05–10
Pro-social Behaviour	6–10	5	0–4

Table 32: Criteria for SDQ scores indicating categorical severity of behaviour (Goodman, 1997).

Group	*General Communication Composite (GCC)*	*Pragmatic Composite*	*Structural Composite*
TD	89	47	42
BESD	38	21	17

Table 33: CCC-2 scores for the two children in ‘high-coherent’ pair 1.

CCC-2 scale	*Mean score*
General Communication Composite (GCC)	80
Pragmatic Composite	36.3
Structural Composite	39.9

Table 34: Normative mean CCC-2 scores, (Bishop, 2003).

SDQ and CCC-2 scores for these two children in ‘high-coherent’ pair 1 indicate considerable differences in behaviour difficulties and language ability between them. The total behaviour difficulties score for the child in the BESD group is noticeably greater (and in the ‘Abnormal’ range) than the same score for the TD group child (in the ‘Normal’ range). The same is true for the hyperactivity and conduct scales, which for the BESD group child lie within the abnormal range but for the TD group child lie within the normal range. A difference in pro-social behaviour is also apparent, and the TD child scores within the normal range, whereas again, the BESD group child scores within the abnormal range. Therefore, the TD group child has more positive behaviour than their BESD group peer, and the BESD group peer has greater difficulty with problematic behaviours.

CCC-2 scores also show a similar pattern of difference between the two children, with the TD child scoring above the mean in all three composite scales and the BESD group child scoring well below the mean on all three scales. Therefore, on the basis of report data, there is a substantial discrepancy in language and communication ability between the two children.

To explore further how these language and behaviour characteristics of the two children might impact on their communicative interaction, a descriptive transcription of their interaction during the 'Story in a Box' task is displayed in Table 35. Under the 'Individual' column, an 'A' represents the adult (researcher), 'BESD' represents the child from the behavioural, emotional and social difficulties group, and '’TD' represents the child from the typically developing group. Under the 'Transcription' column wording in parentheses and italics represents a non-verbal behaviour or a pause in the interaction. In the 'Coding' column, verbal and non-verbal codes that were included in the observational behaviour coding scheme and LENA coding that were used in enquiry 2 are applied, as well as descriptive elements that were outlined at the end of Chapter 11. Coding is therefore the subjective interpretation of the researcher.

Time (secs)	*Individual*	*Transcription*	*Coding*
98.24	A:	Take it in turns to pick an object and decide whether that would help the prince get through the trees.	
104.47		*(Pause)*	
106.78	A:	Who would like to go first?	
107.93	BESD:	*(Raises hand and looks at adult)*	Non-verbal response
108.41	A:	(Name) Go on…	
110.50	BESD:	Glasses *(looks at adult)*	
112.23	A:	Would they help get through the trees?	
114.78	BESD:	*(Looks at adult, shakes his head)*	Non-verbal response
115.15	BESD:	No	
117.34	A:	No. What else?	
118.77	TD:	*(Picks card, shows it to adult)* A flower?!	Non-verbal and verbal response. JAI to adult
119.82	A:	A flower?!	
120.25	TD:	Nooooo *(shakes head)*	Non-verbal and verbal response
121.30	A:	Noooo	
122.49	TD:	That would be silly	
124.35	A:	Wouldn't help at all would it	
126.14	TD:	*(Looks at adult, shakes head)*	Non-verbal response
126.97	A:	What else have we got?	
128.09		*(Pause)*	
130.69	A:	Do you want to pick one (name)?	
132.05		*(Pause)*	
135.10	BESD:	*(Picks card)* Erm. An axe. *Looks at adult*	Verbal

			response
138.53	A:	An axe? Do you think an axe would work?	
142.57	TD:	*(Looks at adult, looks at peer, nods head)*	Non-verbal response
142.91	TD:	Yeahhhhh	
144.30	BESD:	*(Looks at peer, nods head)*	Non-verbal response
145.38	A:	I think an axe is a good one. What could he do with his axe?	
150.13	TD:	*Looks at adult, pulls face and mimics axe action*	Non-verbal response
150.54	TD:	Chops down the trees	Verbal response

Table 35: Transcription of 'high-coherent' pair 1: BESD group child male, TD child female.

In the above example of interaction from pair 1 considered to have 'high-coherent' interaction, the BESD group child begins the game through the use of a non-verbal action, putting his hand up and looking at the adult in response to the question 'Who wants to go first?'. Both children make use of non-verbal referencing actions, which are coupled with or followed by a verbal response. The TD child appears overall to be more vocal than the BESD group child, while the BESD group peer appears more uncertain at times, looking at the adult for reassurance after picking the first card, and being prompted for response by the adult's questions, such as 'Would they help get through the trees?', 'What else have we got?', 'Do you want to pick one [name]?'

Turn-taking in this interaction is evident, as the next turn is taken by the TD child, and remains evident throughout. There is a point in the interaction where it is the BESD group child's turn, yet there is a pause in between turns as they do not pick out a card (126.97 secs–135.10 secs). In this situation the adult asks 'What else have we got?', and the TD child, understanding it is their peer's turn, remains quiet. A subsequent pause means the adult verbally encourages the BESD group child to take a turn, 'Do you want to pick one [name]? to which they respond and choose an axe. After being asked by the adult 'Do you think an axe would work?' the BESD group child does not respond and again there is a pause, perhaps indicating he is unsure. Here the TD peer responds non-verbally, looking at the adult and their peer and nodding (142.57 secs). In doing so, the TD child is helping their peer by communicating their own opinion, which in turn helps to move the interaction forward from the pause. This is then coupled with a verbal reply ‘Yeahhh’, which is responded to non-verbally by the BESD group child, who looks back at their TD peer and also nods their head in agreement. It may be that the TD child is *scaffolding* the interaction, and the BESD group peer follows suit.

12.2 Case Study Two: ‘High-coherent’ Pair 2

The second pair of children within the ‘high-coherent’ cluster included one male from the BESD group and one male from the TD group.

SDQ and CCC-2 scores for each child in this pair are displayed in Tables 36 and 37. As stated above in case study one, score criteria for categorical severity of behaviour for the SDQ and normative mean scores for language and communication measured by the CCC-2 may be referred back to on page 161.

Group	*SDQ Total*	*Emotional Symptoms*	*Conduct Problems*	*Hyperactivity*	*Peer Problems*	*Pro-social Behaviour*
TD	4	1	0	3	0	10
BESD	19	5	4	6	4	0

Table 36: SDQ scores for the two children in ‘high-coherent’ pair 2.

Group	*General Communication Composite (GCC)*	*Pragmatic Composite*	*Structural Composite*
TD	90	44	46
BESD	70	38	32

Table 37: CCC-2 scores for the two children in ‘high-coherent’ pair 2.

SDQ scores for these two children in ‘high-coherent’ pair 2 indicate similar differences between children in behaviour difficulties to those observed in ‘high-coherent’ pair 1. The total behaviour difficulties score of the child in the BESD group is again noticeably greater and within the abnormal range compared to the total difficulties score of the TD group child, which is much lower and within the normal range. Although the BESD group child scores within the abnormal range for conduct problems, they are reported to have less severe difficulty with hyperactivity and peer problems, scoring within the borderline range for these two scales. The TD group child in this pair scores very highly on the pro-social scale indicating very good pro-social behaviour. In contrast, their BESD group peer scores very poorly on this scale.

There is less discrepancy between the children in this pair in terms of their language and communication ability than there is for the ‘high-coherent’ pair 1. Their language scores are closer to each other, although the BESD group child scores just below the mean on the GCC, while the TD group child scores above the mean. However, the BESD child does score above average on the pragmatic composite, which suggests competent, appropriate use of language in social contexts. Thus it can be said that, on the basis of report data, there is less difference in language and communication ability between these children than there is for pair 1, but noticeable differences between them in their reported behaviour.

A descriptive transcription of this pair of children’s communicative interaction during the ‘Story in a Box’ task is displayed in Table 38.

Time (secs)	*Individual*	*Transcription*	*Coding*
93.56	A:	Take it in turns to pick an object and decide whether / that would help …	
97.47	BESD:	*(Raises hand, looks at adult and peer)* / I'm gonna pick first	Non-verbal action plus talking over (BESD group)
105.65	BESD:	*(Picks card and shows it to adult)*	JAI to adult
107.16	BESD:	Glasses	Verbal response
107.94	A:	Do you think glasses would work?	
109.40	BESD:	*(Shakes head looks at adult)*	Non-verbal response
110.91	A:	Noooo. Go on / (name)	Talking over (BESD group)
113.13	BESD:	/ This looks hard	
188.77	TD:	*(Picks card and shows it to adult)* No	JAI to adult
120.32	A:	What's that?	
121.87	TD:	Axe. *(Looks at adult)*	Non-verbal reference to adult
123.92	A:	Do you think that would help him …?	
125.62	TD:	*(Shakes head)*	Non-verbal response
127.65	BESD:	*(Nods)* Yes (*Looks at adult)*	Non-verbal, verbal response
129.72	BESD:	*(Looks at adult, mimics chop action)*	Non-verbal reference to adult
130.49	BESD:	Chop down trees	
137.68	BESD:	I know! *(Picks card, looks at card)*	
146.08	BESD:	That couldn't work 'cos if you *(looks at adult)* hoy money off the dragon it won't die	
155.73	TD:	*(Picks card)* What's this? *(Shows adult and peer)*	Question as conversational turn, JAI to adult and peer
157.15	A:	What's that (name)?	
159.11	TD:	I don't / know	Verbal response. Talking over (BESD group)
160.82	BESD:	/ It's where you put coffee in	Supportive response
163.39	TD:	Naahhh *(Looks at adult)*	
168.50	BESD:	Naahhhh *(Shakes head)*	
171.78	BESD:	*(Picks card and shows it to adult)*	JAI to adult
173.37	BESD:	Naahhhh *(shakes head)*	Displaying agreement

175.16	BESD:	What can them do?	Question as conversational turn
177.26	BESD:	Yeah they can *(looks at adult)* cos watch. If you put it in the castle … ehhh the dragon will be nice *(nods)*	Answering own question. Non-verbal reference to adult, speech monologue
189.03	A:	So you give the flower to the dragon	
190.71	BESD:	Mmmm huh. Mmmm huh.	Uninhibited vocalisation
192.97	TD:	*(Picks card and shows it to adult)*	JAI to adult
193.95	A:	I think that might be the best option. Do you? *(Looks at BESD and TD)*	
197.62	TD:	Yeahhh	Verbal response
200.52	A:	I think so too	Talking over (BESD group)

Table 38: Transcription of 'high-coherent' pair 2: BESD group child male, TD child male.

This interaction between the second pair of children considered to have 'high-coherent' interaction with each other appears quite dominated by the BESD group child. It begins with a verbal and non-verbal interruption from the BESD group peer involving talking over the adult to say they will pick first (97.47 secs). Despite this initial interruption, turn-taking remains evident throughout the interaction, but the subsequent turn of the TD peer is prompted by the adult saying 'Go on'. Both children are prompted by the adult for their opinion as to whether their objects would work, the BESD group child being asked 'Do you think glasses would work?' and the TD child being asked 'Do you think that [an axe] would help him get through the trees? When asked about the axe, the TD peer responds non-verbally with a head shake (125.62 secs). Their peer, however, has a different opinion and verbally replies 'Yes', along with a head nod directed towards the adult, followed by mimicking the action of an axe.

A later turn by the TD peer leads them to ask the adult 'What's this?', as they verbally state they do not know what the picture is. This is responded to (in the form of talking over) by their BESD group peer, 'It's where you put coffee in, that's what it's for' (160.82 secs). The TD peer then uses this information to respond 'Naahhhh', which is mimicked by their BESD group peer 'Naahhhh'. Therefore, together, they have considered the object and decided upon an answer, showing *supportive* behaviour towards each other. This is repeated when the TD peer later picks out the axe card again, the adult asking whether they think that is the best option, and both children verbally respond, the TD peer with ‘Yeahhh’ and the BESD group peer with ‘To kill him’.

12.3 Case Study Three: ‘High-coherent’ Pair 3

The third and final pair of children within the ‘high-coherent’ cluster included one male from the BESD group and one male from the TD group. SDQ and CCC-2 scores of each child in this pair are displayed in Tables 39 and 40.

Group	*SDQ Total*	*Emotional Symptoms*	*Conduct Problems*	*Hyperactivity*	*Peer Problems*	*Pro-social Behaviour*
TD	8	2	1	4	1	9
BESD	24	3	7	10	4	6

Table 39: SDQ scores for the two children in ‘high-coherent’ pair 3.

Group	*General Communication Composite (GCC)*	*Pragmatic Composite*	*Structural Composite*
TD	61	30	31
BESD	64	31	33

Table 40: CCC-2 scores for the two children in ‘high-coherent’ pair 3.

SDQ scores for these two children again represent a similar pattern of discrepancy in behaviour difficulty between the two children. This is most obvious in their total difficulties scores where the BESD group child scores within the abnormal range and the TD group child scores within the normal range for behaviour difficulties. The BESD group child scores most poorly on the hyperactivity scale, with a score of 10 that sits at the most severe end of the abnormal range for this scale. The BESD group child scores within the normal range for pro-social behaviour, which was not observed in other BESD group children within this ‘high-coherent’ cluster.

The CCC-2 scores for these children are very similar. Both score below average on all scales, however the BESD group child scores above the TD group child on each scale. This is a different pattern of scores from that observed in pairs 1 and 2 in this cluster. Therefore, children in this pair are reported to be similar in terms of their below-average language and communication ability, yet different in degree of behaviour difficulty.

To explore how these characteristics may relate to these children's interaction, a descriptive transcription of this pair of children's communicative interaction is displayed in Table 41.

Time (secs)	*Individual*	*Transcription*	*Coding*
72.97	A:	Take it in turns to pick an object and decide whether that will help the prince get through the trees that guard the castle.	
82.57	BESD:	*(Picks card)* No	Initiates first turn
84.25	A:	What's that?	
85.43	BESD:	Em. A lamp.	Verbal response
88.74	A:	Lamp / Nooo	Talking over (TD group)
89.10	TD:	/ Flower! *(shows card to adult)*	JAI to adult
90.68	BESD:	*(Leans head back and silently laughs and looks at peer)*	Non-verbal response to TD child's card
93.13	A:	Flower's no good. What else do we have?	
98.43	BESD:	*(Picks card)* Erm a piece of rope *(looks at peer)*	Verbal response, non-verbal reference to peer
101.05	A:	Could that help?	
101.79	BESD:	Yeah! Because he could *(looks at adult and mimics swinging action)* swing from the tree	Verbal and non-verbal response
109.43	TD:	*(Picks card, shows to adult)* An axe *(shows card to peer)*	JAI to adult and peer

111.76	A:	An axe do you think that would help?	
113.51	BESD:	*(Looks at adult and nods)*	Non-verbal response
114.78	A:	’Cos he could use the axe couldn’t he and / chop down all the trees	Talking over (TD group)
117.34	TD:	/ There’s one more left *(points to card and looks at peer)*	JAI to peer
120.32	A:	What are those?	
125.41	BESD:	*(Picks card)* The tree and a … oooo glasses *(looks at peer)* Tree and glasses *(gently tosses card in direction of peer to look at)*	Verbal response, behavioural response to peer’s JAI. Shared attention with peer
131.63	TD:	*(Picks up card)* Glasses would /	Talking over (BESD group)
132.34	BESD:	/ *(Picks card, shows to peer)* Coins I’m rich I’m rich!! Ooo	JAI to peer
137.36	A:	*(Looks at TD)* And the glasses?	
139.18	TD:	*(Looks at adult)* Noooo	Verbal response
140.98	A:	Nooo wouldn’t need the glasses would he unless he had bad /	Talking over (BESD group)
144.05	BESD:	/ I need coins!	Self-centred speech
145.25	A:	You need coins	

Table 41: Transcription of ‘high-coherent’ pair 3: BESD group child male, TD child male.

This interaction begins with the BESD group child initiating the turn-taking process of the game by picking out a card first, indirectly telling the adult and their peer that they will go first. Interestingly, this example of peer interaction contains a great many joint attention initiations between peers, as well as directed to the adult. This is exemplified in Image 2.

Image 2: The children use joint attention with each other.

These JAI events typically lead to verbal prompting by the adult using questions to guide the interaction. Overall, there is a sense of *co-operative interaction* and of *scaffolding techniques* being used between the peers. This is exemplified when the TD peer realises there is another card yet to be picked, but understands that it is their peer's turn to pick a card and therefore uses JAI alongside vocalisation to communicate this to their peer so that they select the card (117.34 secs). Shared engagement in the task is further exemplified when the BESD group child selects the card, then uses vocalisations to tell his peer what is on the card while gently tossing the card in their peer's direction for them to look at (125.41 secs). The interaction becomes slightly disrupted at the end of the transcription, when the BESD group peer talks over the TD child's observation of the card that they had just been passed by the BESD group child (131.63 secs). The BESD group child has picked another card; he becomes excited about this, then talks over the adult with a self-directed statement.

12.4 Case Study Four: 'Low-coherent' Pair 1

The first pair of children within the 'low-coherent' cluster included one male from the BESD group and one male from the TD group. SDQ and CCC-2 scores of each child in this pair are displayed in Tables 42 and 43.

Group	*SDQ Total*	*Emotional Symptoms*	*Conduct Problems*	*Hyperactivity*	*Peer Problems*	*Pro-social Behaviour*
TD	1	1	0	0	0	9
BESD	12	0	4	8	0	5

Table 42: SDQ scores for the two children in 'low-coherent' pair 1.

Group	*General Communication Composite (GCC)*	*Pragmatic Composite*	*Structural Composite*
TD	90	47	43
BESD	89	47	47

Table 43: CCC-2 scores for the two children in 'low-coherent' pair 1.

The SDQ and CCC-2 scores for the two children in the 'low-coherent' pair 1 show much more similar abilities between the children than was observed in the 'high-coherent' pairings. The child from the BESD group scores in the low borderline range for severity of behaviour difficulties, noticeably lower than the BESD group children in the 'high-coherent' cluster. As with the other BESD group cases, however, hyperactivity is within the abnormal range.

The CCC-2 scores of the two children are also very similar, with them both scoring above average on all composite scales. It may be said, therefore, that this pair of children are more similar in behaviour and language ability than the paired children in the 'high-coherent' cluster, on the basis of report data.

In order to explore how similarities in ability may influence these children's interaction, a descriptive transcription of their communicative interaction is displayed in Table 44.

Time (secs)	*Individual*	*Transcription*	*Coding*
74.13	A:	Take it in turns to pick a card and see if that would help the prince get through the trees.	
79.68	BESD:	*(Picks card and shows to adult)*	JAI to adult
80.53	A:	What's that?	
82.22	BESD:	Rope *(looks at adult)*	Verbal response
83.51	A:	Would that work?	
84.70	BESD:	*(Shakes head and looks at adult)*	Non-verbal response to adult, giving opinion
85.61	A:	Nooooo /	Talking over (BESD group)
85.74	BESD:	/ Well he could get the rope and whack *(mimics chop action)* the trees down so he can make a way	Verbal and non-verbal response, informative
90.50	A:	Mmmm hmmm he could do couldn't he! Right	
97.12	TD:	*(Picks card, laughs and looks at adult)* A flower	Non-verbal reference to adult
99.91	A:	A flower. Would that be any good?	
102.46	TD:	*(Looks at adult and shakes head)* Nooo	Non-verbal and verbal response to adult giving opinion
103.34	A:	Nooo wouldn't do much would it	
107.54	BESD:	*(Picks card shows it to adult*) An axe	JAI to adult
108.74	TD:	Ahh yeahhh *(looks at adult)*	
110.70	A:	Do you think the axe?	
112.56	TD:	Yeahhh definitely	Verbal response
113.21	A:	What could he do with the axe?	
114.99	BESD:	*(Looks at adult)* Well, the sharp bit could, like when normal people they have all the trees around their house and they can't see the view they cut them with an axe.	Verbal response, speech monologue

126.77	A:	Exactly	
127.28	TD:	*(Looks at adult and nods head)*	Non-verbal reference to adult showing agreement

Table 44: Transcription of ‘low-coherent’ pair 1: BESD group child male, TD child male.

As in each of the pairings in the ‘high-coherent’ cluster, the BESD group child initiates the game by automatically picking a card and showing it to the adult (79.68 secs). He requires prompting from the adult to vocalise what the object is and whether it would be of any use. As the BESD group child took the first turn, the second is taken by the TD child, and turn taking remains consistent throughout the interaction. When the BESD group child picks out the axe, *supportive* interaction takes place in that the TD child verbally gives his opinion and looks to the adult to relay this information (108.74 secs). However, the TD child is interacting directly with the *adult* here, rather than with his peer. The BESD group child then provides descriptive verbal information about how the axe would be useful, which is confirmed by the TD peer’s non-verbal head nod response (114.99 secs and 127.28 secs); again this is supportive in nature, but it is directed to the adult rather than to the peer.

12.5 Case Study Five: ‘Low-coherent’ Pair 2

The second pair of children within the ‘low-coherent’ cluster included one male from the BESD group and one male from the TD group. SDQ and CCC-2 scores for each child in this pair are displayed in Tables 45 and 46.

Group	*SDQ Total*	*Emotional Symptoms*	*Conduct Problems*	*Hyperactivity*	*Peer Problems*	*Pro-social Behaviour*
TD	2	2	0	0	0	8
BESD	8	0	2	4	2	4

Table 45: SDQ scores for the two children in ‘low-coherent’ pair 2.

Group	*General Communication Composite (GCC)*	*Pragmatic Composite*	*Structural Composite*
TD	89	47	47
BESD	89	46	43

Table 46: CCC-2 scores for the two children in 'low-coherent' pair 2.

The scores displayed above indicate similar reported behaviour and language ability for both children in this pair. Both of their SDQ total difficulties scores lie within the normal range, and it is only the BESD group child's pro-social score that lies within the abnormal range.

The CCC-2 GCC scores of the children are identical; a marginal difference between these children in language and communication ability is only present on the structural language composite. Children in this pair are therefore reported to have very similar behaviour and language ability.

To investigate how the behaviour and language ability of these children may impact on interaction, a descriptive transcription of their communicative interaction is displayed in Table 47.

Time (secs)	*Individual*	*Transcription*	*Coding*
71.75	A:	Take it in turns to pick an object / which might help the prince get through the trees	
77.67	BESD:	/ My turn first *(Grabs card)*	Impulsive action, displaying dominance
80.73	BESD:	Flower	
81.92	A:	What's that (name)?	
83.27	BESD:	Flower	Verbal response
83.33	A:	Would that help?	
85.95	BESD:	Erm he can *(looks at adult)* No	Verbal response
98.22	TD:	*(Pick card and shows to adult)*	JAI to adult
90.46	A:	What's that?	
91.57	TD:	I don't know	Verbal response
93.13	A:	Don't know looks like a rope	
94.95	TD:	Yeahhhh *(looks at adult)*	
95.25	A:	Do you think that would help him get through the trees?	
97.73	BESD:	No *(looks at adult)* Because it would just flop down *(mimics flop action)*	Verbal and non-verbal response, giving information
100.77	A:	Yeahh wouldn't be much good would it	
104.31	A:	Choose another one	
107.95	BESD:	*(Picks card)* It's some glasses	
110.38	TD:	*(Picks card shows to adult)* A /sword!	JAI to adult, talking over (BESD group)
111.83	BESD:	/ A glass *(shows glasses card to adult)*	JAI to adult
113.453	A:	/ What's that? What have you got (name)	
114.15	TD:	*(Points to card and shows to adult)*	JAI to adult
115.13	A:	A sword what's that it's an axe isn't it	
117.36	TD:	Yaaaay	Verbal response
117.79	BESD:	*(Stands to look at card TD holds)*	
118.83	BESD:	Yeah he could cut / through	

119.89	A:	/ Do you think he could use an axe to get through the / trees?	Talking over (BESD group)
121.89	BESD:	/ Yeah / and these would help him see *(shows card to adult)*	JAI to adult, talking over (TD group)
122.15	TD:	Yeahhhh (looks at adult)	

Table 47: Transcription of low-coherent pair 2: BESD group child male, TD child male.

In the second pairing from the 'low-coherent' group, there are fewer co-operations between children than in previous case studies discussed as children fight for the attention of the adult and to possess the correct answer to the problem. In this transcription, the BESD group peer is more vocal than the TD group peer. The BESD group child initiates turn-taking through impulsive behaviour, grabbing a card and stating 'my turn first' (77.67secs). This may be considered quite a competitive action owing to its impulsive nature, and displays dominance.

Both children throughout the interaction are prompted by the adult for verbal explanations of the objects. When the TD peer picks out a rope and is asked by the adult if that would work, the BESD group child immediately responds, not the TD child at whom the question was directed (97.73 secs). This indicates that the BESD group child is not allowing the TD child to respond. The BESD group child explains why it would not work, while the TD child says nothing. Therefore, the two children do not co-operatively verbally agree whether it would be useful.

There is then a similar occurrence when the BESD group child picks out some glasses, and the TD peer picks out a 'sword' (axe). This event is shown in Image 3. The TD child does not wait until their BESD group peer has made a decision about the usefulness of the glasses before choosing their card and showing it to the adult; therefore, both children show their cards to the adult at the same time.

Image 3: Both children show their picture cards to the adult at the same time.

The BESD group child then stands to look at the TD child's card and states why (the correct card) would be useful, yet then states how the glasses (the card he holds) would also be useful. This is supportive in providing an explanation for why the sword might be useful, but the added JAI to the adult of the glasses card (coupled with an explanation) might be their attempt at showing that they also have the right answer.

12.6 Case Study Six: 'Low-coherent' Pair 3

The third and final pair of children within the 'low-coherent' cluster included one male from the BESD group and one male from the TD group. SDQ and CCC-2 scores for each child in this pairing are displayed in Tables 48 and 49.

Group	*SDQ Total*	*Emotional Symptoms*	*Conduct Problems*	*Hyperactivity*	*Peer Problems*	*Pro-social Behaviour*
TD	4	2	0	0	2	10
BESD	12	0	3	7	2	0

Table 48: SDQ scores for each child in the 'low-coherent' pair 3.

Group	*General Communication Composite (GCC)*	*Pragmatic Composite*	*Structural Composite*
TD	77	33	44
BESD	71	34	37

Table 49: CCC-2 scores for each child in the ‘low-coherent’ pair 3.

SDQ scores for these children show differences between them in overall behaviour difficulties, although the behaviour of the BESD child is reported as less problematic and within the borderline range compared to the behaviour of those in the ‘high-coherent’ cluster. As was observed in many of the other case studies reported here, hyperactivity is again reported as problematic in the BESD group child, scoring in the abnormal range. Noticeably, there is discrepancy between the children on the pro-social scale, with the TD group child scoring at the upper end of the normal range, and the BESD group child scoring at the lowest end of the abnormal range.

The language and communication abilities of these two children are both slightly below average as reported by their CCC-2 GCC scores. Pragmatic language and communication abilities are reported to be most problematic for these children; again these scores are slightly below average. From the reported data, it can be inferred that this pair of children are similar to each other in language ability and behaviour strengths and difficulties.

To explore how these behaviour and language characteristics may impact on interaction, a descriptive transcription of their communicative interaction is displayed in Table 50.

Time (secs)	*Individual*	*Transcription*	*Coding*
78.54	A:	Take it in turns to pick an object and see if that could help the prince get through the trees … Right (pause), who wants to go first?	
87.50	BESD:	*(Reaches for card)*	Non-verbal response initiating turns
91.01	BESD:	*(Looks at adult)*	
91.35	A:	What's that?	
92.44	BESD:	A flower *(shakes head)*	Non-verbal reference
95.89	TD:	*(Picks card, looks at adult)* A jug	
97.20	A:	A jug?! (pause) Noooo	
103.85	BESD:	*(Picks card and shows it to adult)* An axe *(nods head)*	JAI to adult, non-verbal reference
105.07	A:	An axe do you think an axe would / work?	Talking over (BESD group)
107.01	BESD:	/ Would *(unclear speech)*	
109.29	TD:	*(Picks card and shows to adult)* A rope!	JAI to adult
110.36	A:	A rope! Do you think a rope could work?	
112.02	TD:	*(Looks at card and shakes head)*	Non-verbal response
113.27	A:	Not very / helpful	Talking over (BESD group)
116.95	BESD:	/ Errmm … *(picks card)*, ooo what are these? *(points to card and looks at adult)*	Question as a conversational turn, JAI to adult
119.39	A:	What’s those? … Glasses	
121.30	BESD:	Glasses *(looks at card and shakes head)* Mmmm *(looks at peer)* Pii *(points to card)* Pick that	Non-verbal response, JAI to peer
125.98	TD:	*(Looks at peer)*	
128.22	BESD:	(Name) it's your turn *(points to card looks at peer)* You have to pick that one, I think *(points to card)* it's that one. I don't know.	JAI to peer, verbal response, dominant
135.51	BESD:	*(Looks at peer, adult, then peer again)*	

136.09	BESD:	(Name) you *(points to card)* need to pick that	JAI to peer
140.97	TD:	*(Picks card)*	Non-verbal response to peers request
141.14	BESD:	What is it? *(Looks at peer)*	Question as a conversational turn
143.43	TD:	Money *(unclear speech) (looks at peer)*	
145.05	BESD:	*(Looks at adult and shakes head)*	Non-verbal reference
145.27	A:	Noo/ooo	Talking over (BESD group)
146.30	BESD:	/ Axe *(shows card to adult)*	JAI to adult

Table 50: Transcription of 'low-coherent' pair 3: BESD group child male, TD child male.

The interaction between peers of pair 3 of the 'low-coherent' cluster begins with the BESD group child reaching for a card in response to 'Who wants to go first?', which indirectly tells their peer they are going first (87.50 secs). Turn-taking is evident throughout the interaction, although guided by the BESD group child at one point saying 'It's your turn', an example of a BESD group child *scaffolding* the interaction. When the BESD group child picks the correct card, the axe, the TD peer does not state their opinion or agreement and instead picks out his own card (109.29 secs). The BESD group child then later tells his peer which card to choose, saying 'It's your turn … you have to pick that one'. The TD peer seems to take a while to respond; first looking at their peer (125.98 secs), before the BESD group child again says 'You need to pick that one'. The BESD peer then asks 'What is it?' to which he responds 'Money'. While this is an example of interaction between peers and is not just an interaction between the child and the adult, the BESD group child appears to be *carrying* the interaction and to also be *dominant* in the interaction, by trying to determine which card his peer chooses. There is the question here of whether the BESD group child deliberately tells his peer which card to choose as he knows he has already selected the correct card, the axe, thus setting his peer up to choose an incorrect card, or whether he is just wanting to control and give structure to the interaction. Interestingly, the card he tells his peer to choose is the last card left, so the likelihood it will be incorrect is extremely high, which the BESD group child may recognise. When the TD child chooses this last card, the money card (143.43 secs), it is the BESD group child who responds with a decision as to whether it would be useful, via a head shake directed towards the adult (145.05 secs). He then states 'axe' and shows the axe card to the adult as being the correct card.

12. 7 Case Study Conclusions

Exploratory research questions outlined at the beginning of the chapter considered whether behaviour and language/communication competency is related to behavioural equality and coherence of interaction, and whether competency and strategies of social interaction are related to coherence of interaction. Exploring the first of these questions, the most striking outcome from this series of case studies is the discrepancy in similarity/dissimilarity between paired children's reported abilities between the two interaction clusters. Paired children in the 'high-coherent' cluster appear to be more *dissimilar* in reported behaviour and language ability, with the TD group children typically scoring higher in ability than BESD group peers. In comparison, paired children in the 'low-coherent' cluster appear to be much more *similar* in reported behaviour and language ability. This suggests that while greater interaction coherence could be influenced by behavioural strengths and better language ability in typically developing peers, *discrepancy in abilities* between peers appears to be more influential.

There are also differences in the descriptive transcriptions of children's interaction between pairs of children and between the two interaction clusters. This addresses the second exploratory research question, whether competency and strategies of social interaction are related to coherence of interaction. Descriptive interpretations of children's interaction suggest the existence of different strategies of social interaction impacting on interaction quality and coherence. Examples of peer *scaffolding* are evident, involving one child in a pair using scaffolding techniques with his or her peer, enabling them to structure and guide the interaction. This is most apparent in the 'high-coherent' pairs of children, observed in 'high-coherent' pairs 1 (p. 164) and 3 (p. 171). Other paired children appear more equally co-operative or *synchronised* in their interaction, where no one child over-dominates behaviourally or verbally, and peer-to-peer scaffolding occurs from both TD and BESD peers in the form of JAI, mimicked verbal and non-verbal agreements, and turn-taking. For example, this is observed in 'high-coherent' pair 2 (p.168) and 'low-coherent' pair 1 (p. 175). Less coherent pairs of children display sequences of interaction that are more *disjointed*. In these pairs of children, there is less peer-to-peer interaction since many joint attention events are directed towards the adult, and so there is also less peer-to-peer scaffolding. The BESD group children of more disjointed pairs of children appear to be more dominant, displaying characteristics of competitiveness, interrupting more and having less regard for the equality of interaction and contribution of their TD partner. For example, these behaviours are observed in 'low-coherent' pairs 2 (p.178) and 3 (p. 182). Effectively, these children are structuring how the interaction will occur through their behaviour. Yet rather than scaffolding their peer and showing co-operative engagement with their peers, they are controlling the interaction.

This series of case studies therefore suggests that scaffolding and synchronised interaction strategies may lead to greater coherence in interaction. In conclusion, the interaction of children in this series of case studies may be characterised in three ways to reflect different interaction strategies:

- 'Scaffolding', where one child is able to support and guide interaction with his or her peer.
- 'Synchronised', where children are equally contributing to interaction and display shared co-operation.
- 'Discordant', where one child is dominating the interaction, there is less peer-to-peer engagement, and the interaction is more disjointed.

Importantly, however, these categories are not to be considered as mutually exclusive; strategies may vary within interaction and between different interactions occurring in different contexts. For example, in high-coherent pair 3, case study 3 (p. 171), it is suggested children use co-operative interaction and scaffolding techniques. Nevertheless identifying differences in strategies of interaction may have implications for classroom management and co-operative learning, discussed further in forthcoming discussion and conclusion chapters.

Chapter 13. Discussion

This chapter begins with an outline of key research aims, hypotheses and exploratory questions, and discusses how the research findings presented in Chapters 8, 10 and 12 address these.

13.1 Research Aims, Hypotheses and Key Findings

This research primarily aimed to investigate associations between behaviour and language/communication difficulties within a non-clinical community sample of children with behavioural, emotional and social difficulties aged 4–9 years. In addition, it aimed to explore the impact behaviour and language difficulties may have on children's peer-to-peer social interaction. A supplementary aim of this research was to explore the use of the LENA system as a novel technique for the measurement of language characteristics such as vocalisation count and conversational turn counts used by children during social interaction, considering the utility of the system within the current research context. Teacher- and parent-reported language and behaviour data, observed language and behaviour data, and a descriptive case series exploring peer interaction were incorporated into the study to address the above project aims.

In Chapter 6, four research hypotheses, based on existing literature, were outlined. The first of these was that children with identified BESD would have additional language/communication difficulties to a greater extent than typically developing children. In addition, they would score more poorly on reported overall language and communication ability, have more pragmatic and structural language difficulties, and score more poorly on multiple subdomains of reported language than typically developing children. The research hypothesis was confirmed, as significant group differences on General Communication Composite, Pragmatic and Structural composite scales and subdomains of speech (articulation, intelligibility and fluency), syntax (grammatically appropriate sentences), non-verbal communication (understanding of facial and bodily gestures) and social relations (difficulty with social relationships) were found. Corresponding effect sizes also indicated a large magnitude of effect; therefore, the results are meaningful and have substantive significance. Reported data therefore provided support for a relationship between behaviour difficulties and language and communication difficulties in a non-clinical sample of children. However, there was a degree of overlap of language and communication ability between groups. This was apparent on all subscales of the CCC-2. Therefore, while significant group differences were found, some children in the BESD group scored around average or above average for language and communication ability. This indicated a ‘middle ground’ area of average ability, shared by children in both groups.

The second research hypothesis was that a relationship between reported behaviour and language difficulty would exist, however the degree of and direction of a correlation between scores would be difficult to predict based on existing evidence. A significant negative correlation between teacher-reported SDQ total difficulties scores and parent-reported General Communication Composite scores was found. Therefore, the hypothesis of a relationship is supported and degree and direction of association has been informed: severity of behaviour difficulties was shown to be related to severity of language and communication difficulties in the current sample of children.

The third research hypothesis was that pragmatic language difficulties would be related to social behaviour difficulties including peer problems and prosocial behaviour problems. No pragmatic subscales of the CCC-2 were found to be related to social behaviour however the social relations subscale was found to be correlated with peer behaviour problems, but not pro-social behaviour. This finding may suggest a relationship between behaviour and language/communication at the operational level, where each of these reciprocally impact on children’s social interactions.

A final research hypothesis was that during peer interaction children with identified BESD would vocalise more but engage in fewer conversational turns during peer interaction than typically developing children (based on LENA data). This hypothesis was not supported as no significant differences were found between groups on vocalisation count data, conversational turn count data, or any of the key LENA variables. There was, instead, considerable overlap between groups in LENA vocalisation data.

13.2 Exploratory Research Questions

Exploratory research questions included in the study were those that were unable to be informed by existing literature, or arose during progression of the project. An initial question explored group differences in reported behaviour. As expected, owing to child selection criteria, teacher-reported behaviour confirmed half of the sample’s categorisation into the BESD group. The BESD group were reported to have significantly greater difficulty in total behaviour difficulties, conduct problems, hyperactivity, peer problems and pro-social behaviour than the comparative typically developing group. These characteristics reflect those most common to BESD, primarily externalising and social behaviour difficulties. Relative effect sizes indicated a large magnitude of effect for each of these; therefore group differences in behaviour outcomes may be considered as representative of everyday school life. There was, however, some degree of overlap in reported behaviour between the two groups, and a much greater range of degree of difficulty reported in the BESD group. This suggests a spectrum of behaviour strengths and difficulties representing variability in both groups.

Exploration of group differences in observed verbal (speech monologues, self-centred speech, use of questions, uninhibited vocalisations) and non-verbal behaviours (impulsive behaviour, joint attention initiation) during peer interaction did not show significant differences; however, there was a trend for children with BESD to be more vocal than their typically developing peers in terms of uninhibited vocalisations and their use of questions as a conversational turn. Observations therefore did not support reported group differences in behaviour and language/communication difficulties. However, post hoc power and effect sizes suggest that some group differences in observed behaviour may be found with a larger sample size of children. It was then explored whether correlations existed between observed variables (Observer and LENA variables) within peer dyads, indicating equality or inequality in observed behaviour and language between peers, and greater coherence in interaction behaviour between them. Significant correlations were found for child vocalisation counts, conversational turn responses, proportion of overlapping noise, and joint attention initiations. This indicated that paired children were displaying these behaviours similarly during peer interaction, which suggested increased coherence in interaction (as a result of equality) as well as the possible use of strategies of interaction such as scaffolding or synchronisation. First discussed in relation to co-operative learning and peer interaction in Chapter 1, scaffolding and synchronisation strategies were also subjectively observed in case studies of peer dyads in Chapter 11.

Investigating observed behaviour and language led to the exploration of children's use of behaviour and language characteristics together. It was questioned whether simultaneous use of behaviour and language (events occurring within 3 seconds of each other) provided 'mutual operational reinforcement' (reciprocal supportive acts of behaviour and language that operate for the same function). Firstly, outcomes found some interesting group differences in the degree to which simultaneous events occurred: three times as many within the BESD group in comparison to the TD group. In addition, more children from the BESD group used simultaneous events than children from the TD group; therefore, the increased number of events in the BESD group was not the result of multiple events from only one or two children. Behaviour and language characteristics that were incorporated together appeared to be those that were operationally beneficial and complementary to each other, thus providing ‘mutual operational reinforcement’. This was observed in both groups despite differences in the apparent aims of simultaneous events between groups; children from the BESD group appeared to use simultaneous events for self-engagement in the task, whereas children in the TD group appeared to use simultaneous events for informative purposes. Exploring the characteristics of the children who were observed to use simultaneous behaviour and language suggested that children in the BESD group were those who had comorbid behaviour and language difficulties primarily in social and pragmatic domains. This suggests that poorer behaviour and language competency may influence the use of simultaneous behaviour and language. As suggested above with regard to the third research hypothesis examining associations between social subscales of report data, this finding also leads to a suggestion of a relationship between behaviour and language at the operational level.

It was questioned whether characteristics of language and behaviour led children to interact better or worse with other peers. Variability in equality and inequality in frequency of observed characteristics of behaviour indicated some pairs of children were more equal than others. This suggested greater coherence in interaction contribution between them. In comparison, some pairs of children were less equal, suggesting less coherence and more unequal contribution between them. Six case studies of peer dyads were selected for descriptive exploration of observed peer interaction during a co-operative story task. Exploring the influence of behaviour and language ability on children’s observed peer interaction suggested that competency can impact on quality and coherence of interaction, but that this is mediated by the competency of interaction partners. Therefore, it is suggested that it is not necessarily the degree of children’s competency alone that impacts on quality of interactions, but that the discrepancy of ability between interaction partners may also influence quality of interaction. Descriptive interpretations of children’s interaction further suggested the existence of different strategies of social interaction impacting on interaction quality and coherence. Interactions observed in the six case studies were characterised into three categories relating to strategy: ‘scaffolding’, ‘synchronised’ and ‘discordant’. It is proposed that scaffolding and synchronised strategies may lead to greater quality and coherence of interaction.

A supplementary aim of the research was to explore the utility of the LENA system within the current context, as the inclusion of an older group of children with behavioural, emotional and social difficulties furnishes an alternative sample of children to those typically included in LENA research. Audio collected from the children throughout the interactive task was clear and comprehensible for each pair of children and the system correctly identified the 'Key child' voice as being the child who was wearing the corresponding LENA DLP. Therefore, the older age range and behavioural difficulties of the children did not impact on the LENA data collection. The utility of the system will be discussed in more depth in section 13.8 p.203).

13.3 Discussion of Research Outcomes Relating to Behaviour Difficulties

As stated above, it was expected that teacher-reported behaviour assessment data would support the BESD categorisation of half of the sample of children in this study. These children were those who were referred by teachers and SENCO's because they frequently displayed characteristics of behavioural, emotional and social difficulties within school. Behaviour report data showed that 90% of children in the BESD group were perceived by teachers to have difficulties with overall behaviour that lay within the abnormal or borderline range. More specifically, these children had most difficulty with conduct problems, hyperactivity, peer problems and pro-social characteristics of behaviour. Therefore, their difficulties are not specific to one type, but are externalising in nature and likely to impact on the child's social engagement. These characteristics support the children's BESD categorisation, and confirm that child selection criteria were adhered to by teachers and SENCOs. These criteria included characteristics outlined by educational guidance of behavioural, emotional and social difficulties and the SEN code of practice (2001) found in Chapter 2, and involved disruptive behaviour, difficulties with peers, attention, hyperactivity and problematic externalising behaviours such as aggression, as well as internalised emotional symptoms.

Outcomes of report data also match typical behaviour qualities of children with BESD reported in existing literature, and educational and clinical guidance of BESD (discussed in Chapter 2 under educational and clinical frameworks of BESD). The majority of existing literature and guidance show that problem behaviour in children with BESD is mainly externalising in nature (Gilmour et al., 2004; Howarth and Fisher, 2005; Ketelaars et al., 2010; Mackie and Law, 2010; St Clair et al., 2010), and behaviour reports in the current study support this. Furthermore, existing evidence presented in Chapter 1 in relation to classroom management and peer interaction also suggests that children with BESD have poor peer relationships (Newcombe, Bukowski and Pattee, 1993; Dodge, 2003), which current evidence supports through high scores on reported peer problems within the BESD group of children.

Reported behaviour data indicated that two children in the TD group had difficulty with behaviour that lay within the ‘Borderline’ range of severity. The characteristics of their behaviour difficulties were similar to those reported within the BESD group. These include conduct, hyperactivity, peer and pro-social problems, but also emotional problems. This unexpected result may indicate the existence of unidentified difficulties in these two children. Alternatively, it may represent reporter bias, reflecting teacher perceptions of children which may not be accurate representations of children’s behaviour. These representations themselves of course may change over time in relation to the child’s recent behaviour, or they may be influenced by context so children may behave differently within school and outside school.

Statistical group differences further confirmed that the BESD group of children were a noticeably different group from their TD peers in terms of their overall degree of behaviour difficulties and number of specific areas of behaviour difficulties. However, it is important to note that the behaviour difficulties of the current BESD group of children were generally low-abnormal in severity and within the sub-clinical range; that is, the difficulty scores were higher than that expected in typical populations yet lower than the clinical impairment threshold. This represents less severe, but still persistent and problematic, behaviour difficulties in this group of children from mainstream schools. Examination of the range of scores in the BESD group indicated a large range within degree of severity of behaviour; there were, therefore, some children in this group with less problematic difficulties, as well as children with greater difficulties. The range of scores in the TD group also shows overlap *between* groups in terms of severity of difficulty across a number of behaviour scales. There were, therefore, some children in the TD group with behaviour difficulties, and this overlapped with some children in the BESD group with less problematic difficulties. It may be said that the groups were not completely *distinct* from each other in terms of behaviour difficulty, but that there exists an area of low-abnormal scores that includes children from both groups. These results support the suggestion that degree of behaviour difficulty lies upon a spectrum.

Observational measurement of non-verbal behaviour did not show the same statistical group differences as reported behaviour data. Instead, the two groups were found to be similar in the degree to which they used each of the included behaviour codes. This investigation of observed non-verbal behaviour was exploratory and was not informed by the existing literature presented in Chapter 4, owing to its limited evidence and relevance to the current project making it difficult to derive hypotheses. However, as group differences in reported behaviour characteristics were found, this outcome is unexpected. This outcome may be the result of using a small sample size (indicated by post hoc power and effect size analysis), and additional Bonferroni correction for multiple testing. Increasing sample size and study power may detect group differences in behaviour, particularly in the area of impulsive behaviour, which was shown to have medium effect size even though the analysis here was underpowered.

13.4 Discussion of Research Outcomes Relating to Language and Communication Difficulties

Outcomes of parent-reported language and communication comparisons included significant group differences in all three composite languages scales: general language and communication, and pragmatic and structural language ability. These differences were also reflected within the subscales of speech, syntax, non-verbal communication and social relation language, with the children in the BESD group being reported to have greater difficulty in these areas than the children in the typically developing group. Corresponding large effect sizes confirmed the substantial impact of these characteristics. This supports the research hypothesis and view of existing literature presented in Chapter 3, literature review 1, that children in the BESD group would have pragmatic and structural language/communication difficulties, and that more than one subscale would be reported as being problematic for these children. These outcomes also support the suggestion by Bishop (1997a) that language difficulties are not typically associated with one specific type of impairment only, but rather with a range of associated impairments. Where no statistical significant group differences were found, post hoc power calculations showed the study was underpowered to detect a medium effect, most particularly for the three subscales: Interests (referring to specific interests the child has), Semantics (the child's expression of meaning), and Inappropriate Initiations (appropriate initiations in speech/conversations). Increasing the power of the study through a larger sample size may lead to more significant outcomes on these scales. Two subscales had greater power in the 70th percentile: Stereotyped language and Coherence. As regards these subscales it could be argued that although there remains potential to increase study power further (no result reached full power), the application of Bonferroni correction impacted on the number of outcomes considered to represent a significant group difference. Focusing on a few key language/communication variables may increase the likelihood of statistically significant group differences.

Mean scores showed that for each CCC-2 composite and subscale, children in the BESD group scored consistently below the normative mean provided by Bishop (2003) whereas the TD group scored consistently above the mean. It is important to note that mean general communication, pragmatic and structural composite scores of the BESD group lie within or around one standard deviation of the normative mean for these composites. Therefore, while significant group differences were found on all three composite scales and some subscales, generally speaking the language and communication ability of the BESD group may be described as below average rather than distinctly impaired. Examining the range of scores for each group shows differences between groups in upper and lower scores, with greater range in the BESD group, and noticeable overlap in scores between groups, suggesting a spectrum of language and communication ability. Some children in the TD group scored at below average level in ability, and this may indicate difficulties in children that lie undetected. The possibility of undetected difficulties in language and communication was suggested in Chapter 1 (Cohen et al., 1993, 1998; Cross, 1998; Ripley and Yuill, 2005). In addition, some children in the BESD group were reported to have average-to-above-average language/communication ability, matching the scores of the TD group children. This therefore creates an area of 'average ability' which is shared by children in both groups. In relation to these CCC-2 outcomes, it is important to consider that the reliability of the checklist has been shown to be variable and there is likely to be discrepancy between parent and teacher ratings (Chapter 4, p. 49). Therefore this limits the reliability of present scores, which will be discussed further in study limitations in Chapter 14.

Focusing on the most problematic areas of difficulty in children in the BESD group shows that difficulty in both structural and pragmatic language domains is equally apparent. Children were reported to have difficulty in Speech and Syntax, which partly make up the Structural language and communication composite of the CCC-2, while Non-verbal communication and Social Relations were other areas of notable difficulty, and these subscales are part of the Pragmatic language and communication composite of the CCC-2. These findings are in line with clinical literature that reports the existence of both pragmatic and structural difficulties in clinical populations (van Daal, Verhoeven and van Balkom, 2007; Ketelaars et al., 2010; Mackie and Law, 2010; St Clair et al. 2010), and suggests similar patterns of difficulties may also be present in non-clinical populations. Therefore, current evidence supports and adds to this accumulating evidence of social language impairments in children with BESD, and also supports the existence of overlap of type of language difficulties in children.

In Chapter 1, it was questioned whether similar rates of language difficulties would be found within a non-clinical community sample of children with behaviour problems. Current language and communication outcomes showed that 65% of children in the BESD group scored below average for language competency. Results were therefore as expected; proportions of difficulty were higher than reported in typically developing children, but lower than in clinical samples reported in Chapter 3. Hollo, Wehby and Oliver (2014) reported unidentified language difficulties in 81% of a group of children with emotional and behavioural difficulties, and Benner, Nelson and Epstein (2002) reported clinically significant language problems in 71% of children with emotional and behavioural difficulties. Differences in rates may therefore be due to differences in clinical/non-clinical sampling.

Observed verbal behaviour did not support group differences in language and communication found based on report data as group differences were non-significant. As stated above, observations of verbal and non-verbal behaviour were exploratory and thus were not informed by existing literature. Despite there being no significant differences between groups, the range of scores is noticeably greater in the BESD group for uninhibited vocalisations and the use of questions as a conversational turn than in the TD group. This suggests there was a trend towards children in the BESD group using more of these vocalisations than children in the TD group. Relatively large effect sizes were found for Speech monologues (in the form of talking over) and Questions used as conversational turn, suggesting a large magnitude of effect. Post hoc power for these variables was much greater than for other variables, and indicated that the study was only slightly underpowered in detecting an effect of group; therefore, by increasing the sample size, it is likely that significant group differences may be found for these variables.

Observed language data as presented by the LENA system also did not show the same statistical group differences as reported language data, and instead the two groups were very similar in their frequency counts of LENA vocalisation codes. These outcomes do not reflect existing LENA evidence, discussed in Chapter 4, which suggests that children who have difficulty with social communication and interaction engage in fewer conversational turns and have longer durations of speech than typically developing children (Warren et al., 2010). In addition, vocalisation outcomes do not support evidence reported in studies coding language of children with behaviour or language disorders, discussed in Chapter 3. Such evidence suggests the existence of longer durations of speech, increased talkativeness, verbosity and slower responses in conversation in children with behaviour or language disorders (Stroes, Albert and van der Meere, 2003; Redmond, 2004; Adams and Lloyd, 2007) (Chapter 4). However, these studies sampled children from clinical populations. As was concluded in Chapter 4, observed language and vocalisations of children with non-clinical BESD and co-occurring language difficulties were unexplored within the existing literature reviewed; it is likely that degree of severity of language impairment influences detection of group differences on LENA data. In addition, overlap in difficulty between groups indicated by report data may mean groups were not distinct enough in their use of vocalisations to produce significant group differences.

Differences in methodology between existing literature and the current project may also have influenced results. Studies discussed in Chapter 4 coded semi-scripted conversational interaction with an adult. The use of semi-structured conversation is to some degree designed to target and elicit specific language characteristics in children. In comparison, the methodology of the current study was designed to be more naturalistic. Interaction partners of children were familiar peers of the same age rather than an unfamiliar adult, and the interactive task offered the *opportunity* for particular language and behaviour, but characteristics were not elicited by semi-structured conversation. Furthermore, the short time frame during which LENA measured vocalisations could have also impacted negatively upon the detection of group differences in vocalisations. As will be discussed in Chapter 14, the reliability of LENA data was compromised owing to this short time frame. Alternatively, outcomes could be the result of lack of study power. Corresponding effect sizes for LENA codes were small and post hoc power analysis indicated power statistics of 5% and 9% for each variable, and so the study was highly underpowered in detecting an effect.

13.5 Is there an Operational Relationship between Behaviour, Language and Communication?

Outcomes discussed above indicate the existence of language and communication difficulties in children with behavioural, emotional and social difficulties according to report data, but indicate also that there is overlap between groups in both behaviour and language difficulties. This is supported by rates of comorbidity within groups, with the majority (58%) of children in the BESD group, and 12% of those in the TD group, reported to have difficulty with language and behaviour. Behaviour and language report data have shown that children identified as having BESD primarily have problems with externalising behaviour, which is inherently social in nature, as its greatest impact is on the child's surrounding social environment, as well as difficulties with the pragmatic use of language. This therefore supports existing evidence for social types of impairment in behaviour and language and communication (Benner, Nelson and Epstein, 2002; Gilmour et al., 2004; Ketelaars et al., 2010; Mackie and Law, 2010; St Clair et al., 2010; Goh, Yew and O'Kearney, 2013). In addition, the BESD group of children are reported to have a number of different types of behaviour and language difficulties that have social impact, and a correlation between two particular social subscales of behaviour and language was found (peer problems and social relation language). Social difficulties may represent difficulties within the child in ability to behaviourally or communicatively conduct themselves appropriately in their engagement with the social environment. Goh, Yew and O'Kearney (2013) propose similar difficulty with self-conduct, suggesting children with language difficulties may have difficulty managing their behaviours and/or emotions. Both of these suggestions may be related to existing evidence and theory suggesting that children with externalising behaviour problems and/or language problems have difficulty with self-regulatory processes (Posner and Rothbart, 2000; Tomasello, 2003; Rothbart and Bates, 2006; Rothbart, 2007). To further understand how behaviour and language difficulties may impact on children's social interactions, children's operational use of behaviour and language was explored.

The incorporation of simultaneous behaviour and language events during social interaction was explored in research enquiry two. Main outcomes included the striking difference between groups in the degree to which children used behaviour and language events together (within 3 seconds of each other). Children from the BESD group were observed to use simultaneous events three times more frequently than children in the TD group. Firstly, it was found that behaviour and language that was used together within a simultaneous event appeared to provide 'mutual operational reinforcement'. This was true for events made by either BESD group or TD group children. Events from BESD group children were operating for self-engagement in the task (impulsive in nature). A typical example of simultaneous events from these children is an impulsive 'I'll start' vocalisation talking over another person, coupled with an impulsive grab of the box task.

Investigation showed that children with comorbid behaviour and language difficulties primarily in social and pragmatic domains used simultaneous behaviour and language more frequently than TD children. In addition, more children from the BESD group (n = 10) used simultaneous events than children in the TD group (n = 2). This leads to the suggestion that behaviour and language competency may influence the use of simultaneous events which provide operational reinforcement to each other. This may be related to children's reported difficulties with pragmatic aspects of language, and social, externalising difficulties with behaviour; if these children struggle more in social situations as a result of these difficulties, perhaps there is a greater need for operational reinforcement from both domains to support their social engagement and communication. Operational reinforcement may also be influenced by difficulties with hyperactivity reported in a majority of the BESD group, creating the impulsive nature of the simultaneous events observed in this group. Impulsivity may also indicate difficulty with self-regulation and inhibition, as existing literature and theory suggest. It is therefore suggested that co-occurring difficulties in pragmatic language and social behaviour are a mechanism whereby children may reinforce their communication during social interaction through combined behaviour and language.

However, it was not only children in the BESD group who used simultaneous behaviour and language, as two children from the TD group with no language or behaviour difficulties also used simultaneous events. In comparison, these children had much greater language competency than the children in the BESD group and it appeared that they used behaviour and language together for a different purpose; to obtain information about a concrete *object*, typically asking questions about task picture cards. An example of this is a child saying 'What's that?' while showing the adult a picture card. This type of combined language and behaviour was also used by some of the BESD group children. However, it appeared that their questions were used to establish other people's *thoughts*: for example, 'Do you think the octopus?' Despite these slight differences in the purpose of questions between groups, combined behaviour and language events had the same social nature and functioned for the same outcome, to obtain information. It could be suggested that the TD children used simultaneous events to enhance communication, but that their reasons for this were less oriented around enhancing their own social engagement (as suggested in relation to the BESD group of children above), and alternatively were more concerned with obtaining task information. The finding that BESD group children were asking about other people's thoughts might indicate they were seeking to confirm their own thoughts, or seeking guidance in interaction from others. This is supported by the proposal by Paris and Paris (2001) that children use questions for self-regulation purposes, as well as the suggestion of the literature discussed above that these children have difficulty with self-regulation.

Thought-related questions exemplify the relationship between thought and language. There is existing evidence for this relationship from van Daal, Verhoeven and van Balkom (2007).

They suggest that language operates within the context of communication, which is influenced by cognitive processes such as thought and attention, and this is indicative of shared neurological processes. Neurological processes and cognitive functions such as attention may influence the thought and language relationship. The use of thought-related questions discussed here, as well as self-oriented simultaneous behaviours discussed above, may indicate that these children possess some difficulty regulating their own thought and inner speech processes. This may lead them to externalise their thoughts, and create a need for clarification of their thoughts from other people. This suggestion is supported by Vygotsky's *Thought and Language* work (Vygotsky, 1962, p. 211), which suggests that the pathways of thought and speech do not run parallel, that they are not separate entities; instead, their curves of development cross and re-cross. Therefore, there is scope for the mutual influence of thought and speech, and the regulatory systems responsible for these. Outcomes of simultaneous behaviour and language, however, must be treated with caution as they are based on relatively small numbers of children; however, they are suggestive of a relationship between behaviour and language at the operational level.

13.6 Behaviour and Language Competency and Peer Interaction

Suggestive evidence of a relationship between behaviour and language at an operational level leads to the question of whether behaviour and language competency influences quality of peer interaction. In Chapter 1, the importance of co-operative learning and peer interaction skills in the classroom was emphasised, meaning that explorations of peer interaction are valuable with regard to current educational practice. Behaviour difficulties, coupled with difficulty in language and communication, are likely to impact negatively on the child's co-operative learning. Effective social engagement involves not only socially-oriented behaviour, but also effective pragmatic language and the ability to understand the perspectives of others (Terwel et al., 2010). Current findings support this and indicate that children with BESD may have difficulty relating to and understanding the perspectives of others, which may impact negatively on co-operative engagement. Difficulty relating to others is indicated in reported poor peer-related behaviour and social relation language, and suggests that this behaviour has often been observed to be self-oriented (as demonstrated in the use of simultaneous behaviour and language to enhance self-engagement). Coherence of interaction, therefore, may be directly related back to co-operative learning, as more equal contribution is likely to indicate greater co-operation; therefore, in reality we might expect these pairs to learn better from each other.

As Chapter 3 concluded, there is little existing evidence about which characteristics of behaviour and language may provide for more effective co-operative engagement and coherence of interaction. Research enquiry three indicated varying degrees of equality and inequality in paired children during interaction, confirmed through paired correlations of child vocalisations and use of joint attention. This supports existing evidence from Bruce, Hansson and Nettelbladt (2010), who found significant correlations between children on various aspects of conversational dialogue, indicative of peer influence on verbal interaction. Exploration of a case series of peer dyads with different degrees of interaction coherence suggested competency may impact on interaction, but also that differential ability between paired children may also impact on interaction quality. Where there was greater discrepancy in reported behaviour and language ability between children, these pairs were classed as more coherent in interaction, and as displaying more equal contributions to interaction than those pairs who were more similar in behaviour and language ability. Descriptive transcription of children's paired interaction suggested the existence of different strategies of social interaction impacting on interaction quality and coherence. It was suggested that interactions observed in the six case studies could be characterised into three categories relating to strategy; 'scaffolding', synchronised' and 'discordant'. However, such categories are not to be considered as mutually exclusive; interactions may include more than one strategy, influenced by natural dynamics of interaction or perhaps by different contexts within which interaction occurs. Furthermore, it was proposed that scaffolding and synchronised strategies may lead to greater quality and coherence of interaction.

It was observed that scaffolding of interaction occurred in the majority from children with more typical behaviour and greater language competency than their peer (though one example of scaffolding occurred from a BESD group child with poorer language and communication scores who was paired with a TD child who also had poorer language and communication). That scaffolding was observed to occur in the majority from children with more typical behaviour and greater language competency than their peer supports research discussed in Chapter 3, literature review 2, that suggests children with better behaviour or language/communication competency may influence interaction. Scaffolding mainly occurred with children *guiding* their peer through the interaction. The typically developing children who provided scaffolding excelled in overall behaviour skills in comparison to their BESD group partner, but they also had much better *peer-related* and *pro-social* behaviour. This could contribute to coherence of interaction as those with better peer skills are likely to be more co-operative. Appropriate peer behaviour also involves consideration of others' perspectives, thus again providing a scaffold for co-operative interaction to occur, and for equal contribution to the task to take place.

When paired children were similar in language and communication ability and ability was above average, interaction was more balanced and synchronised; no one child over-dominated and supportive behaviour was observed from both the TD and the BESD group children. Again, TD children in these pairs were reported to have good peer and pro-social behaviour, which perhaps allowed them to synchronise their interaction behaviour to that of their peer. This concept of synchronisation was introduced in Chapter 1, proposed by Farmer and Cadwallader (2000). If children synchronise their behaviour with that of their peer, through imitation, reciprocity and complementarity as Farmer and Cadwallader (2000) suggest, it would be expected that greater coherence in interaction would occur.

Discordant interaction was defined as instances where one child dominates the interaction, involving less peer-to-peer engagement and more disjointed interaction. Discordance in interaction was observed in two pairs of children. One pair were similar in below-average language ability and the BESD group child scored high for hyperactivity problems while the TD group child scored low on pro-social behaviour. Over-dominance in this pair's interaction could be influenced by hyperactive behaviour in one peer and poorer helping behaviour in their partner. However, this profile is not evident in the second pair demonstrating discordance. Children in this pair were similar in above-average language ability and were reported to have fewer behaviour problems. Perhaps other characteristics of children that were not detected by current behaviour assessment, such as competitiveness or dominance, also contribute to discordant interaction.

Case study findings support literature discussed in Chapter 3 about peer interaction and the effects of scaffolding, and discussions in Chapter 5 about the Zone of Proximal Development (Vygotsky, 1978). These concepts may be used to apply current case study outcomes to real life contexts. Murphy, Faulkner and Farley (2014) found that pragmatically highly skilled peers that were coupled with pragmatically low-skilled peers showed significantly more sensitivity to their peers' difficulties than when they were paired with a peer of similar ability. Likewise, in current results children who were in the 'high-coherent' cluster differed more on pragmatic language ability. The Zone of Proximal Development concept proposes that children's learning should be matched with their actual developmental level. In order for developmental progression to occur, the potential level the child could achieve through adult guidance or peer collaboration must also be recognised. In the current study, this may be indicated by, and provided by, the more advanced peer. Current case studies would indicate that, when considering children whom it may be suitable to position together in a classroom context for co-operative learning activities, pairing children with a discrepancy in ability and identifying children with good peer and pro-social behaviour may improve co-operative interaction learning. It is, however, important to note the limitations of making judgements on the basis of small case numbers. The current exploration is preliminary and subjective. Generalising findings must be treated with caution. Furthermore, the findings presented here are the result of one-off assessment, which therefore captured a specific moment in time between peers. Therefore, the stability of these interaction behaviours over time may be questioned, and this is yet to be explored.

13.7 Theory of a Spectrum of Behaviour and Language Association

It is suggested that current outcomes represent a relationship between behaviour and language that exists on a spectrum with regard to severity of difficulty and degree of association. Furthermore, association is suggested to be present at the characteristic level evidenced by report data, as well as at the operational level evidenced by correlated problematic behaviour and language, and by observation of shared social functions and impacts in children's use of simultaneous behaviour and language. However, the proposal of a spectrum of association means the two domains of difficulty may also exist entirely separately from each other. This is evidenced by the fact that not all BESD group children had co-occurring language difficulties and some TD group children had independent language or behaviour difficulties. In addition, and as expected, the majority of the TD group had no difficulties. These findings lead to the question as to why such differences in ability exist in children.

Theoretical perspectives presented in Chapter 5 would suggest that it is most likely that comorbid behaviour and language difficulties share the same underlying processes (Carpenter and Drabick, 2011) and association is influenced by interactions between internal and external constraints on development, cognitive processing and active construction from the child. Together these influences may begin to provide an underlying framework for association between behaviour and language difficulties within non-clinical populations of children. Although the current project did not explore underlying processes such as cognition or neurology, theoretical explanations for association may be speculated upon on the basis of current outcomes.

Each of the above influences lies within a developmental perspective. It was identified in Chapters 1 and 5 that an appropriate theoretical perspective that may account for behaviour and language association must be grounded within this perspective. This considers the dynamic influences occurring throughout child development of experiential and internal constructs. Developmental perspectives would argue for the variability in presentation observed in the current study as the result of differential dynamic influences. Applying this theory to a spectrum of association suggests that comorbid behaviour and language difficulty may share underlying processes such as neurology or cognition, but the degree of association at the underlying, characteristic and operational levels may be influenced by variable dynamic interactions between children's experience and internal development. Likewise, degree of severity of behaviour and language may also adhere to the same influences. Therefore, different interactions throughout development lead to variability in social functioning. Furthermore, the degree to which a child's own active construction of development and learning influences development must not be overlooked. This would add to the explanation of variability in phenotypical outcome, explaining why some children have comorbid difficulties, others single difficulty in only one domain and others no difficulties. Developmental perspectives therefore appear appropriate to the explanation of a *spectrum of association*.

The majority of children in the BESD group were reported to have comorbid behaviour and language/communication difficulties. Some (unexpected) distinct difficulties in either language or behaviour were reported in some children in the TD group but none were co-occurring. This may suggest a greater influence of behaviour on language development; poorer behaviour may be a mechanism for poor language development to occur, creating co-morbid difficulties. This suggestion would be supported by literature discussed in Chapter 3, reporting prevalence of comorbidity as being greater in children with behaviour difficulties than children with language difficulties. It was questioned whether these children with co-morbid difficulties represent a distinct group in comparison to typical children, or are instead a subgroup at one end of a spectrum of difficulties. Current evidence suggests these children *are not an entirely distinct group* from the TD children in this sample. There was a degree of overlap between groups in reported and observed language and behaviour difficulties. It was also noted that the behaviour and language difficulties reported in some of the typical children shared similar social qualities to those reported in the BESD group. This again suggests a spectrum of difficulty, particularly with regard to social and pragmatic aspects of behaviour and language. Theoretically, if we think of dynamic influences on children's development as potentially influencing a spectrum of ability, it is perhaps likely that children's competency and degree of comorbidity may change over time. As the current study is cross-sectional, this may be an interesting direction for future research.

The above suggestion of a greater influence of behaviour on language development may be explained through the cognitive-behavioural theory. Existing cognitive-behavioural theory and literature addressed in Chapter 5 proposes that children with externalising behaviour difficulties have impairment in executive function and cognitive processes such as self-regulation and effortful control, which incorporates attention, perception and inhibition (Posner and Rothbart, 2000; Rothbart and Bates, 2006; Rothbart, 2007). This suggests that children in the BESD group may be less able to inhibit and control their behaviour, and therefore display more frequent problematic behaviour of the kind currently reported. As was discussed in Chapter 1, there is evidence that children with BESD have impoverished peer interaction and relationships (Newcombe, Bukowski and Pattee, 1993; Dodge, 2003). A child who repeatedly experiences poor engagement with peers is perhaps more likely to avoid situations where peer social interaction is involved. Current findings support this, as case study outcomes showed that some children with BESD engage less with their peer and more with an adult. This could be detrimental to their learning of appropriate social interactive language and communication.

Children's social environment and opportunities for learning effective behaviour and language strategies for social engagement are therefore diminished relative to those of children who have good peer engagement and relationships (more opportunity to practise and develop strategies of social interaction involving behaviour and language). Furthermore, impoverished engagement may become the type of social input repeatedly processed by the child at the neurological and cognitive level, reinforcing atypical behaviour and difficulty in language/communication development. Constraints at the environmental level therefore operate differently for children with BESD from how they operate for TD children. Cognitive-behavioural influences may also impact on language development through self-regulatory constraints. Reduced access to good-quality peer interactions throughout development may mean the child has less chance to practise appropriate self-regulation in social situations. This may be related to the ideas of Vygotsky (1962) that typically, children's egocentricity becomes internalised throughout development forming inner speech. This involves a self-regulatory process. Observational evidence suggests that much of the speech of the BESD group is impulsive and self-oriented. Therefore, deficits in self-regulatory processes may be influenced by poor social experiences, subsequently impacting on language and communication.

While theoretical explanation for association between behaviour and language has been speculated on here, as discussed in Chapter 5, currently there is no theoretical account sufficient to explain association. The inclusion of shared neurological influences and consideration of the role of interactions occurring *within* the biological architecture and external environment may be the missing links in creating a theory that might account for behaviour and language association and variable degrees of association. However, such a theory would involve further experimental investigation, which will be discussed in relation to future research in the final chapter.

13.8 Utility of the LENA System

A supplementary aim of the current study was to explore the utility of the LENA system with a different sample of children from those typically used in LENA research. The current study was the first to apply LENA technology to children aged 4–9 years with behavioural, emotional and social difficulties.

Current research has shown that the system can be used effectively with children in this older age range (as opposed to its most common use with children aged 2–36 months) in terms of clarity of audio recording, the correct identification of the child's voice, and the production of automated report data from audio files, all within short time frames of recording. Therefore, older age range did not appear to impact on using the LENA system. The current study is also able to show that children with behavioural, emotional and social difficulties can be assessed using LENA and that their behavioural qualities such as hyperactivity, problems with attention and disruptive behaviour (identified through selection criteria and report data) do not impact on the LENA process, or appear to impact on the quality of audio data. Overall, the LENA system offered an advantage over laborious techniques of manual language transcription, and was able to efficiently report upon characteristics of children's language at a descriptive level. There was an additional aspect of the current methodology that differed from typical LENA research, primarily the use of short audio recordings, whereas originally LENA was designed for continuous full-day recordings. This was discovered after LENA measurement had been carried out, during the analysis phase. This and other limitations to the inclusion of LENA are discussed further in Chapter 14.

Final conclusions of the current project will be presented in the following chapter. These include strengths and limitations of the research, key implications for practice of project outcomes, and important directions for future research.

Chapter 14. Conclusions; Strengths and Limitations, Implications for Practice, and Future Research Directions

Typically, behaviour and language and communication are considered independently of each other. They have separate diagnostic categories of disorder, and within the field of research are most typically examined independently of each other. The current research evidence indicates that in fact, behaviour, language and communication may not be as separate as they are currently regarded as being, and alternatively the two domains share a degree of overlap. Investigation has indicated their association most concretely at the report level, and has suggested association at a descriptive operational and subjective level. It has added to existing research findings by confirming that associations exist in a non-clinical sample of children, as well as suggesting the existence of two spectrums of behaviour and language; a spectrum of *ability* and a spectrum of *association.* It is proposed that a spectrum of ability exists that is shared by typically developing children and those considered to have BESD. This is evidenced by variability in competency between children in the current sample, ranging from greater degrees of competency and overlapping 'average' competency to poorer degrees of competency. A spectrum of association is evidenced by variable degrees of association between different behaviour and language constructs reported and operationally observed in the current sample. In the current study, it is important to note that these observed spectrums of ability and association were also influenced by the inclusion of four children in the BESD group who had a clinical diagnosis in data analysis: one child had Autism Spectrum Disorder, one had Attention Deficit Hyperactivity Disorder, and two had Learning Disability. Although not examined independently, it is likely that group scores for severity of behaviour and language difficulty may have been raised as a result of these more severe problems.

It is tentatively suggested that children's behaviour and language ability may impact on their operational use of behaviour, language and communication, and their peer interaction. Operational reinforcement from both domains may be a supportive mechanism in children who have comorbid difficulties, as a means of enhancing their social communication. It is suggested that the negative impacts that problematic behaviour and language may have on interaction may be mediated by the competency of children's interaction partner. Scaffolding and synchronisation techniques may be important for coherent interaction, and these techniques are perhaps most likely to occur when there is discrepancy in ability between peers (where one child is at a developmental advantage), or when children are competent in their peer-related and/or pro-social behaviour.

14.1 Strengths and Limitations

A main strength of the current research is that it has identified co-occurring language and behaviour difficulties in a non-clinical sample of children, whereas the majority of existing research exploring the relationship between language and behaviour focuses on clinical samples of children. This study has therefore addressed a need in research with regard to sampling, and its outcomes have created a dimensional view of difficulties relevant to a wider community population. Furthermore, recognition of co-occurring difficulties in non-clinical samples allows for intervention and remediation of difficulties in children who may be less likely to receive adequate support, as co-occurring difficulties may go unidentified, and these children do not have a clinical diagnosis. The sampling, along with a mixed-methods design combining report data, observational data and the inclusion of an automated language vocalisation assessment, has allowed for a dimensional consideration of language and behaviour difficulties. Limitations of one measurement methodology may be counteracted by the strengths of another. Report data enabled the confirmation of BESD group categorisation, which supported the reliability and application of child selection criteria. A further strength of the methodology is the observation of live verbal and non-verbal behaviours of children. Observation occurred in the same social and naturalistic context for each child; therefore variable contextual and environmental influences on children's behaviour were avoided. It was also unclear from existing research to what extent co-occurring behaviour and language difficulties impact on peer interaction. Therefore, the current study has provided suggestions as to the types of impacts they may have, but in addition, it has provided information about the type of analysis that could demonstrate the nature of some peer interactions of children with BESD.

Original aspects of the current project are additional strengths of the study. The successful development and application of a new behaviour coding scheme that has reliably captured communicative verbal and non-verbal behaviours of children with and without BESD is a central element of and further strength of the project. This has bridged a gap in coding research where existing schemes are targeted towards clinical populations and the characteristics of these populations; therefore, they are less applicable to BESD characteristics or typically developing children's language and behaviour. During the project it was found that there was also a gap in available tasks that would elicit a sufficient amount of peer-to-peer interaction involving behaviour, language and communication for this to be measured. In addition, tasks used in existing research targeted specific behaviours common to clinical disorders such as ASD, and observations in research were between children and an adult rather than between peers. There was also a need for a task that would engage children with typical hyperactive and inattentive characteristics of BESD for a sustained period of time so as to be able to assess them. The creation of the 'Story in a Box' has filled this gap, allowing for observation of naturalistic peer-to-peer interaction behaviours while engaging children enough for accurate measurement. It has therefore been a valuable and indispensable component of the current research methodology.

The main limitations of the study relate to the small sample size and lack of power to detect an effect of group. As was presented in Chapter 7, in order to reach a power of 0.8 with a 0.5 effect size, a sample size of 26 children per group was needed. Therefore, the current study was underpowered at 20 children per group and this was lowered again in analyses where there were missing data for children. Post hoc power analysis indicated low power for non-significant observational variables most particularly in the analysis of LENA data. Some medium to large effect sizes on verbal and non-verbal coding scheme variables indicated that an increased sample size (and therefore greater study power) may detect group differences on these variables. A further limitation is the exploratory nature of parts of the research, particularly in relation to peer interaction. Therefore these outcomes are subjective and suggestive only and there is a need for further research into exploratory aspects of the research.

Low power subsequently impacted on the interpretation of outcomes. Interpretation has relied upon SDQ and CCC-2 report data as no statistical group differences in coded observation or LENA assessment were found. Report outcomes have led to subjective interpretation of children's operational use of behaviour and language, and of peer interaction. This is a limitation to the study, as report data may be subject to bias and teachers' perceptions of children in an educational context and that time-point. It may be questioned whether report data are representative of children's skills across different contexts and interaction partners as well as across time. Therefore as findings are based on report data only the validity and reliability of outcomes is jeopardised. As reported in Chapter 13, the reliability of the children's communication checklist-2 (upon which the interpretation of the language ability of the children with BESD relies) has been shown to be variable and there is likely to be discrepancy between parent and teacher ratings (Chapter 4, p. 49). Therefore this limits the reliability of present scores. There is an additional risk of bias with regard to coded observational data as the coder (the researcher) was not blind to children's group allocation.

Furthermore, the current study is not longitudinal, and judgements have been based on the outcome of one-off assessments of children. It is understood from existing literature and theory that change in behaviour and language ability, as well as their association over time, is highly likely to be due to the dynamic interplay of development. It cannot be certain, therefore, to what degree outcomes represent stability, and it is most likely that association and competency will change over time. If the study were to be conducted again, it is unlikely findings would be exactly replicated. Similarly, interpretation of peer interaction is based on assessment of children at one particular time-point in a standardised context across children, rather than longitudinally and within differing contexts. Whilst this offers the opportunity to avoid variable contextual and environmental influences on children's behaviour, as noted above, it may be questioned how applicable current interpretation is to alternative contexts, and how representative it is of the everyday interactions of the children.

Some characteristics of the sample have created further limitations within the design and analysis of the study. As mentioned above, four children from the BESD group had received a diagnosis of disorder; one had ASD, one child had ADHD, and two had learning difficulty. These were kept in the final sample as difficulties were disclosed at a late stage during assessment and it was felt that eliminating these children would compromise the project. Their main difficulties were also in line with educational criteria for BESD. However, the inclusion of these children could have impacted on results by inflating outcomes of behaviour and language difficulties in the BESD group, as these children's difficulties would be more impaired, and further above clinical thresholds, than those of the rest of the group. Two children from the TD group were reported to have behaviour problems, and this may have restricted the detection of group differences as overlap of difficulties between groups was increased; however, degree of overlap in children was an interesting finding.

There are additional methodological limitations in relation to the matching procedures used to pair children together for observation. Pairing children aimed to match children on gender and language ability, however matching procedures took place after the recruitment of the children. This restricted the number of TD children available to be matched to BESD group children, making matching much more difficult, resulting in some pairs of children being unmatched with regard to gender and language ability yet still included in the final sample. Miscommunication with schools and unreturned language assessments hindered the matching of children and the inclusion of these children reduced the degree of control for language in the observational assessment of children's interaction. In addition it cannot be ruled out that differential gender pairing influenced peer interaction. Current interpretations are therefore limited in reliability. Furthermore, using a median cut-off point for matching children on language ability for observational assessment may be criticised as being not strict enough (compared to using upper and lower quartiles of scores) to differentiate between pairs; however, the aim was to keep in line with the targeted non-clinical population and to allow for the detection of difficulties within mainstream school.

There were additional limitations in the use of the LENA system, and these are related to accuracy of data and the practicality of the system. The accuracy of LENA data was compromised as a result of the design of the study. Recording children's vocalisations for a short time-frame, and therefore having lower frequency counts than typical LENA data, increased the risk of error in the system's output by reducing the sensitivity of LENA measurement. The smallest segmentation time for which LENA can provide data is five minutes; it is unable to select out parts of recorded audio at the minute segment level and provide automatic count data for individual assessment. Examination at the minute segment level was necessary to standardise analysis across paired children as different pairs of children completed the interaction tasks at different rates. This meant that another program, Transcriber, was employed to analyse data at the one-minute segment level. Although LENA data and codes were exported directly into Transcriber, analysis at the finer one-minute level included manual frequency counts of LENA codes. This is a limitation to the study, as reliability of the data is reduced and there is the risk of human error in final count data. Furthermore, LENA analysis relies on algorithmic and iterative processing models to identify speakers and to create frequency counts of vocalisation codes. Although the system reports good reliability against human transcription, there is a presumption among users that data output is accurate. Testing the output for accuracy would involve labour-intensive human transcription. This reliance on the system's accuracy is further compromised in the current study, owing to reduced sensitivity of measurement because of short recording time.

Practical limitations to LENA include the need for the DLP to be uploaded after each child's vocalisations are recorded to enable the software to assign the audio file to the correct child. This upload takes time; a ten-minute audio file may take around 7–8 minutes depending on the complexity of the file. The inclusion of two DLPs then doubles this upload time. This means that there is a delay in the assessment process as further children cannot be recorded using the LENA DLP until upload from one pair has completed. In initial trials of LENA (Appendix C), it was discovered that using one DLP to record both children in a pair (swapping the DLP halfway through the assessment) did not provide accurate data as the DLP cannot differentiate between children's vocalisations without being uploaded after each child. In instances where upload was carried out before the DLP was given to a peer partner, children were left waiting for the upload to finish and therefore became irritable and uninterested in the task. Subsequently, a second DLP was ordered for full testing. This limitation should be considered in similar future research using more than one child.

14.2 Implications for Practice

Outcomes of the current study have significant implications for practice in a number of areas, including education and classroom context, clinical practice, and mental health trajectories. The existence of co-occurring difficulties in children with BESD suggests there is a need in education and clinical practice for the mutual impacts of behaviour and language to be considered, rather than viewing and addressing behaviour and language difficulties as distinct domains. Currently, there is no clinical diagnostic or educational guidance category which groups behaviour and language difficulties together. While children with comorbid difficulties may not represent a distinct group (suggested by overlap between groups in the current sample), recognition of associated and reciprocal language and behavioural difficulties remains necessary. Substantial overlap of both language and behaviour difficulties between groups in the current sample not only indicates that difficulties may exist in typical populations of children also, but is an example of heterogeneous profiles of behaviour and language among children. As was discussed in Chapter 1, learning difficulties are highly related to rates of SEN, and so awareness and treatment of difficulties that either lie within a 'sub-clinical' range or are below average are important if rates of SEN among children are to decrease and educational achievement is to increase. Awareness of the mutual influence of behaviour and language is also important for guiding developmental pathways to provide for the best developmental outcome. Furthermore, guidance and intervention should take into consideration the heterogeneous nature of presentation, and strategies for providing optimum behaviour and language outcomes should be tailored towards individual children's difficulties.

As stated above, it is suggested that behaviour and language ability exists on a spectrum. Therefore it is dimensional, and children who are regarded as 'typically developing' attending mainstream school may nevertheless have unidentified behaviour or language difficulties. This is evidenced by reported behaviour difficulties and poor language and communication ability in typical children in the current sample. Supposing these outcomes are a realistic representation, this suggests there is a need for improved monitoring of children's abilities throughout development.

As was discussed in Chapter 1, behaviour and language problems negatively affect child inclusion in classrooms and peer relationships (Terwel et al., 2010). If replicated with a larger sample size and measurement over a longer period of time, current peer interaction findings could be used to inform the set-up of better interaction opportunities between peers. This would not only make for better learning through co-operative strategies, but also make for inclusion in the classroom and better peer relationships. Rates of comorbid behaviour and language problems and associations found at the reported characteristic level and subjective operational level have implications for clinical practice and educational guidance for children both with and without special educational needs. Findings may therefore lead to the development of useful guidance if intervention strategies involve social interaction between peers, or if educational contexts explore the formation of co-operative interaction or co-operative learning through peer scaffolding and synchronisation.

In addition, peer interaction is not only a context for academic learning to occur, but for strategies of social interaction to be learnt and practised. Observations of children completing the interactive task the 'Story in a Box' have demonstrated this. The 'Story in a Box' task itself, therefore, may be a useful context within which teachers could help children to learn to interact co-operatively using not only techniques such as scaffolding and synchronisation, but also positive communicative behaviour and language such as joint attention and questions.

14.3 Directions for Future Research

Directions for future research have arisen from the outcomes of the current project. Most prominently, there is a need for future research to focus on the mutual influences between behaviour, language and communication within non-clinical populations. This will further clarify the extent and nature of association and inform strategies for intervention. The three enquiries in the current study focus on reports, observations, or descriptive interpretations of children's behaviour and language/communication at one time-point. Future investigations might involve expanding upon this by looking longitudinally at language and behaviour difficulties. This would not only increase the ecological validity of findings, but would allow for the exploration of the stability of language and behaviour difficulties and association over time.

The current study has suggested the existence of spectrums of ability and association of behaviour and language difficulties. There is a need for further exploration of this using a much larger sample of children and therefore greater power, as this suggestion is based upon report data and subjective interpretation of a small sample of children. Further investigation of the proposal of a spectrum might also consider changes in association and competency over time as a result of dynamic influences on development.

There is a need for improved methodology in future research which would include matching children on gender and language by assessing a larger group of TD children then selecting out of this group in order to match with a child from the BESD group. Furthermore there is a need for improved methodology in research that incorporates the LENA system. Primarily, this would include lengthening audio recording time to multiple hours or full-day recordings. This would provide for more reliable, richer and more ecologically-valid data, as well as allowing for the exploration of children's vocalisations across different contexts. Acoustic features of vocalisations of children with BESD and/or language difficulties may also be explored. Acoustic features were investigated in existing LENA research discussed in Chapter 5 that demonstrated differential vocal syllabification between children with Autism, children with language delay and typically developing children. It would be interesting to investigate whether differentiation in acoustic features is apparent in non-clinical samples of children with behaviour and/or language difficulties and typically developing children.

The proposal that children with comorbid difficulties may use behaviour and language of a shared nature together for operational reinforcement may also be explored further, as this interpretation was based on a small sample size and is highly subjective. Aside from increasing sample size, an intervention approach would also be an effective way of determining this relationship. If behaviour and language are associated via nature and function, and comorbid difficulties are the result of shared underlying processes as suggested in current theoretical discussions, improvement in one domain should lead to improvement in the opposing domain. One piece of research addressing this issue of mutual impact of intervention on behaviour and language was conducted by Law and Plunkett (2009). However, firm conclusions could not be made due to low weight of evidence. There remains a need for more intervention research targeting behaviour and language together and exploring the outcomes.

Measurement of the underlying neurology and cognitive processes of children with comorbid difficulties would also confirm whether difficulties share the same neurological and cognitive underpinnings. Investigations may include determining how neurology of children may vary between children without difficulties, those with difficulties in one domain, and those with co-occurring difficulties. Research may also explore the influence neurological vulnerability has on alternative developmental trajectories of behaviour and language ability.

It has been suggested that peer interaction outcomes may be useful in informing co-operative learning opportunities in the classroom in light of the proposal of three types of interaction profiles: ‘scaffolding’, ‘synchronised’ and ‘discordant’. As this was based on a series of case studies, future research might expand on this by looking at how behaviour and language competency impacts on peer interaction in a much larger sample of pairs of children where power is increased and outcome effect size can be interpreted. This may also include exploring whether other children’s interactions adhere to these three profiles of interaction, further defining these profiles and testing their validity. Research may also explore the extent to which each style may improve or exacerbate peer interaction, and whether/how context variability influences the use of particular strategies for interaction. Furthermore, the effect of differential gender-pairing on peer interaction was not explored in the current study. As stated in Chapter 1, gender is an important predictor of SEN with higher rates in males than females. It is also recognised by teachers as an important factor in peer-group composition, impacting on the efficiency of co-operative working. In addition, it was stated in Chapter 3 that determining differential gender-pairing effects on peer interaction was difficult based on existing literature. Therefore, there may be a gap in research for the further exploration of this.

Aside from peer interaction, it would be interesting to explore whether other characteristics of children’s social environment are related to behaviour and language ability and association. These include socio-cultural influences and parental engagement. Developmental perspectives consider the impact of the social environment and experience on behaviour and language development; therefore, under this perspective, the influence of culture and variability between cultures cannot be overlooked. As was stated in Chapter 5, social interaction is necessary for ‘developing culturally organised, specifically human psychological function’ (Vygotsky, 1978). Exploring variability in behaviour and language difficulties and associations between different cultures may therefore be a future direction for research. Parental engagement as part of children’s socio-cultural experiences may also influence children’s behaviour and language and peer interactions. It may be questioned whether the parents of children identified as having BESD display similar characteristics and difficulties.

For example, do they have social behaviour difficulties which may negatively impact on their children's social behaviour development? Furthermore, since school deprivation levels were collected in the current study, it would be interesting to explore whether deprivation is related to children's ability to adapt to social situations. As the existing literature suggests (Chapter 1), children from socially deprived areas are more likely to have BESD. The current sample of children were recruited from relatively deprived areas, so it may be questioned whether the same outcomes are evident in children at the other end of the deprivation spectrum. Additional research questions may include whether children from less deprived areas have better behaviour and language strategies for coping and adapting to social interaction than children in more deprived areas. Furthermore, is this influenced by parental competencies, or any other experiences that may be linked to deprivation, for example overcrowded living circumstances?

As a result of the success of the 'Story in a Box' development and application, it would be interesting to explore the use of this task further, as well as how children use different strategies to complete the task. This might include clarifying the task's primary audience; exploring which age range it is best used with, whether it may be used successfully with children who have more severe clinical difficulties, and whether larger groups of children can complete it instead of pairs. It could also be clarified whether the 'Story in a Box' is most appropriate for the research context, as used in the present methodology, or whether it may have additional applications in educational and clinical domains. As mentioned above, it may provide a useful context in which teachers can help children learn and develop appropriate peer interaction behaviours. There is also the potential to develop more 'Story in a Box' tasks which may vary in difficulty and target other characteristics and abilities regarding behaviour, language and communication and the interaction strategies of children.

The current study has indicated an association between behaviour, language and communication difficulties in a non-clinical sample of children attending mainstream schools. Most concretely, this is at the report level, and the suggested association has been presented at a descriptive observational and subjective level. The existence of spectrums of ability and association has been proposed, which may account for variability in the severity of difficulties and degree of comorbidity. Impacts of co-occurring difficulties in relation to peer interaction and operational use have been explored and speculated upon. These include the proposal of behaviour and language characteristics providing mutual operational reinforcement for communication; the suggestion that greater discrepancy of ability between peers may lead to greater interaction; and the suggestion that differential strategies for interaction may exist and influence interaction quality and coherence. As a result of the project, a novel behaviour coding scheme for the detection of communicative verbal and non-verbal behaviours in a non-clinical sample of children was developed. An original task for the measurement of communicative behaviour, language, and interaction strategies has also been created. Strengths and limitations of the study have been presented, and directions for future research have been suggested.

Appendix A. Creating a Behaviour Coding Scheme

Rationale

In order to enhance data regarding the communicative interaction behaviour of the two groups of children, an observational coding scheme was designed which would capture non-verbal and verbal behaviours of the children during the ‘Story in a Box’ game. The development of this coding scheme for further analysing communicative behaviours alongside LENA’s outputs began with a review of existing coding schemes of verbal and non-verbal behaviours. This review included The Facial Action Code (Ekman and Friesen, 1976), the Social Orienting Continuum and Response Scale (Mosconi et al., 2009) and the Psychosocial Processes Coding Scheme (Leaper, 1991). Typically, coding categories adopt a hierarchical structure which includes primary and secondary codes, a reflection of the complexity of children’s behaviour interactions. Coding scheme development began with the formation of two primary tiers of behaviour codes: verbal and non-verbal. Under each of these, categories were chosen which reflected the most commonly occurring and most relevant communicative interaction behaviours. Two secondary tiers of codes were then added to further specify primary behaviour codes: the direction of non-verbal communicative interaction (to the adult or peer), and the form of verbal interaction (talking over or question).

After a review of existing behaviour coding schemes, it was decided that the Social Orienting Continuum Response Scale captured the most similar interaction behaviours to those the current project aimed to capture between pairs of children completing the ‘Story in a Box’ game. Coding scheme development then proceeded with reviews of the trial videos of children taking part in the ‘Story in a Box’ game while wearing the LENA device. Under the hierarchical structure, and with consideration of the SOC-RS coding and LENA’s key outputs, behaviours were highlighted from the videos which reflected good or poor communicative interactions, those which replicated some of LENA’s key verbal outputs, and others which were non-verbal yet were considered to contribute to the overall picture of how children interact.

Primary Coding Tier: Non-verbal Behaviour

Non-verbal communication refers to any movements of the body or face that convey non-verbal information, such as hand and arm movements, facial expressions, eye gaze and posture. The face, hands and arms are thought to convey primary messages of non-verbal communication over other areas of the body. Research has shown that typically developing children effectively communicate through non-linguistic communicative behaviours such as eye contact, social referencing and gestures, long before they produce verbal language (Bates, Camaioni and Volterra, 1975). It is estimated that the use of non-verbal communication occurs 70–90% of the time (Butt et al., 2011). Non-verbal behaviours are therefore equal to, even perhaps more important than, verbal language in relaying communicative information to others.

When considering how the face and body convey information, it is important to consider the meaning of non-verbal behaviours. Can specific meanings be associated with specific movements? Or are some non-verbal behaviours conveying a more global interpretation, and a less specific meaning? Ekman and Friesen (1976) considered these questions and determined that there are different types of non-verbal behaviour, some intending to convey messages, others not related to communication, some that are transmitting specific information and others that are more globally informative; also, some behaviours provide information about emotions while others represent personality traits an attitudes. Ekman and Friesen (1976) suggest that the face conveys more information about the nature of an emotion than its intensity, whereas the body conveys information about the nature and intensity of the emotion. They also propose three ways in which to analyse non-verbal behaviour: origin, codes and usage. ‘Usage’ refers to the regular circumstances in which a non-verbal act occurs, and considers the environment surrounding the behaviour, the relationship it may have to verbal behaviours, and the type of information it conveys. Ekman and Friesen differentiate between three types of information non-verbal behaviour conveys: informative, communicative, and interactive. ‘Informative acts’ they define as those which have some shared decoded meaning, so that observers would derive interpretation from this act. However, acts that are idiosyncratic and simply a reflection of the child’s characteristics rather than possessing a shared meaning should not be considered informative. The idiosyncrasy of behaviours is important to consider across all types of behaviour codes when the focus of coding is communicative interactions; idiosyncratic behaviours, verbal or non-verbal, would not be coded. ‘Communicative acts’ Ekman and Friesen define as those which intend to convey a message to another individual. They may not necessarily elicit shared meaning between individuals as informative acts would, in instances where there is intention to communicate and transmit a message; however, the receiver may misunderstand that message and provide no response. This distinction between informative and communicative acts is important since communication may easily be interpreted as shared meaning between two people; however, communicative acts, by Ekman and Friesen's definition, must include a *desire to transmit* a message. Interactive non-verbal behaviours are defined as those which are performed by one person, but modify or influence the behaviour of another. For the purpose of the development of this coding scheme, the definition of communicative behaviours will be taken into account: its distinction from informative and interactive behaviour, and the nature of its use, idiosyncratic or shared meaning.

Two non-verbal behaviours that convey communicative information are: (1) meaningful episodes of social referencing, involving facial orientation towards another's face that transmits a message or a willingness to understand or comprehend a situation; and (2) joint attention initiations, involving facial and body movements reflecting engagement initiation with another individual, the initiation transmitting a message of seeking shared attention to a specific object.

Social referencing and joint attention

Definitions of 'social referencing' and 'joint attention' are provided by Mosconi et al.'s (2009) Social Orienting Continuum and Response Scale (SOC-RS), an observational coding system initially developed to code deficits in social orienting in children with Autism. Mosconi and Reznick's definitions, although developed in the context of Autism, were used as starting points for the development of the current coding scheme applied in this project. Children with Autism display deficits in social communication in the social orienting domain; much research has found deficits in social referencing and joint attention (Mundy and Willoughby, 1996; Stone et al., 1997; Dawson, 2008). There is also evidence that early deficits in social orienting behaviours are predictive factors of social and communication difficulties later in life (Nadig et al., 2007). Therefore, social orienting behaviours appear to be a fundamental aspect of non-verbal communication, reflecting engagement with and information sharing with others.

Social referencing

Argyle and Ingham (1972) state that shifts in gaze may co-ordinate the behaviour of two persons. This is referenced in the SOC-RS as 'Social referencing'. Social referencing is defined by Mosconi and Reznick as an instance in which the key child fixates attention on another individual's face, the adult or peer. For an instance to be coded as a social referencing event, the child must fixate on the face for > 2 seconds. A new code of referencing should only be coded if the child looks away for > 1 second; glances away that are shorter than 1 second should not be coded as a new referencing event. If the child changes fixation between adult and peer (for > 2 seconds each), a new code is applied for each person. (Based on SOC-RS criteria)

This criteria outlined in the SOC-RS were, however, slightly amended for the purpose of coding children with behaviour difficulties, as opposed to children with Autism. Whereas autistic children are frequently characterised by a lack of eye contact and few social referencing behaviours, difficulty with eye contact is not so frequently reported in children with BESD. However, we might hypothesise that these children engage in fewer *purposeful* social reference events which reflect deliberate attempts to communicate or understand a situation, perhaps as a result of poor attention span or deficits in communicative behaviours. Therefore, during the development of this coding scheme, the term '*social* referencing' was amended to '*purposeful* referencing' as this definitional distinction taps more into behaviours expected from children with BESD rather than those frequently associated with Autism.

Joint attention

Joint attention involves two behaviours: joint attention *response* whereby an individual has engaged the child in joint attention and the child has responded appropriately by becoming engaged; or joint attention *initiation* whereby the child has initiated the joint attention with another individual as a means of communication. Joint attention initiation is also representative of sharing knowledge with another person, as it involves one person understanding and attending to the object or event that another person is attending to. From this perspective it is communicative, and so may be regarded as a useful measure of shared attention but also of communicative skill.

For the purposes of the current study, it was decided that the code of joint attention should be more specified, to refer only to joint attention *initiations* made by the child. Like the social referencing code, Mosconi and Reznick's joint attention definition was developed in reference to children with Autism, as they frequently display deficits in joint attention. Children with BESD, however, do not have such a frequent deficit with joint attention, yet we may hypothesise that, owing to inattention or deficits in producing effective communicative behaviours, they may make fewer joint attention *initiations* with others as they make fewer communicative interactions or attempts to *engage* in communicative interaction. 'Joint attention initiation' is defined as an instance where the child attempts to gain the attention of another to direct them towards an object. It must involve a look and action from the child, such as a showing or pointing action. At the same time, the child must be looking at the individual with whom they are engaging in joint attention or looking between the object they are referencing and the individual.

A further definitional criterion that arose while reviewing videos of the children's interactions was the nature of joint attention initiations. While coding for joint attention initiations, it is important to take into account whether the initiation is proto-declarative in nature (where the initiation is social in nature and reflects sharing of information), or whether it is pro-imperative (where the child uses joint attention as a means of obtaining a wanted object, with no social means or intent to share). Only joint attention initiations that are proto-declarative are coded, as these represent *social* communication and *intent* on sharing attention.

Impulsive behaviours

After reviewing trial videos of children's interactions, it was found that one noticeable behaviour difference between children with BESD and typically developing children was the amount of impulsivity displayed, BESD children displaying impulsive behaviours much more frequently than typical children. The types of behaviours displayed by BESD children were snatching or grabbing the box or the picture cards, or an eagerness to get into the boxes. Initially, this behaviour category was termed 'uninhibited'. However, it was felt that the 'uninhibited' children had a degree of control over their behaviours; and while some of the behaviours viewed lacked an inhibition that perhaps other typical children may possess, such as aggression, one quality that each behaviour possessed was impulsivity.

Primary Coding Tier: Verbal Behaviour

Key components of verbal communication are sounds, words and language. Although all species communicate through behaviours, verbal behaviour is a purely human phenomenon. Just as non-verbal behaviours can clarify vocalisation meaning, the use of speech has the ability to eliminate any communicative misunderstanding. In conjunction with non-verbal behaviour, verbal communication is the primary tool for the relay of information and communicative exchanges between two or more people. At a fundamental level, verbalisations convey a message that the speaker intends to project through the use of words. Although it is important to consider the recipient's role in effective communicative exchange (they must be able to go beyond literal words and interpret the sense and perspective of the message the speaker intends to convey), the speaker themselves must also be able to take the recipient's perspective into account, and judge whether they will be able to understand the message they are conveying (Krauss, 2002).

Language itself is the most effective component of verbal behaviour for conveying information. How language is used can affect communicative efficacy. Krauss and Fussell (1996) proposed four paradigms of the process by which language functions as a medium for communication. These are: encoding and decoding; intentionalist: perspective-taking; and dialogic. Each of these paradigms, while individually able to describe how language effects communication, are intimately linked through consideration of their limitation. The encoding and decoding paradigm states the popular view of language, that speakers encode what they want to convey within words and sentences, which is then decoded by the listener to retrieve meaning. However, 'decoding a message' is a simplistic view of communication; for the message to be understood, the speaker's intention must be understood. This therefore brings about the intentionalist paradigm. This paradigm states that for a listener to understand a speaker's message, they must have also comprehended what the speaker intended to mean. Effectively understanding intentions, however, involves sharing the same perspectives on the world, which does not always occur with guarantee. This leads on to Krauss and Fussell's perspective-taking paradigm, which states that speakers must take into account their listener's perspective, vantage points and knowledge before speaking their utterance. Perspective-taking is most obviously necessary when addressing spatial awareness, such as with directions. However, it is also necessary in non-spatial contexts: for example, 'the boy with the horrible shirt' relies on the listener sharing the same perspective on what a horrible shirt would be in order to understand the speaker's conveyed meaning. This also provides an example of egocentrism, which can influence a speaker's consideration of others' perspectives; that is, people have a tendency to assume that others share the same views as those they themselves hold. However, effective communication is a collaborative process between individuals, and so adaptation to others' perspectives is important. Krauss and Fussell named this collaborative nature of communication 'dialogism'. Dialogism refers to the process of a speaker formulating an appropriate utterance that will convey their message, the listener processing this utterance, and then comprehending their intended meaning. In the dialogism paradigm, conversation is the primary model for communication. When considering this in relation to children who have language and behaviour difficulties, however, we might expect communication to be heavily jeopardised if reliant upon effective utilisation of language and conversational speech, especially as research findings have repeatedly shown children with behaviour problems to have difficulty with the social, pragmatic side of language (Gallagher, 1999; Benner, Nelson and Epstein, 2002) as well as the structural (Mackie and Law, 2010) and expressive (Nelson, Benner and Cheney, 2005; St Clair et al., 2010) aspects of language (which may influence the formation of an utterance that conveys the intended message)

The development of a coding scheme applicable to verbal behaviour began with consideration of the research hypotheses: what types of vocalisation differences might we find between the two groups of children on the basis of previous findings, using the LENA system? This brought about vocalisation qualities reported by LENA, such as speech monologues, conversational turns or episodes of talking over, which were then considered in a communicative context. How useful are these in terms of a child's communicative interactions? Are these categories applicable to the aims of this research regarding potential differences in verbal communication between the groups of children? Previous research using LENA had found differences in such vocalisation qualities between different groups of children: typical children, and children with ASD (Oller et al., 2010; Warren et al., 2010). Therefore, it was thought interesting to use this as a basis to investigate whether there were any similar differences between typical and BESD children. The inclusion of speech monologue coding and codes related to conversational turn would also replicate and back up data provided by the LENA system.

Speech monologues

After reviewing data from the LENA trials, it became apparent that children in the BESD category were frequently displaying a higher count of child vocalisations and a lower count of conversational turns than their typical peers. This led to the question, do children who have a higher count of child vocalisations on the LENA software have a higher count of speech monologues? A speech monologue is defined by LENA as a block of child vocalisations lasting longer than 5 seconds. Other research using LENA and comparison groups of children have also found differences between groups in speech vocalisations. Warren et al. (2010) found that children with ASD had a higher count of speech monologues and fewer conversational turns than typically developing children, who had engaged in more conversational turns and had a lower count of speech monologues. This finding provided the basis for the speech monologue hypothesis in relation to BESD; we might hypothesise that the BESD group would talk more, yet engage less, for example in conversation with others.

Self-centred speech

Initial review of the trials and video recorded tasks suggested that there was a noticeable difference in the amount of self-centred statements made by children with BESD (such as statements that orient attention towards themselves, or speech used as a means to get what they want: ‘Give it to me’, ‘I want it’) compared to statements made by TD children. It may be that if children with BESD are less behaviourally inhibited than TD children, this leads them to speak aloud what other children may inhibit. Such self-centred speech is considered a speech ‘statement’ as the majority of such statements made by the children are less than 5 seconds long (otherwise coded as a monologue). For coding purposes, if an episode of self-centred speech lasts longer than 5 seconds, it would be primarily coded as a speech monologue.

Questions used as a conversational turn

The use of questions is a key part of verbal communication, as it creates communicative interaction by requiring a response. Directing questions to another individual is a means of obtaining information and demonstrates engagement with that individual. Do children who have a higher count of conversational turns also use more questions? If TD children are displaying higher counts of conversational turns, as shown in initial trials, it would be interesting to look at their use of questions (which may be creating opportunity for conversational turns). However, it is important to take into account the nature of the question: is the question being used as a means of obtaining information, and therefore communicative in nature, or is it more self-regulating in nature, such that the child is speaking to him- or herself rather than to another individual? When developing the coding scheme, it was felt necessary to view questions as a positive communicative interaction. This also meant that not all verbal behaviours being coded were negative and children could also be coded on their positive use of verbal behaviours. The question code was therefore modified to ‘question as a conversational turn’. Therefore, a question was coded if it was used as a means of conversing with another individual, eliminating self-regulating or non-purposeful, indirect questions. A question used to initiate a conversation can be viewed as positive, effective communicative interaction behaviour; therefore, the inclusion of this code in the coding scheme makes a valuable contribution to capturing communicative interaction behaviours.

Uninhibited vocalisations

As with the emergence of the ‘self-centred statements’ code, what also became apparent after initial viewings of the trials was the amount of uncontrolled, uninhibited vocalisations or speech that the BESD children made in comparison to TD children. These included noises, which were either relevant or non-relevant to the task in hand, or speech that was ‘off-task’, out of context and unrelated to the situation. As before, perhaps their inhibition leads them to create more noises or speak thoughts that the other children have inhibited, or attentional difficulties may cause them to become unfocused easily, thinking about events other than the task in front of them. Examples of uninhibited vocalisations may be ‘It’s my dad’s birthday’, or noises, either mimicking an event related to the box task or unrelated noise such as squeals.

Secondary Coding Tiers

A secondary tier of codes was added to further specify the direction of non-verbal communicative interaction (to the adult or peer), or the form of a verbal code, whether the vocalisation was in the form of talking over someone else’s speech. These were categorised as ‘modifiers’, a name given to secondary tiers by the Noldus Observer software.

‘Direction’ modifier: adult, peer, adult and peer

A direction modifier was added to the non-verbal codes ‘joint attention initiation’ and ‘purposeful referencing’ in order to establish any differences between typical and BESD groups with regard to who they are interacting with (adult or peer or both).

‘Form’ modifier: talking over

A form modifier was added to verbal codes in order to establish whether any of the children’s vocalisations were talking over others’ speech, potentially associated with poorer communicative engagement. In this coding scheme, ‘talking over’ refers to an interruption to another’s speech by the child. LENA trials indicated that children with BESD engage in fewer conversational turns yet create more vocalisations, and so from this finding it was hypothesised that children with behavioural problems or difficulty with attention may be more likely to talk over speech as opposed to engaging in conversational turns.

Reliability Testing

The coding scheme was tested for inter-rater and intra-rater agreement using 20% of the video data obtained in phase 1 trials of the ‘Story in a Box’ task (see Chapter 9). An inter-rater reliability Kappa agreement statistic of 0.67 was established, and an intra-rater agreement of 0.86. Therefore, it was agreed that the coding scheme was reliable enough for inclusion in the current methodology. During reliability testing, one code, ‘purposeful referencing’, was eliminated from use in the final application of coding as a result of its unreliability in inter-rater observations.

Appendix B. Behaviour Coding Guide

Non-verbal Behaviour

Joint Attention Initiation (JAI)

This is an action event. The coded child must be initiating joint attention with another person by drawing their attention to an object, showing the object to another, placing a picture in front of another person, or pointing to an object. At the same time the child must be looking at the person with whom they are engaging in joint attention, or looking between the object and person; this code *must* involve clearly looking at the person with whom they are initiating JA. For reliability consistency, the code must be entered at the start of the JAI event. If a JAI is also an example of a verbal code (e.g. monologue, self-centred speech, or uninhibited vocalisation) these may also be coded, as they are in different coding categories (non-verbal and verbal).

Purposeful referencing

To be coded, the child must direct a *purposeful look* at the adult or peer's face which intends to seek information from, or a response from, that person (adult or peer), or intends to send a communicative message to another person (adult or peer). For example, the child may say 'What?' and look up at the adult to receive their answer, or put their hand up in the air to indicate they want attention. They may nod or shake their head at someone (this sends a communicative, non-verbal message).These actions must be coupled with eye gaze. The child must be looking at the person they are receiving/sending a message from/to. Purposeful referencing may not always coincide with speech (e.g. a child may pull a face to convey confusion). Purposeful referencing is distinguishable from passive looking in that it has intent to convey a message. The reference must be an attempt from the child to *understand a situation* or purposefully *engage* in non-verbal social communication with another person. It is different from JAI events in that it does not involve showing or pointing to an object. For reliability, the code must be entered at the start of the referencing event.

Modifier: 'direction'

If a code of joint attention initiation or purposeful referencing is applied, it must be specified who it is with by a choice of the appropriate modifier: adult, peer, or both (adult and peer).

Impulsive behaviour

This code is applied to impulsive behaviours that are less controlled, such as *quick* snatching, flipping the lid off the box, grabbing, throwing objects, or aggressive behaviours. They may occur during engagement with another individual or while the child is on their own. If an impulsive behaviour occurs at the same time as an uninhibited vocalisation, for example the child snatches an object and squeals, both could be coded, as they are different coding categories (non-verbal and verbal). Impulsive behaviour may also be coded at the same time as any other verbal behaviour. In events where the child may snatch an object and then perform a joint attention initiation, although these are within the same coding category (non-verbal actions), both could be coded as there is likely to be time between the snatch action and the joint attention action.

Example of a marginal coding decision; deciding when to code:

Marginal Coding	*Possible Codes*	*Nature of occurrence*	*Decision*	*Reason*
Unsuccessful snatch	Impulsive behaviour No code	The child is attempting to snatch the box out of the adults hand, but the adult does not let the child have the box, so the snatch is unsuccessful	Impulsive behaviour	This event is still coded as an uninhibited behaviour as the child is clearly attempting to snatch or grab the box from the adult; the only reason it is unsuccessful is because the adult keeps hold of the box, if this didn’t happen the child would have quick snatched or grabbed the box.

Verbal Behaviour

Monologue

A speech monologue is coded when the child speaks continuously for longer than 5 seconds (based on LENA definition of a speech monologue). If a speech monologue occurs, it takes priority over other verbal codes. If the child stops speaking for longer than 2 seconds, this is the end of the monologue and whatever behaviour follows this is a new code. Speech monologue codes should be applied at the start of the monologue. If a non-verbal behaviour occurs within the speech monologue such as a joint attention initiation, this can be coded.

Self-centred speech

This code is applied to speech statements that are self-centred, such as 'Give it to me', 'I want it', 'When's it my turn'. They are most likely to be statements (less than 5 seconds long, otherwise coded as monologue) related to the child themselves, and often have a quality of impulsiveness and a lack of inhibition, or reduced awareness of other events (verbal or non-verbal) occurring around themselves. This code is not applied to polite asking or negotiations, for example 'Can I wear the red T-shirt?'. If self-centred speech lasts longer than 5 seconds, it is primarily coded as a speech monologue. For consistent reliability, this code is applied at the start of the self-centred statement. The content of the self-centred speech should be written in the comments space.

Examples of marginal coding decisions where an event could possibly be two codes:

Marginal Coding	*Possible Codes*	*Nature of Occurrence*	*Decision*	*Reason*
'How come she gets it?'	Self-centred speech Question as conversational turn	Said when peer finds princess; impulsive, said moodily, overlaps adult speaking	Self-centred speech	High in impulsivity, does not require or want a response, occurs as talking over event, not an attempt to engage in conversation.

Uninhibited vocalisations

Uninhibited vocalisations are defined as speech that is not in context and is 'off-task', unrelated to the box game, for example one child saying to another 'You're a pea', or 'It's my dad birthday'. This code also includes noises made by the child or repetitive speech, for example 'Oh dear, oh dear oh, dear'. In the case of noises and repetitive speech, these may be coded even though they are in context (e.g. mimicking the sounds of objects in the box game for a dragon's roar, or the loud sound of a sword). Over-the-top loud laughing which appears non-communicative is also coded here; the child seems to be laughing to themselves rather than sharing laughter with another person. If a noise is followed by > 2 seconds' pause then another noise is made, a new code would be applied, so this would be 2 uninhibited vocalisations. Uninhibited vocalisations code also applies to uninterpretable speech that may be brief, unclear, or episodes of talking over someone else. Loud over-the-top laughing is also coded as an uninhibited vocalisation. Uninhibited vocalisations are coded at the beginning of the vocalisation.

Example of marginal coding decisions, deciding whether to code or not code:

Marginal Coding	*Possible Codes*	*Nature of Occurrence*	*Decision*	*Reason*
'Chop chop chop …'	Uninhibited vocalisation (noise) No code	Said when child forgot the name of an object (axe), within a sentence, with chopping action	No code	Said within sentence with same tone of voice as other words, said because she had forgotten the word, not to mimic chopping sound.

Question as a conversational turn

This code is applied to questions used by the child that are positive in nature and obey the rules of conversation; they are used to engage in conversation with another person or to gain a response from that person, are not coded as self-centred speech (not impulsive), speech monologue or uninhibited vocalisations (off-task), and do not talk over anyone else. For example, if a child said ‘How does the prince kill the dragon?’ or ‘Can I put that in there?’, these are questions used to create conversational turns.

Example of a marginal coding decision:

Marginal Coding	*Possible Codes*	*Nature of Occurrence*	*Decision*	*Reason*
‘Can I go first’	Self-centred speech Question as conversational turn	*Almost* a talking over event, slightly impulsive by jumping in ahead of other child, yet more representative of eagerness to participate than impulsive disregard for other people or situation occurring.	Question as a conversational turn	Not sufficiently impulsive, waits for answer from adult, positive use of question to gain response from adult.
‘What about that turtle that turtle could help?’	Question as conversational turn No code	Figuring out what object to use	No code	The child is not using the question to engage in conversation with anyone, they are speaking to themselves and also answers their own question.

Modifier: 'form'

There is one modifier for verbal codes – 'talking over'. If a speech monologue, self-centred speech or uninhibited vocalisation occurs in the form of 'talking over' someone else's speech, the 'talking over' modifier is applied. This is defined as an event where the child begins to talk (this may be relevant or irrelevant to the task in hand) when someone else (adult or peer) is already talking. The talking over code is not applied to 'questions as a conversational turn' code, as the LENA system does not count a conversational turn if it involves overlapping speech. Talking over code is considered important as talking over someone else is representative of the types of verbal behaviours most frequently seen in children with BESD, and is also a problematic behaviour within classroom contexts.

Appendix C. Piloting the LENA System and Exploring Interaction Tasks for Inclusion in Observational Enquiries

Aims

Initial pilot work was conducted to explore the use of the LENA system and existing interaction tasks for observational research enquiries. This work had two aims: to test the efficacy of the LENA Digital Language Processor (DLP) in terms of recording quality, and practicality and suitability to the controlled test environment; and to explore different interaction tasks in order to find a task which could elicit communicative interaction in the form of verbal and non-verbal behaviour, which could then be measured during observational research enquiries.

Recruitment

The Head Teacher of a local North Tyneside LEA primary school was initially contacted by email with information about the project, within which they were informed that there was a need to explore the use of a new technology for measuring children’s vocalisations (LENA). It was specified to the Head Teacher that this exploratory phase of the research would recruit children aged between 4 and 7 years. Random opportunity sampling was used to select children by their class teachers. Therefore, inclusion criteria did not target particular children with or without difficulties; rather, teachers were told to randomly choose children in their class that could be paired up for the trial. As pairs of children were chosen from the same class, they were of the same age.

Participants

Twenty children (ten pairs) were included in this exploratory trial. All were aged between 4 and 7 years, and all were considered typically developing (any difficulties children had were not made known by the teachers). Children were put into pairs by their class teacher to take part.

Materials

Materials included the LENA software, which comprised the DLP, a laptop computer with the LENA software installed, and two LENA T-shirts. The interaction task materials present were the Map Task (Anderson et al., 1991) and the Lego construction task. A thin wooden ‘barrier’ was used to separate the children while they completed their tasks, so that each task was a barrier task and children were unable to see their partner's map or Lego, in an attempt to create communication between the children.

Procedure

The LENA software was installed on a portable laptop, and this was present at each trial in order for the DLP data to be uploaded between each recording. The DLP with its USB connector for uploading data, and 2 LENA T-shirts, were present at each trial. One T-shirt was a small size, designed to fit children aged 4–5 years, the other a medium designed to fit older children of 6–7 years. Children were asked to sit at opposite sides of the table and the communication task (Lego or map task) was placed in front of them. Children first completed the map task, followed by the Lego task. One child was chosen at random to wear the LENA T-shirt and DLP first. The DLP was switched on and placed in the T-shirt pocket once the child was wearing the T-shirt. Instructions were provided to the children on how to complete their task by the researcher, after which the DLP 'Rec' was pressed and recording started.

As stated above, two different communication tasks were trialled with the children to assess which ones the children enjoyed the most, which elicited the most communicative interaction between pairs of children, and how long each task took to complete. It was important that the task should last over 10 minutes, as the LENA programme can only process audio files and produce core reports on recordings longer than 10 minutes. The first task the children were asked to do was the map task, where one child was the 'instructor' and described to their partner a route through the map, while their partner, the 'instruction follower', attempted to draw the same route on their map. For this task, the 'instructor' child wore the DLP, as it recorded their vocalisations as they guided their partner through their map. Once the map task had been completed, the children then swapped roles and the other child became the 'instructor'. Role swaps also meant the T-shirt and DLP were swapped, so that the new 'instructor' wore the DLP. The DLP continued to record throughout this. A Lego task was then trialled with the children. This was given to the children after they had completed the map task. As with the map task, both children were asked to wear the DLP. If the map task had exceeded ten minutes' completion (therefore, ten minutes of audio had been recorded), the DLP was uploaded onto the laptop before the Lego task was completed. If the 10-minute threshold had not yet been reached, the DLP continued recording and was swapped between children in between rounds of the Lego task. Children were given the same amount of, and the same-coloured, Lego blocks, and again were seated opposite each other, separated by a barrier. The aim of this task was for one child to tell their partner how to create the same shape as they had designed by describing the shape and colour of their design, in order for their partner to re-create their shape.

Analysis

Analysis of LENA efficacy and task suitability and was descriptive. Analysis of the efficacy of the LENA system involved playback of each pair's audio on the LENA software to establish audio clarity and to ascertain whether the system correctly identified the 'key child' vocalisations. Practical issues relating to the use of LENA and the interaction tasks were noted down during and after trails.

Results

The LENA system

It was found that the LENA system accurately captures the vocalisations of children who present with difficult behaviour, those who are often hyperactive and create a lot of movement. Such characteristics did not affect the quality or clarity of LENA DLP recordings, and the system correctly identified the vocalisations of the 'key child' wearing the LENA DLP. Correct identification of the 'key child' vocalisation, however, was dependent on the DLP being uploaded in between each child who wore the DLP (discussed further below). Furthermore, children were also happy to wear the LENA T-shirt and DLP device. Once placed in the pocket of the T-shirt, the DLP device remained safely and securely inside until the end of the session.

In relation to the practicality of the LENA process, a main finding was that each LENA DLP audio recording, and therefore each child's vocalisation recording, must be a minimum of 10 minutes. Ten-minute audio is necessary for the DLP data to be uploaded onto the LENA programme, and for LENA to carry out its analysis. Any recording of less than 10 minutes in length will not be uploaded onto the LENA programme. The map task, however, did not exceed 10 minutes, and children were completing the task in around five minutes, which meant that when the DLP was swapped from one child to their partner the DLP needed to remain on and recording until at least 10 minutes of audio had been captured. When this audio file was uploaded onto LENA, the LENA programme could not differentiate between the two children. This meant that all 'key child' reports (word counts, conversational turns) produced by LENA were referring to the initial child who wore the DLP, and no reports for the second child wearing the DLP were given. The DLP must be uploaded after each child's vocalisations are recorded to enable the software to assign the audio file to the correct child. Furthermore, uploading the audio data from the DLP to the software takes time; a 10-minute audio file may take around seven to eight minutes depending on the complexity of the file. Therefore, in cases where the initial task completion exceeded 10 minutes and the DLP data were uploaded onto the software, children were left waiting for the audio data to be processed before the DLP could be given to their partner. This often caused children to become irritable, distracted and disengaged with the task at hand.

Interaction tasks: Map task and Lego construction task

The Map task failed to evoke a sufficient amount of verbal communication between the two children. Instead of conversation between children and reasonable amounts of dialogue from each child being generated, children guiding their partner through the map consistently used very short and simple directions such as 'Go to the tree', 'Go to the bridge'. Their partners following these instructions simply drew straight lines between each target on their map and asked very few questions. Behaviourally, although children were separated by a barrier between them of approximately two feet in height, it was difficult to stop children from standing up to look at each other's maps to make sure they were following the routes correctly. This compromised the aims of the task whereby children listened to and followed verbal instructions only. This pattern of verbal communication and behaviour between partners was evident in each pair of children trialled with the Map task, across ages 4–7 years. The limited communication between the children also compromised the accuracy of their drawn routes through the map. While route accuracy was not a primary measurement variable, it was still necessary for the task in hand to elicit a certain degree of communicative interaction, verbal and non-verbal, between children to permit a reliable understanding of their communication skills. The Map task failed to do this with children aged 4–7 years.

With the Lego task, when this was trialled with younger children (4- and 5-year-olds), this task seemed too difficult a task for them, as they lacked the descriptive language skills required to describe more complex shapes that involved more than 4–5 Lego blocks. As with the Map task, whether the children copied each other's shapes correctly was not a primary outcome measure, although it would be considered an indication of how well instructions were followed or how well they were given by the children, which may in turn indicate effectiveness of communication skill. Out of all the Lego trials, no Lego shapes were replicated correctly by the children. Furthermore, time-wise, this task was too short and did not allow for the Lena DLP to capture a minimum of 10 minutes’ audio recording from each child. The Lego task was therefore deemed an unsuitable communication task for use in this project.

Appendix D. Descriptions and Examples of LENA Codes

LENA Code	*Description*	*Example vocalisation*	*Frequency count*
Key child vocalisation count*	Words, babbles, and pre-speech communicative sounds such as squeals or growls.	'Can I have that'	Four
Conversational turn count	A 'key child' (with the DLP) vocalises and an adult responds, or an adult speaks and a child responds.	Key child: 'What's that?' Adult: 'a book'	One
Conversational turn initiation	Identified by ADEX** clarifies 'turn type' which identifies the speaker who *initiated* the turn, the first vocalisation within a conversational turn segment.	Key child: 'Do you think the octopus?' *Initiation* Adult: 'Yes could be the octopus'	One
Conversational turn response	Identified by ADEX clarifies 'turn type' which identifies the speaker and who *responded* to a turn initiation.	Key child: 'Do you think the octopus?' Adult: 'Yes could be the octopus' *(response)*	One
Proportion of overlapping noise (OLN)	OLN must include a speaker vocalisation that occurs at the same time as another speaker's vocalisation or noise.	(/) represents overlap in speech) Key child: 'He wouldn't need glasses unless she had bad/… Other child: /I need coins!	One

*Key child – the child who is wearing the LENA Digital Language Processor (DLP)

**ADEX – Advanced Data Extractor software that accompanies LENA for further analysis of vocalisations and language environment.

Appendix E. Trialling the ‘Story in a Box’ Task

Aims

As identified in exploratory trials of the LENA system and interaction tasks, existing methods for eliciting communicative interaction between children to a degree where behaviour and language may be measured have limitations. For this reason, it was necessary to design a novel task which would allow for the assessment of children’s behaviour and language during naturalistic interaction. This task is the ‘Story in a Box’, which was trialled with the aim of exploring its suitability for the current project.

Recruitment

The Head Teacher of a local North Tyneside LEA primary school was initially contacted by email with information about the project, within which they were informed that there was a need to explore the use of a new interactive task for children (the ‘Story in a Box’). Notably, the primary school used in these trials was a different one from the one included in explorations of the LENA system and other interactive tasks. It was specified to the Head Teacher that this exploratory phase of the research would aim to recruit children aged between 4 and 7 years, but that some of the children would be those identified as having behavioural, emotional and social difficulties (BESD) and some would be those considered as ‘typically developing’ (TD) and having no identified difficulties. Exploring the task with these children was necessary since the main project data collection would include children with BESD and typically developing children; therefore, outcomes could be considered as representative of what might6 be observed in the final sample of children.

A meeting took place between the researcher and two class teachers of children aged between 4 and 7 years and the schools Special Educational Needs Co-ordinator (SENCO). Teachers were informed that targeted children for inclusion would be those with BESD and typically developing peers of the same age. This would enable to the task to be explored with three different types of paired children: typically developing pairs, pairs of children who both have BESD, and mixed pairs of children (one with BESD and one TD). These groupings of children were chosen to investigate the task’s efficacy among various combinations of children, as it was unknown how children in different pairs would respond to the task. The selection of children with BESD occurred first. Educational definition of BESD was used to select these children; therefore, the criteria specified to teachers included children who presented *one or more* of the following difficulties:

- Persistent disruptive externalising behaviour in school.
- Difficulties interacting and engaging with peers (e.g. problematic peer relationships).
- Difficulty with hyperactivity and attention.
- Problematic externalising behaviours such as aggression or conduct difficulties.
- Children with internalised emotional difficulties (e.g. heightened levels of anxiety).

The selection of typically developing children was the result of random sampling by class teachers; however, these children were to be in the same class as those identified for inclusion with BESD. Teachers then paired children together to create the three groups specified above. Matching children on gender was not specified as a criterion for pairing children together. Information letters and consent forms for children to take part in exploratory trials were distributed to the parents of selected children (Appendix H). These were signed and returned to school. Consent was gained from the parents of each child included in the trials.

Participant Groups 1 and 2

Exploratory procedure differs slightly between TD pairs (group 1) and BESD pairs (group 2) of children, and mixed pairs (BESD/TD) (group 3). Therefore, procedure and outcomes for groups 1 and 2 will be presented first, followed by procedure and outcomes for group 3.

Group 1, typically developing children (TD + TD)

Group 1 included two pairs of typically developing children, aged 4 years (n = 4). One pair included two females and a second included two males. The mean age of the children was 53 months.

Group 2, children with behavioural, emotional and social difficulties (BESD + BESD)

Group 2 included two pairs of children with BESD, aged between 4 and 7 years (n = 4). Both pairs were males and their mean age was 70 months.

Procedure

Within these two groups the LENA software was also included to ensure both methods, LENA and the ‘Story in a Box’, could effectively be used in combination. One child from each pair was chosen at random to wear the LENA DLP. To begin, children were asked to sit opposite each other at a table with the box placed in the centre of this table (Image 4). The LENA T-shirt was given to one of the children in the pair, and the record button was pressed on the DLP as the DLP was placed in the pocket of the T-shirt. The ‘Story in a Box’ task was introduced by the researcher, and completed using the procedure outlined in Appendix F.

Image 4: Set-up of the ‘Story in a Box’ task.

Analysis

As trials of the task were exploratory, analysis was descriptive; notes were taken during each trial in relation to the suitability of the task for final inclusion in the overall project.

Results: Groups 1 and 2

The box task was first trialled with typically developing children, aged 4–7 years. It proved popular with the children and elicited a large amount of communicative interactions between child pairs. It also generated questions from the children when problem solving, and conversational turns with the adult and between each other. When the data collected from these trials was processed by LENA and compared to the data produced from the map tasks, core reports showed that the box task generated approximately three times more conversational turns (mean 91) and almost twice the amount of vocalisations (mean 78) from the children than the map task. Furthermore, the timing of the box task was much more suitable, and each lasted over the 10-minute minimum threshold for recordings.

The box task was then trialled with children with behavioural, emotional and social difficulties, aged 4–7 years. Children with BESD were paired with another child with BESD. Again, the task proved popular with the children and elicited communicative interactions between pairs of children as well as interaction with the adult. As with the typically developing children, the box task generated more child vocalisations than the map task (mean 119), also indicating that more vocalisations were generated by children with BESD than by those without BESD. Conversational turn counts from the BESD group were lower than the typically developing children's (mean 42). Although the box task does generate more opportunities for conversation than the map task, this difference between the BESD group and the TD group may reflect differences in communication styles, and therefore may be interesting to explore in the final data collection trials.

One noticeable difference between the children with BESD and those without was the time it took to complete the box game. The children with BESD took an average of 7 minutes to finish the game. This means that to gain a DLP recording minimum of 10 minutes per child, the children needed to be given another task after the box game. In these trials, free play Lego was used, which the children were happy to play with until the DLP had recorded 10 minutes of audio. It was also noted that different styles of interaction occurred when a boy was paired with a girl, in comparison to two boys paired together. There was no opportunity to trial girl/girl pairs, as typical behavioural difficulties present mostly in males. Anecdotally, boy and girl pairings appeared to elicit more disruptive and challenging behaviours than boy/boy pairings, but this may be due to differences in the severity of behavioural difficulties. However, no such differences between boy/girl and same-sex pairings in the typical development group were noticed. Such behaviour patterns highlight the necessary consideration of gender pairings when completing data collection trials; should the children be matched on gender, thus providing some control over their possible interactions, or should they be paired boy/girl to allow for such problem behaviours to present (i.e. if there exist real empirical differences in interactions between opposite and same-sex pairings)? A further difficulty evident in these trials with children with BESD is their elevated levels of hyperactivity and inattention that presented challenges during task completion. Often, these children were eager to explore their environment surroundings, which distracted them from the task in hand (i.e. other objects in the room). Therefore, settings must be carefully chosen when completing data collection trials; the room in which the task is taking place must ideally be limited in the amount of external stimuli available to distract them.

These trials identified one main methodological flaw: the timing of task completion. In response to this, a second 'Story in a Box' task was created with a different story and problems for the children to solve, the 'Sunken Pirate Ship' task. This meant that the task completion time was doubled and the minimum audio recording time of 10 minutes could be met. Using this second box task as well, final trials were completed with BESD/TD pairings.

Participants Group 3

Group 3, TD children and children with BESD pairings (TD + BESD)

Group three included three pairs of children where one child was identified as having BESD, and another as typically developing (n = 6). Children were aged between 4 and 6 years, with a mean age of 64 months. Four children were male and two were female. Two pairs were mixed gender and one pair was two boys.

Procedure

In group 3 trials, additional procedure was included. The second 'Story in a Box' task was used after the children had completed the first one, and a video recorder was used to investigate whether a camera could effectively capture behaviours of the children in this type of set-up for future behaviour coding. Before trials began, the camera was placed on a table approximately two metres away from the children, with the tripod extended at full length. This then captured the adult (facing the camera) and the two children (sitting either side of the table) so that behaviours such as eye contact could be coded. The camera was kept on record throughout the whole session until both box games had been completed. As in previous trials, the LENA DLP measure was also used in this final trial; however, the children with BESD wore the DLP. Procedures for the set-up and completion of the task were the same as for groups 1 and 2, with children sitting either side of the 'Story in a Box' task.

Results: Group 3

Each box game in these trials, similar to previous trials, took an average of 7–8 minutes for the children to complete. Completing the two box games together took around fourteen minutes, thus extending task completion time beyond the 10-minute threshold required for LENA to process audio data. A further advantage of adding the second box task was that it enabled typically developing children and children with BESD to each be measured completing the same type of task, but with different problems to solve, thereby reducing any practice effects but still allowing for the same amount of communicative interaction to occur. As a result of these advantages, it was then considered whether it might be possible for each child to wear a LENA DLP at the same time; thereby, the audio data would exceed the minimum 10 minutes required for LENA processing, and each DLP would pick up data from each child completing the same task. As well as increasing the audio recording time, this would also eliminate the need to swap the DLP between children in between each box game. In previous trials, when the DLP has been uploaded after capturing 10 minutes of audio, this has resulted in a significant amount of time in which the children were left waiting for upload to be complete before the DLP could be passed on to the other child. Therefore, a second DLP was ordered. Data could then be uploaded onto the software after the session and each DLP was assigned a child category ‘BESD’ or ‘TD’.

Appendix F. ‘Story in a Box’ Narratives and Procedure

This appendix outlines the narratives of each ‘Story in a Box’ task, the Prince and Princess (box 1) and the Sunken Pirate Ship (box 2). Spoken words are highlighted in italic.

Prince and Princess

An adult introduces the game with the following narrative:

‘Once upon a time there was a Princess locked away inside the tower of an old stone castle. The castle was hidden away in an enchanted forest, and inside lived a giant, fire-breathing dragon that guarded the Princess. The Prince, desperate to rescue his Princess, set out on his journey into the enchanted forest. To save her, the Prince must fight his way through the trees, find the castle and kill the fire-breathing dragon. Can you help the Prince rescue his Princess?’

The first problem is introduced to the children. Object cards at this round are displayed face down on the table in front of the Story in a Box. The first box represents an enchanted forest.

‘The Prince’s journey begins outside the enchanted forest. He must find an object to help him get though the big trees of the forest that hide the castle. What could he use to do this? Take it in turns to pick a card from the table.’

The children then take it in turns to choose object cards from the table, until they reach a decision as to which to use to solve the problem of getting through the trees. The first box is then opened to reveal a new box inside, the castle.

‘*The Prince is now inside the forest and can see the castle, but the gates to the castle are locked! What object can he use to get into the castle?’*

The children take it in turns to choose object cards hidden within textured shredded paper within the box. Once a correct object is chosen to get into the castle, the box is opened to reveal a new box, the dragon.

‘*The Prince is now inside the castle, but the fire-breathing dragon guards the tower that the Princess lies in! What can he use to kill the dragon?’*

The children take it in turns to choose cards hidden inside shredded paper. Once an object is chosen which would kill the dragon, the box is opened to reveal a new box, the locked room.

'*The Prince has killed the dragon, but the room that holds the Princess is locked! Help the Prince find the key which matches the lock on the door.'*

The children take it in turns to choose object cards hidden in the shredded paper (objects are all keys at this stage). Once the correct key is identified, the box is opened to reveal the Princess inside.

Sunken Pirate Ship

An adult introduces the game with the following narrative:

'There has long been a mystery of a sunken pirate ship that lies deep beneath the ocean. Its mystery lies within the golden treasure hidden inside the ship, but to this day, no one has been able to find the treasure chest which holds the pirate's gold! Can you help Ben find the ship, and discover the pirate's treasure?'

The first problem is introduced to the children. Object cards at this round are displayed face down on the table in front of the Story in a Box. The first box represents a beach scene.

'Ben's journey begins on the sandy beach of the island. First, Ben needs to get to the ship deep beneath the sea. What can he use to help him do this …? Take it in turns to choose a card from the table.'

The children then take it in turns to choose object cards from the table, until they reach a decision as to which to use to solve the problem of getting to the sunken ship. The first box is then opened to reveal a new box inside, the shark.

'Ben is now deep below the sea and can see the sunken pirate ship in front of him. But the ship is guarded by a big scary shark! What can Ben hide behind so that the shark won't see him …?'

The children take it in turns to choose object cards which are hidden within shredded paper inside the box. Once an object is chosen to hide from the shark, the box is opened to reveal a new box, the sunken pirate ship.

'The shark didn't see Ben! Well done, now Ben is inside the sunken pirate ship, but where is the treasure chest that holds the pirates gold? What can Ben use to find the treasure chest …?'

The children again take it in turns to choose an object card that would help find the pirate's treasure chest. Once an object is decided upon, the box is opened to reveal a new box, the treasure chest.

'Ben has now found the treasure chest, but the chest is locked by a padlock! Ben must open the lock to claim the pirate's gold. What can Ben use to open the lock …?'

Children take it in turns to choose an object card from within the shredded paper that will unlock the treasure chest. The box is opened to reveal the pirate's gold inside.

Appendix G. SPSS Outcomes Testing for Normal Distribution of Data

Normality statistics for SDQ and CCC-2 scores of the behavioural, emotional and social difficulties (BESD) group

Tests of Normality[a]

	Kolmogorov–Smirnov[b]			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
GCC	.201	17	.067	.899	17	.065
Prag	.151	17	.200*	.911	17	.103
Struc	.221	17	.027	.901	17	.070
SDQTotal	.131	17	.200*	.961	17	.641
Emo	.151	17	.200*	.927	17	.193
Conduct	.184	17	.129	.946	17	.391
Hyp	.195	17	.084	.931	17	.225
Peer	.180	17	.144	.931	17	.225
Pro	.165	17	.200*	.923	17	.166
speechEBD	.180	17	.145	.914	17	.119
syntaxEBD	.156	17	.200*	.916	17	.127
semanticsEBD	.139	17	.200*	.953	17	.498
coherenceEBD	.147	17	.200*	.959	17	.605
inapinitEBD	.147	17	.200*	.929	17	.212
stereoEBD	.188	17	.114	.901	17	.072
contextEBD	.129	17	.200*	.985	17	.988
nonverbaEBD	.167	17	.200*	.939	17	.303
socialEBD	.134	17	.200*	.957	17	.585
interestsEBD	.134	17	.200*	.964	17	.717

*. This is a lower bound of the true significance.

a. Group = EBD.

b. Lilliefors Significance Correction.

Normality statistics for SDQ and CCC-2 scores of the Typically Developing (TD) group

Tests of Normality[a]

	Kolmogorov–Smirnov[b]			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
GCC	.195	17	.084	.951	17	.470
Prag	.189	17	.107	.929	17	.213
Struc	.128	17	.200*	.960	17	.625
Speech	.209	17	.046	.906	17	.087
Syntax	.215	17	.036	.883	17	.036
Semantics	.186	17	.119	.907	17	.089
Coherence	.194	17	.089	.922	17	.162
InapInitiation	.133	17	.200*	.963	17	.681
Stero	.216	17	.034	.877	17	.028
Context	.142	17	.200*	.941	17	.333
Non-verbal	.247	17	.007	.886	17	.040
Social	.349	17	.000	.739	17	.000
Interests	.130	17	.200*	.956	17	.564
SDQTotal	.189	17	.109	.921	17	.154
Emo	.224	17	.023	.900	17	.069
Conduct	.183	17	.132	.891	17	.049
Hyp	.184	17	.127	.899	17	.064
Peer	.209	17	.047	.849	17	.010
Pro	.262	17	.003	.825	17	.005

*. This is a lower bound of the true significance.

a. Group = TD.

b. Lilliefors Significance Correction.

Normality statistics for LENA scores of the BESD and TD groups

Tests of Normality

	Kolmogorov–Smirnov[a]			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
EBDCVSegTotal	.133	18	.200*	.972	18	.835
TDCVSegTotal	.240	18	.007	.804	18	.002
EBDCTSegTotal	.147	18	.200*	.953	18	.475
TDCTSegTotal	.152	18	.200*	.908	18	.081
EBDInitiaTot	.133	18	.200*	.957	18	.544
TDInitiaTot	.254	18	.003	.741	18	.000
EBDResponseTot	.199	18	.057	.825	18	.004
TDResponseTot	.185	18	.106	.942	18	.314
EBDOLNTotal	.112	18	.200*	.959	18	.589
TDOLNtotal	.170	18	.181	.920	18	.129

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction.

Normality statistics for Observer scores of the BESD and TD groups

Tests of Normality[a]

	Kolmogorov–Smirnov[b]			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
EBDJAI	.111	20	.200*	.970	20	.761
TDJAI	.116	20	.200*	.964	20	.633
EBDJAIAdut	.126	20	.200*	.964	20	.632
TDJAIAdult	.126	20	.200*	.932	20	.168
EBDJAIPeer	.261	20	.001	.802	20	.001
TDJAIPeer	.294	20	.000	.601	20	.000
EBDImpulsiv	.304	20	.000	.694	20	.000
TDImpulsive	.389	20	.000	.572	20	.000
EBDMono	.313	20	.000	.739	20	.000
TDMono	.303	20	.000	.580	20	.000
EBDMonoTalkOver	.499	20	.000	.447	20	.000
TDMonoTalkOver	.538	20	.000	.236	20	.000
EBDSCS	.225	20	.009	.902	20	.045
TDSCS	.256	20	.001	.746	20	.000
EBDSCSTalkO	.423	20	.000	.623	20	.000
TDSCSTalkO	.391	20	.000	.574	20	.000
EBDUV	.251	20	.002	.674	20	.000
EBDUVTalkOver	.359	20	.000	.612	20	.000
TDUV	.283	20	.000	.745	20	.000
TDUVTalkOver	.502	20	.000	.440	20	.000
EBDQuesTalkOver	.459	20	.000	.477	20	.000
EBDQues	.209	20	.022	.770	20	.000
TDQuesTalkOver	.422	20	.000	.631	20	.000
TDQues	.229	20	.007	.738	20	.000

*. This is a lower bound of the true significance.

a. Group = .

b. Lilliefors Significance Correction.

Appendix H. Information Sheet and Consent Form for Trials of the 'Story in a Box' Task

Exploring the 'Story in a Box'

Dear Parent/Guardian,

I am writing to you as a PhD student from Newcastle University completing a research project exploring children's behaviour and language used during peer interaction.

As part of my project, I have designed a new interaction task called the 'Story in a Box'; therefore I wish to trial this task with children aged 4–7 to explore its utility and suitability to be used in my final PhD project. I would like to ask for your consent for your child to take part in these trials. Please read the information below and if you are happy for your child to take part, sign and return the consent for attached to this information sheet to school.

What is the 'Story in a Box' task?

The 'Story in a Box' involves 2 players sitting opposite each other at a table with a box between them. The box represents a made up story with a main character; a prince. Inside the box, is a smaller box, and again inside this box, another smaller box, and so on. The aim is to solve a problem at each box, which enables the character to get into the next box, each time moving through the story to reach an outcome (i.e. for the prince to rescue his princess). Each round involves the children picking a picture card which represents an object, and deciding whether that card might help the prince through his journey and to the next box.

What will be measured during these trials?

The main aim of these trials is to explore the use of the 'Story in a 'Box' task with children. I am primarily aiming to answer the following research questions about the task, does the task engage children and hold their attention, do children like it, how long does it take to complete, does it elicit interaction between children? While children take part in this task, interaction behaviour will, however, be recorded using video-recording, and their speech will be measured using a small lightweight recording device which sits neatly into the pocket of a custom-made T-shirt. The device will not cause any harm or distress to your child. These measures are included in trials for exploratory development of my PhD project. No data will be included in final research.

Should you have any questions about this research please do not hesitate to get in touch with me or your child’s school.

Yours Sincerely,

Jenna Charlton

Email: j.j.v.charlton@ncl.ac.uk

If you would **LIKE** for your child to take part in this exploratory research project, please sign this form and return to your child's school.

I WISH for my child (please print name)________________ to take part in this research project.

Parent/Guardian name (please print)

Parent/Guardian signature,

Appendix I. Information Sheet for Schools

The Story in a Box Study.

Information for Schools.

Research Background

This project is looking at how children aged 4–9 years communicate with adults and peers. Children differ in how they use communication (verbal and non-verbal) to express themselves, and this project will look at how they interact with an adult and a peer during a task that requires them to use their communication skills in order to successfully complete the task.

There is evidence for a relationship between emotional and behaviour difficulties (BESD) and communication and language problems in children; however, we are less clear about the nature and extent of this relationship or about how social interaction can affect children's behaviour.

Within an educational setting, the close relationship between behaviour and language is reflected in rates of Special Educational Needs (SEN) and exclusions in school. Pupils with SEN are over 8 times more likely to be excluded from school than those without SEN (DfE, 2010c). The number of permanent exclusions of pupils with SEN has continued to rise throughout the past 7 years. In primary schools the most common type of SEN among pupils with statements is speech, language and communication needs, and the most common reason for both permanent and fixed period exclusions is persistent disruptive behaviour. The greatest increments in rates of SEN occur between the foundation stage and key stage 2 of education, an important stage of development where children adjust to changes in classroom activities.

Research Project

I am looking to recruit children aged 4–9 years old to take part in this project through schools within the North Tyneside Local Authority district. The project will include children recognised as having behavioural, emotional and social difficulties, and those without such difficulties, being briefly assessed on their interactions with others. In this project, 'emotional and behavioural difficulties' refers to those children who have problems with behaviours such as being disruptive in class, over-activity, and conduct disorders (Special Educational Needs Co-ordinators within school will be asked to identify these children).

What does the project involve?

Should you agree for your school to take part, you would be asked to help recruit parents and children by sending out information letters about the project, and for special educational needs co-ordinators and teachers to identify those children with such emotional and behavioural disorders.

The project will involve myself having 2 meetings with each child recruited in order to carry out an initial assessment of cognitive ability, and then an assessment of their interactions with an adult and with a peer (in this assessment the children will be in pairs; one identified as having behaviour difficulties and another without behaviour difficulties) These meetings would be held in school at a convenient time during the school day. Parents will also be asked to fill in a short parent report about their child's language, and teachers a short questionnaire about the child's behaviour.

The first meeting will last approximately 20 minutes. Each child recruited will meet with myself and be assessed on their cognitive ability (as each assessment carried out is brief and for research purposes only, parents will not be given individual reports on their child's performance). The idea of assessing cognitive ability and language ability is to match children into pairs according to their cognitive and language abilities. Therefore, depending upon their assessment scores, it may be that some children are not included in the full project if suitable pairings cannot be made.

The second meeting will take place on a different day, once children have been matched into pairs on the basis of their assessment scores. The children, in pairs, will play a 'Story in a Box' game along with the researcher which is designed to create interaction between the children through a story and problem-solving scenario. This meeting will last approximately 20 minutes.

What is the 'Story in a Box' Game?

The ‘Story in a Box’ Game involves 2 players sitting opposite each other at a table with a box between them. The box represents a made up story with a main character; a prince. Inside the box, is a smaller box, and again inside this box, another smaller box, and so on. The aim is to solve a problem at each box which enables the character to get into the next box, each time moving through the story to reach an outcome (i.e. for the prince to rescue his princess). Each round involves the children picking a picture card which represents an object, and deciding whether that card might help the prince through his journey and to the next box.

Recruitment to the research project will end in winter 2012. Information from these assessments will be analysed and used to identify any differences in communication between those children recognised as having behavioural, emotional and social difficulties and those without.

All schools which have taken part in this research, and all participants will receive a summary of the results upon project completion. Thank you for taking time to read this information sheet. Please do not hesitate to contact me should you have any queries.

Yours sincerely,

Jenna Charlton

Email: j.j.v.charlton@ncl.ac.uk

Research Supervisor: Professor James Law

Email: j.law@ncl.ac.uk

Telephone: 0191 2225250

Appendix J. Information and Consent Form for Parents (BESD Group)

The Story in a Box Study.

Information for Parents.

Research Background

The Story in a Box project is aiming to study the relationship between communication difficulties and behaviour difficulties in young children aged 4–9 years old. The project will look at how different children communicate with adults and peers; those very active in behaviour and those that are less active. Children differ in how they use communication (verbal and non-verbal) to express themselves, and I am interested in how they interact with an adult and a peer during a task that requires them to use their communication skills in order to successfully complete a problem solving the task (the 'Story in a Box' game, which has been developed by the researcher).

Who am I looking to recruit?

I am looking to recruit children aged 4–9 years old to take part in this project. Parents of children who attend school in the North Tyneside area are being invited to take part, and I am contacting you because your child's school has kindly agreed to participate in this project, and the Special Educational Needs Co-ordinator (SENCO) has identified your child as being suitable for this project.

What will taking part involve?

In the project, children will be observed on their interactions with an adult and with a peer of the same age during a short task (the 'Story in a Box' game). During the task, children will be observed by video recording and their speech will be recorded. Taking part will involve your child having 2 short meetings with myself in order to study their interactions with an adult and with a peer. These meetings will take place in school. Should you choose to take part, you will be asked to fill in a short report about your child's communication.

The first meeting will last around half an hour and will take place during the school day. Your child will meet with me, and I will carry out some assessments of how he/she is doing in school. Children will be matched in pairs with another child from their class according to their assessment scores; therefore it may not be guaranteed that your child will take part in the full project if pairings are not suitable.

The second meeting will take place on a different day for those children who have been paired with another child from their class. Together, your child, their peer and I will complete the problem-solving box game. This will be video recorded for later review and their voice will be recorded throughout the game. The game will last around half an hour.

What is the 'Story in a Box' game?

The 'Story in a Box' game involves 2 players sitting opposite each other at a table with a box between them. The box represents a made up story with a main character, a prince. Inside the box, is a smaller box, and again inside this box, another smaller box, and so on. The aim is to solve a problem at each box which enables the character to get into the next box, each time moving through the story to reach an outcome (i.e. for the prince to rescue his princess). Each round involves the children picking a picture card which represents an object, and deciding whether that card might help the prince through his journey and to the next box.

What will be measured during these meetings?

While they take part in this task, your child will be observed on their interaction behaviour using video-recording, and their speech will be measured using a small lightweight recording device which sits neatly into the pocket of a custom-made T-shirt. The device will not cause any harm or distress to your child.

What will happen with the information collected from my child?

Information collected will be kept fully confidential and anonymous, identified by ID number only. Only my supervisor and I will have access to this information. As the tasks involved are brief and used for research purposes only, no individual reports on children's performance will be given out.

What happens if I change my mind?

You can withdraw from the study at any time should you decide you no longer wish to take part. Your child can also withdraw from taking part at any time, and they will be verbally informed of this right to withdraw at the start of the task. Any data collected will not be used in the final results.

When does the project end?

Recruitment to the research project will end in winter 2012. All schools which have taken part in this research, and all participants will receive a summary of the results when the project is completed in.

Thank you for taking time to read this information sheet. If yourself and your child are happy *to take part* in this study, please sign the below form and return to school. Please do not hesitate to contact me should you have any further queries. Alternatively, you may contact my research supervisor Professor James Law by email; j.law@ncl.ac.uk, or telephone 0191 2225250.

Yours Sincerely,

Jenna Charlton

Email: j.j.v.charlton@ncl.ac.uk

If you would **LIKE** your child to take part in this research project, please sign this form and return to your child's school.

I WISH for my child (please print name)__________________ to take part in this research project.

Parent/Guardian name (please print)

Parent/Guardian signature,

Appendix K. Information and Consent Form for Parents (TD Group)

The Story in a Box Study.

Information for Parents.

Research Background

The Story in a Box game project is aiming to study the relationship between communication difficulties and behaviour difficulties in young children aged 4–9 years old. The project will look at how different children communicate with adults and peers; those very active in behaviour and those that are less active. Children differ in how they use communication (verbal and non-verbal) to express themselves, and I am interested in how they interact with an adult and a peer during a task that requires them to use their communication skills in order to successfully complete the task (the 'Story in a Box' game, which has been developed by the researcher).

Who am I looking to recruit?

I am looking to recruit children aged 4–9 years old to take part in this project. Parents of children who attend school in the North Tyneside area are being invited to take part, and I am contacting you because your child's school has kindly agreed to participate in this project.

What will taking part involve?

In the project, children will be observed on their interactions with an adult and with a peer of the same age during a short task (the 'Story in a Box' game). During the task, children will be observed by video recording and their speech will be recorded. Taking part will involve your child having 2 short meetings with myself in order to study their interactions with an adult and with a peer. These meetings will take place in school. Should you choose to take part, you will be asked to fill in a short report about your child's communication.

The first meeting will last around ten minutes and will take place during the school day. Your child will meet with me, and I will carry out some assessments of how he/she is doing in school. Children will be matched in pairs with another child from their class according to their assessment scores; therefore it may not be guaranteed that your child will take part in the full project if pairings are not suitable.

The second meeting will take place on a different day. Your child will be partnered with a peer from their class, who has also been recruited into the study. Together, your child, their peer and I will complete the problem-solving box game. This will be video recorded for later review and their voice will be recorded throughout the game. The game will last around fifteen minutes.

What is the 'Story in a Box' Game?

The 'Story in a Box' Game involves 2 players sitting opposite each other at a table with a box between them. The box represents a made up story with a main character, a prince. Inside the box, is a smaller box, and again inside this box, another smaller box, and so on. The aim is to solve a problem at each box which enables the character to get into the next box, each time moving through the story to reach an outcome (i.e. for the prince to rescue his princess). Each round involves the children picking a picture card which represents an object, and deciding whether that card might help the prince through his journey and to the next box.

What will be measured during these meetings?

While they take part in this task, your child will be observed on their interaction behaviour using video-recording, and their speech will be measured using a small lightweight recording device which sits neatly into the pocket of a custom-made T-shirt. The device will not cause any harm or distress to your child.

What will happen with the information collected from my child?

Information collected will be kept fully confidential and anonymous, identified by ID number only. Only my supervisor and I will have access to this information. As the tasks involved are brief and used for research purposes only, no individual reports on children's performance will be given out.

What happens if I change my mind?

You can withdraw from the study at any time should you decide you no longer wish to take part. Your child can also withdraw from taking part at any time, and they will be verbally informed of this right to withdraw at the start of the task. Any data collected will not be used in the final results.

When does the project end?

Recruitment to the research project will end in winter 2012. All schools which have taken part in this research, and all participants, will receive a summary of the results when the project is completed.

Thank you for taking time to read this information sheet. If yourself and your child are happy ***to take part*** in this study, please sign the below form and return to school. Please do not hesitate to contact me should you have any further queries. Alternatively, you may contact my research supervisor Professor James Law by email; j.law@ncl.ac.uk, or telephone 0191 2225250.

Yours Sincerely,

Jenna Charlton

Email: j.j.v.charlton@ncl.ac.uk

If you would **LIKE** your child to take part in this research project, please sign this form and return to your child's school.

I WISH for my child (please print name)__________________ to take part in this research project.

Parent/Guardian name (please print)

Parent/Guardian signature,

Appendix L. Cover Letter for Parents Completing the CCC-2

Re: The 'Story in a Box' Study

Dear Parent/Guardian,

I am writing to you as you kindly gave your consent for your child to take part in my PhD research project in Priory Primary School. As part of my project, I would like to ask you to complete a brief language checklist which I have enclosed with this letter about your child's current language use (The Children's Communication Checklist).

Instructions on how to complete this are provided on the front of the checklist, and the list typically takes 10–15 minutes to complete. However, if you have any queries please do not hesitate to contact me on the below details. Once completed, if you could return it to [*school*] reception or your child's teacher by [date].

For confidentiality purposes, your child's name has been replaced with an ID number on the front of the checklist. Thank you again for your participation in my project.

Yours Sincerely,

Jenna Charlton

PhD student Newcastle University
Email: j.j.v.charlton@ncl.ac.uk
Telephone: 07816857574

Supervisor: Professor James Law
Email: james.law@ncl.ac.uk

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