



PHD

Investigating the pathways between Developmental Language Disorder and increased social and emotional difficulties in adolescents

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Award date:
2019

Awarding institution:
University of Bath

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Citation for published version:

Forrest, C 2019, 'Investigating the pathways between Developmental Language Disorder and increased social and emotional difficulties in adolescents', Ph.D., University of Bath.

Publication date:
2019

Document Version
Publisher's PDF, also known as Version of record

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Investigating the pathways between Developmental Language
Disorder and increased social and emotional difficulties in
adolescents

Claire Louise Forrest

A thesis submitted for the degree of Doctor of Philosophy

University of Bath

Department of Psychology

January 2019

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The material presented here for examination for the award of a higher degree by research has not been incorporated into a submission for another degree.

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Conflict of Interest Statement

The candidate declares no conflicts of interest.

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Acknowledgements

Thank you to the participants and their families who volunteered for this study. I am very grateful for your time and hope that the findings from this research prove valuable. I am also grateful to the Centre for Longitudinal Studies for making their data from the Millennium Cohort Study freely available.

Thank you to my supervisory team, Dr Michelle St Clair and Professor Sarah Halligan, for their outstanding support. Thank you, Michelle for all the excellent guidance, both academic and pastoral. I feel very proud to be your first PhD student. Thank you, Sarah for your feedback and insightful questions that encouraged me to think more deeply about my research.

I am grateful to the departmental staff: Caroline Ransford, Susie Martin and Mary Nikolaidou for their administration and technical help with recruitment and testing. I am also very grateful to everyone who shared details of my study to help with recruitment.

Thank you to the “Office of Dreams” for providing an enjoyable working environment through in-depth discussions (about not so deep things), singing and copious amounts of food. Thank you to Filipa and Elaine for your guidance and support. Thank you to the “Perfect 16” for listening to me talk about all things PhD and special thanks to Kazzie McStan, Kirst, Lisa Simpson, Oats, Ruthie and Saz for reading!

I would also like to acknowledge the very fortunate circumstances that have enabled me to complete this PhD. Part of that is due to my extremely hard-working, supportive parents who have always been there for me. A huge thank you for the emotional and financial support. I’ve now done enough uni for all three of us! So I (probably) won’t put you through this again...

And finally, thank you to Drew. I could not have done this PhD without you to help celebrate the successes, commiserate the failures and provide encouragement. You have been an excellent navigator (expedition leader?) of this journey. You were with me every step of the way despite being thousands of miles away. You’re the best. Now let’s go be doctors together.

Abstract

Developmental language disorder (DLD) affects approximately 7% of the population and is defined as a difficulty comprehending or expressing language that cannot be explained by any hearing impairment, intellectual disability or autism diagnosis. This thesis examines the pathways between DLD and increased socioemotional difficulties in adolescents. The literature review (Chapter 1) discusses potential models to explain how this relationship develops, before proposing three new models to be tested in the empirical studies of the thesis.

Investigating the adaptation model, Chapter 2 finds that teacher-rated peer problems partially mediate later parent-rated emotional problems in adolescents considered at risk of DLD (rDLD) in a population cohort. These findings were replicated in cross-sectional clinical study (Chapter 3) with parent-rated peer problems fully mediating concurrent parent-rated emotional problems. The following three chapters test the proposed models. First, by demonstrating poor social cognition abilities in a cross-sectional study of adolescents with DLD using the Social Attribution Task (SAT) (Chapter 4), then by exploring the mediating effect of performance on a novel social cognition task, the Social Evaluation Learning Task (SELT) (Chapter 5). Finally, the moderating effect of language difficulties on the relationship between emotion regulation, peer problems and emotional problems is investigated in a longitudinal population cohort (Chapter 6).

The findings from each study are discussed in Chapter 7. Overall, the thesis replicates previous findings that young people with DLD are at increased risk of anxiety and depression compared to their peers. Furthermore, it extends the literature by using population cohorts and investigating social cognition and emotion regulation as predictors for increased socioemotional problems. Language interventions for DLD may do well to incorporate more aspects of socioemotional development to tackle additional difficulties that individuals with DLD may face.

List of abbreviations

- ADHD – Attention Deficit Hyperactivity Disorder
- ASD – Autism Spectrum Disorder
- CAMHS – Child and Adolescent Mental Health Services
- DLD – Developmental Language Disorder
- rDLD – risk of Developmental Language Disorder
- MCS – Millennium Cohort Study
- MLS – Manchester Language Study
- SAT – Social Attribution Task
- SEBD – Social, Emotional and Behavioural Difficulties
- SELT – Social Evaluation Learning Task
- SENCO – Special Educational Needs Coordinator
- SLCN – Speech, Language and Communication Needs
- SLI – Specific Language Impairment
- SLT – Speech and Language Therapist
- TD – Typically Developing/ed
- TLD – Typical Language Developed
- ToM – Theory of Mind

Thesis Introduction

Communication is a fundamental human right, underpinning everything that we do in a society. Not only are we required to communicate effectively to ensure our basic needs are met, but understanding others and expressing ourselves is also key to success in educational and social aspects of our lives. Moreover, research shows that social functioning is crucial for mental health so it is no surprise that a difficulty with communication, such as Developmental Language Disorder (DLD), will act as a barrier to these positive outcomes.

Yet, despite this clear link, DLD has been described as “the most common childhood disorder you’ve never heard of” (Norbury, 2017). DLD affects approximately 7% of the population and is defined as a difficulty comprehending or expressing language that cannot be explained by any hearing impairment, intellectual disability or autism diagnosis (Bishop, Snowling, Thompson, Greenhalgh, & consortium, 2016). A large body of research in both clinical and community settings has shown that children and adolescents with DLD experience higher ratings of peer problems, anxiety and depression compared to their typically developing (TD) peers, as reported by parents, teachers and themselves (Beitchman et al., 2001; Conti-Ramsden, Mok, Pickles, & Durkin, 2013; St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). Cross-sectional studies have demonstrated that children with DLD may have more problems making and keeping friends than their peers (Hart, Fujiki, Brinton, & Hart, 2004). They are more likely to be bullied (Conti-Ramsden & Botting, 2004; Knox & Conti-Ramsden, 2007; van den Bedem, Dockrell, van Alphen, Kalicharan, & Rieffe, 2018) and are often perceived to be more withdrawn by their parents and teachers (Maggio et al., 2014). Despite early intervention to improve language and communication, the additional psychosocial difficulties of anxiety, depression and poor social skills have been found to persevere throughout adolescence (St Clair et al., 2011) and into adulthood (Botting, Durkin, Toseeb, Pickles, & Conti-Ramsden, 2016). Lower educational attainment and limited future career prospects have been identified in the DLD population (Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018). Indeed, the link between language and increased psychiatric problems is such that a high rate of young people referred for Child and Adolescent Mental Health Services (CAMHS) (approximately 40%) have been identified with previously undiagnosed language problems (Cohen, Barwick, Horodezky, Vallance, & Im, 1998). Furthermore,

there is emerging evidence that many young offenders have undiagnosed language problems (Hughes et al., 2017). Therefore, a greater understanding of the relationship between DLD, social and emotional problems is needed in order to provide better support for these long-term problems.

Despite the convincing evidence for this association between language and social and emotional problems, the mechanisms involved in this relationship are unclear (Yew & O’Kearney, 2013). Is it a case of rejection from peers due to poor expressive language abilities? Withdrawal from social situations due to poor comprehension of social cues? Frustration or embarrassment of being unable to communicate? Understanding the specific pathways that underlie this relationship will allow for the delivery of more targeted interventions through speech and language therapy. Furthermore, the benefits of understanding this relationship may extend to wider society as well as the individual. DLD has been found to predict the education, health and employment of an individual in adulthood (Clegg, Hollis, Mawhood, & Rutter, 2005; Law, Rush, Schoon, & Parsons, 2009; Whitehouse, Watt, Line, & Bishop, 2009) and it is possible that these outcomes have a negative impact on society as a whole. For instance, language difficulties could have a bearing on resources provided by the NHS, such as speech and language therapy and mental health services. Therefore, a better understanding of how the relationship between DLD and associated socioemotional difficulties develops is important in order to help alleviate these negative long-term outcomes.

Part of the reason for the uncertainty of the pathways is due to the difference in theories used to describe DLD. Traditionally, typical language development has been viewed from a “nativist” perspective, with Chomsky arguing for a rule-based, bottom-up approach, claiming that individuals possessed a Language Acquisition Device (LAD), which enabled language learning based on Universal Grammar (UG) and later Principles and Parameters. A more widely accepted view that has since emerged is the usage-based theory of language acquisition (Tomasello, 2009), which posits that children’s knowledge and understanding of language is constructed from the language that they hear around them in a top-down process. In this sense, language learning draws on other cognitive abilities, such as gaze following, imitation and intention-reading and is not solely based on grammatical abilities. In a similar way, theories describing DLD have moved from a domain-specific hypothesis to a domain-general account. Theorists arguing for a domain-

specific approach have focused on linguistic deficits, such as morphology, syntax and phonology (van der Lely, 2005). For example, Rice, Wexler and Cleave (1995) suggested that children with DLD were delayed in an extended optional infinitive stage where they have yet to master the correct usage of word endings based on different tenses. This viewpoint has been challenged by proponents of the domain-general theory of DLD, which suggests that cognitive deficits, such as processing speed (Hayiou-Thomas, Bishop & Plunkett, 2004) or auditory perception (Tallal & Piercy, 1973) are responsible for the difficulties associated with DLD. However, given the heterogeneity of DLD, these theories have been criticised for being too narrow or too general in their focus (Hulme & Snowling, 2013). The procedural deficit hypothesis (Ullman & Pierpont, 2005) aims to bridge the gap between approaches based on grammatical or processing speed deficits by explaining DLD in terms of neural deficits. The procedural deficit hypothesis states that individuals with DLD have deficits in procedural memory, the ability to learn and remember skills, which hinders their ability to learn language. Overall, the cognitive approach to DLD is more aligned with the widely accepted usage-based theory of typical language acquisition and could account for the additional socioemotional difficulties seen in DLD. Therefore, the theoretical approach within which this thesis is framed will be the domain-general theory, with more detailed discussion of usage-based theory in Chapter 1.

It is also important to note the diverse definitions of DLD that have been used in the literature. Previous studies have varied in their use of clinical cut-offs to define DLD; both in whether they categorise DLD or use a continuous scale of language and what level of cut-off they use. Tomblin, Records and Zhang (1996) endorse the stricter “Episli” cut-off of 1.25 standard deviations (SDs) or more below the mean on two out of five subtests measuring expressive and receptive language ability, as well as a nonverbal intelligence quotient (NVIQ) of 85 or more. Conversely, the International Statistical Classification of Diseases and Related Health Problems (ICD – 10; World Health Organization, 1992) employs a wider cut-off of 2 SDs or more below the mean on two language subtests. Meanwhile, the Diagnostic and Statistical Manual of Mental Disorders – 5th Edition (DSM-5; American Psychiatric Association, 2013) falls in the middle with DLD diagnostic criteria defined as 1.5 SDs or more below the mean and has a more relaxed criterion of NVIQ of 70 or more, removing the requirement of a discrepancy between verbal and nonverbal IQ. The differing criteria for defining DLD could explain the inconsistency in findings in the literature surrounding DLD and associated socioemotional difficulties.

Indeed, DLD is a heterogeneous disorder and not all children with a clinical diagnosis are identified by the cut-off, with some scoring within 1 SD below the mean on the common standardised subtests (Spaulding, Plante & Farinella, 2006). Given the arbitrary cut-offs used and the finding that nonverbal IQ does not limit responsiveness to therapy (Reilly, Bishop & Tomblin, 2014), recent recommendations have called for a combination of parent report and standardised tests to measure language ability (Bishop et al., 2016) to provide a more comprehensive account of language. In the current thesis, DLD is defined as a categorical entity based on referral from speech and language therapists (SLTs), special educational needs coordinators (SENCOs) and parents. Parent-report of a history of language difficulties is a key factor as this provides a measure of functional language ability that cannot be found in only two subtests of expressive and receptive language (Bishop & McDonald, 2009).

The usage-based theory of language acquisition (Tomasello, 2009) used in this thesis clearly indicates that language learning and impairment must be seen in a social context in both the way it is learned and used. When an individual has difficulty with language they may have missed out on the key social skills that develop in conjunction with language learning (i.e. joint attention and understanding speaker intentions). An underlying deficit in social cognition skills, potentially due to the difficulties in learning language, may leave the individual more susceptible to misunderstanding social cues and reacting inappropriately in social situations. This could lead to rejection from peers or withdrawal by the individual, resulting in less exposure to social situations and fewer opportunities to practice social skills (Crick & Dodge, 1994). In turn, these social difficulties could be contributing to mental health problems because peer difficulties, specifically victimisation, are a known risk factor for emotional problems (Bowes, Joinson, Wolke, & Lewis, 2015).

Previous accounts of the specific relationship between language impairments and socioemotional deficits have focused on work by Redmond and Rice (1998); the Social Adaptation Model (SAM) and the Social Deviance Model (SDM). The SAM claims that individuals with DLD have intact psychosocial functioning but they adapt to the different and changing demands of each situation they are in, evidenced by differences in ratings of socioemotional behaviours from teachers and parents. More specifically, Redmond and Rice (1998) found increased ratings of social and emotional problems by teachers and

lower ratings from parents, perhaps reflecting the increased challenges faced by children in the classroom environment. These social difficulties could result in emotional problems due to being rejected and feelings of loneliness. Thus, this model indicates that social and emotional problems are directly related to language and treatment of language should decrease these additional negative outcomes. The SDM on the other hand, argues that individuals with DLD have an underlying vulnerability to socioemotional problems, suggesting that psychosocial ratings should remain stable over time and context. The authors maintain that there is little evidence to support the SDM, citing their own study on differential parent and teacher ratings. However, there has been limited evidence to suggest that socioemotional problems are a direct consequence of DLD (Bakopoulou & Dockrell, 2016). That is, early language abilities are not the strongest predictor of later social, emotional and behavioural difficulties (SEBDs) (Wadman, Botting, Durkin, & Conti-Ramsden, 2011) and there is no relationship between the severity of DLD and SEBDs (Fujiki, Brinton, & Clarke, 2002; Hart et al., 2004). Indeed, some children with DLD have no problems with social and emotional functioning (Durkin & Conti-Ramsden, 2007), suggesting that there may be other factors involved in the relationship.

This thesis first investigates a model similar to the adaptation model by examining whether children and young people with DLD have poorer social functioning than their TLD peers, and whether these social difficulties are influencing emotional difficulties. This thesis also examines whether there are mediating factors responsible for increased socioemotional problems in adolescents with DLD. Specifically, this thesis examines whether social cognition may be mediating the emotional difficulties in adolescents with DLD. There is evidence that young people with DLD have poorer social cognition abilities and this has been linked to peer acceptance (Andres-Roqueta, Adrian, Clemente, & Villanueva, 2016; Bakopoulou & Dockrell, 2016; Botting & Conti-Ramsden, 2008; Farmer, 2000). However, excepting Botting and Conti-Ramsden (2008), there is a dearth of research on adolescents in this area. This thesis uses experimental tasks to assess how skilled adolescents with DLD are at attributing mental state words to a silent animation of simple objects and whether they are poorer than their TLD peers at understanding whether or not someone likes them on a computerised task. Finally, the thesis evaluates the effect of emotion regulation as a predictor of socioemotional difficulties using a longitudinal cohort and comparing those considered at risk of DLD with those who are not.

Aim and Objectives

The overall aim of this thesis is to understand the mechanisms involved in the relationship between DLD and increased social and emotional problems in adolescents. Specifically, do young people with DLD experience these additional socioemotional problems due to a difficulty communicating with others, or do they develop a different way of viewing and experiencing social situations that leads to these poor emotional outcomes? The thesis aims to answer this question by examining three potential mechanisms: peer problems, social cognition and emotion regulation, which span the areas of environment, cognition and biology.

The environmental stream investigates whether language difficulties lead to poor social functioning, resulting in emotional problems. Similar to Redmond and Rice's (1998) social adaptation model, peer problems could be a result of communication difficulties. Adolescents with DLD could be rejected by their peers and/or withdraw from social situations, leading to feelings of isolation, depression or anxiety. The cognitive stream examines the mediating effect of social cognition on poor socioemotional outcomes. It could be that poor social and emotional functioning is a result of social cognition difficulties. That is, children and young people with DLD may have more difficulty understanding social cues than their TLD peers, and this contributes to, and is exacerbated by social difficulties, leading to increased feelings of loneliness, anxiety and/or depression. In both these streams, social factors play an important role. A difficulty with communication could discourage further social interactions, exacerbating the already weak social skills present in adolescents with DLD.

Alternatively, the increased socioemotional problems reported in adolescents with DLD could be the result of poor emotion regulation, a combination of biological and environmental factors. For instance, language difficulties could contribute to a difficulty labelling and understanding emotions, and therefore a difficulty expressing and controlling emotions.

Objectives of the Thesis:

- Examine social and emotional outcomes in adolescents with DLD compared to their TLD peers in a clinical sample and a population cohort
- Investigate whether adolescents with DLD perform poorly compared to their TLD peers on novel social cognition tasks
- Investigate whether emotion regulation abilities differ between children at risk of DLD (rDLD) and a general population (GP) group
- Explore whether peer problems or social cognition abilities mediate the relationship between DLD and poor socioemotional outcomes
- Evaluate whether the relationship between poor emotion regulation and poor socioemotional outcomes is moderated by rDLD group status

Research Design

There are two types of study design used in order to address these objectives; secondary data analysis of a population cohort and cross-sectional studies of a clinical sample (see Table 1 for sample overview). Different informants (parent, teacher and self) are used across the studies. Firstly, Chapters 2 and 6 analyse existing data from a longitudinal population study, the Millennium Cohort Study (MCS; Connelly & Platt, 2014). Secondary data analysis of a large cohort allows for more in-depth examination of the mechanisms responsible for poor socioemotional outcomes across different time-points, which is not feasible to conduct in the timeline of a PhD. The MCS was chosen as it consists of data from approximately 19,000 participants born in the year 2000-2002 throughout the UK. Data was gathered at six waves (i.e. at age 9 months, 3 years, 5 years, 7 years, 11 years and 14 years) with respondents including parents/caregivers, teachers and the child themselves. For this thesis, a variable defined as ‘risk of Developmental Language Disorder’ (rDLD) was created based on parent report of language difficulties and scores on a language task (Naming Vocabulary) at age five. Participants who did not meet criteria for this group were included in the General Population (GP) group as a comparison. Chapters 2 and 6 use Stata 14 (StataCorp., 2015) to analyse the data as this statistical software is recommended for the MCS (Ketende & Jones, 2011). Chapter 2 uses a mediation analysis to examine the effect of peer problems at age 7 on emotional problems at age 14. Chapter 6 also uses Mplus (Muthén & Muthén, 1998-2012) to conduct

a cross-lag analysis to explore the relationship between emotion regulation, peer problems and emotional problems between ages 3-14 years.

The remaining chapters in this thesis (Chapters 3-5) follow a cross-sectional design in order to compare the social functioning, social cognitive abilities and emotional outcomes of adolescents with and without DLD. One study uses questionnaires and standardised scales to measure social functioning (Chapter 3) and two studies use experimental tasks to measure social cognition (Chapters 4 and 5). In particular, Chapter 3 evaluates whether parent- and self-reports of socialisation and friendship differences mediate the relationship between DLD and emotional problems. Social cognition is examined in Chapter 4 using the Social Attribution Task (SAT; Klin, 2000) and the novel Social Evaluation Learning Task (SELT; Button et al., 2015) is investigated as a mediator of social and emotional problems in Chapter 5.

Participants were included in the study if they were native English speakers, aged 11-18 years old and had no hearing impairment, intellectual disability or autism diagnosis. An additional exclusionary measure of scoring above the cut-off of the Autism Quotient (AQ) was also included. All participants attended mainstream schools, although three participants were recruited from a specialised language unit within a mainstream school. There were two recruitment streams for the study (see Appendix B for flowchart). Participants with a diagnosis of DLD were recruited directly either through a local speech and language therapy service employed by the local authority to provide services to schools, referral from Special Educational Needs Coordinators (SENCOs) within schools, or from flyers posted in online support groups for DLD. A screening procedure was used to recruit TLD participants matched on age (within six months) and sex, and participants with a history of language difficulties. Screening participants were recruited through flyers advertised in school newsletters, on social media and through the University of Bath community participation panel. Screening packs consisted of background questionnaires for parents/caregivers and self-report of language and communication skills for participants. Participants were included in the DLD group if they reported poor language and communication abilities and/or were reported to have had language difficulties in the background questionnaire.

Participants were recruited and tested over the course of two and half years. The testing involved 90 minutes of experimental tasks and socioemotional questionnaires for

participants and questionnaires for their parent/caregiver about the young person's developmental history and socioemotional functioning. The results from the testing phase formed three separate papers (Chapters 3-5). Background questionnaires were used to obtain participants' developmental history of language, motor and self-help abilities, and a history of family mental health and learning difficulties. Parent/caregivers also completed the Strengths and Difficulties Questionnaire (SDQ) to provide a measure of their child's peer and emotional difficulties. During the testing phase, the adolescents themselves completed the Revised Children's Manifest Anxiety Scale (RCMAS), the Moods and Feelings Questionnaire (MFQ), the Warwick Edinburgh Mental Wellbeing Scale (WEMWBS), and the Perceived Social Support – Friendship scale (PSS-Fr). These measures are commonly cited in the literature on DLD and socioemotional difficulties (Botting, Toseeb, Pickles, Durkin, & Conti-Ramsden, 2016; Lindsay, Dockrell, & Strand, 2007; St Clair et al., 2011; Wadman et al., 2011).

Additional tasks were used to measure language and social cognition abilities. In particular, the Recalling Sentences and Word Classes subtests from the Clinical Evaluation of Language Functioning – 4th Edition (CELF-4) and the Block Design subtest from the Wechsler Intelligence Scales for Children – 4th Edition (WISC-IV) provided a measure of language skills and nonverbal ability. These subscales are accurate measures for the diagnosis of DLD (Conti-Ramsden, Botting, & Faragher, 2001). The SAT (Klin, 2000) and the SELT (Button et al., 2015) measure social cognition abilities. The SAT (Chapter 4) measures the adolescents' social interpretation skills by examining their ability to describe what is happening in a silent video of interacting objects. The SELT (Chapter 5) measures how adolescents interpret positive and negative evaluation in relation to either themselves or to an external "other" in a computerised task. Both the SAT and the SELT allow for an online assessment of social judgements that is more appropriate to the research questions about individuals' social understanding and behaviours in social situations than the Theory of Mind (TOM) tasks that are typically found in the literature (Abell, Happé, & Frith, 2000).

Stata 14 (StataCorp., 2015) was again used for all analyses in Chapters 3-5. Mediation analysis was used in Chapter 3 to examine the effect of social functioning (peer problems) on the relationship between DLD and emotional problems, and in Chapter 5 to examine the effect of social cognition (performance on the SELT) on the relationship between DLD and peer and emotional problems. Hierarchical regression was used in Chapter 4 to establish

the influence of social cognition skills (performance on the SAT) on socioemotional problems. Chapter 4 also includes qualitative analysis of the SAT using a prescribed coding system adapted from Klin (2000).

Table 1.

Sample used in each chapter

Chapters	Sample
2 & 6	<p>Risk of DLD (rDLD) derived from Millennium Cohort Study based on 1.5 SD below mean on Naming Vocabulary subtest and parental report of language difficulties (n = 891).</p> <p>General population (GP) comparison group (n = 14,242).</p> <p>Waves measured at age 3, 5, 7, 11 and 14 years.</p>
3-5	<p>DLD sample recruited by referral from speech and language therapists (SLTs) and parent report of early language difficulties (n = 26).</p> <p>Typical language developed (TLD) comparison group matched on age (within 6 months) and sex (n = 27).</p> <p>Age range from 11-17 years (M = 13 years 6 months).</p>

Contribution to Knowledge and Relevance

Overall, this thesis will add to the somewhat limited research examining the mechanisms involved in poor socioemotional outcomes for adolescents with DLD (Yew & O’Kearney, 2013). A better understanding of how these additional problems develop throughout childhood and adolescence may help inform more targeted interventions and potentially help young people referred to CAMHS. The longitudinal studies in particular can help with identifying specific times that may be key to addressing the social and emotional problems associated with DLD, by identifying the onset of these problems and how they develop over time. Targeted interventions are particularly important when focusing on socioemotional problems associated with DLD, as typical psychological approaches such as cognitive behavioural therapy (CBT) rely on language. While evaluating interventions is out of the scope of this thesis, a better understanding of the processes involved may help inform future studies.

Previous research has focused on children (e.g. Beitchman et al., 1996; Brinton, Fujiki, Spencer, & Robinson, 1997; Redmond & Rice, 2002) but we now know that the additional social and emotional problems associated with DLD can last throughout the lifespan (Clegg et al., 2005; Conti-Ramsden et al., 2018). This thesis examines cross-sectional samples of adolescents with and without DLD aged 11-17 years, and analyses secondary data from a population cohort aged 3-14 years. Adolescence is a critical period to study social and emotional problems as this is an age when many lifelong psychiatric disorders first manifest (Jones, 2013). Additionally, adolescence is a period of change when young people start new schools, academic challenges increase and the subjects they choose may determine their future careers. Indeed, there is a lot more choice and independence during this time with adolescents seeking more support from their peers than from their parents and therefore peers may be having an increased influence on adolescents' behaviours and emotions during this period.

Secondary data analysis of the MCS allows for an investigation into the pathways involved in the relationship between language ability and mental health outcomes in the years leading up to adolescence, to examine what causal factors could be at play. Analysis of population cohorts is necessary in order to assess whether the same effects from clinical cohorts of individuals with a diagnosis of DLD, such as the Manchester Language Study (MLS; Conti-Ramsden & Botting, 1999), can be found in community samples. The MLS has been analysed extensively with regards to longitudinal psychosocial outcomes of individuals with DLD, therefore analysis of the MCS diversifies the current literature in the field. Previously, expressive language ability in the MCS has been found to predict conduct behaviour (Girard, Pingault, Doyle, Falissard, & Tremblay, 2016) and prosocial ability (Girard, Pingault, Doyle, Falissard, & Tremblay, 2017) in early childhood. Other population cohorts have examined psychosocial outcomes in children with a language difficulty but the sample consisted of much younger children, aged 4-7 years old (Levickis et al., 2017; McKean et al., 2017). To address this gap in the literature, two chapters in this thesis will analyse data from children at risk of developing DLD (rDLD) from the MCS, spanning early childhood to early adolescence (3-14 years old) with a focus on social and emotional outcomes.

Poor social cognition ability is one possible explanation for the increase in social and emotional problems in adolescents with DLD that is emerging from the literature. However, previous studies have examined social cognition in terms of social outcomes

(Andres-Roqueta et al., 2016; Botting & Conti-Ramsden, 2008) and/or within a primary-school aged population (Bakopoulou & Dockrell, 2016; Marton, Abramoff, & Rosenzweig, 2005). This thesis examines social cognition as a mediator between DLD and social and emotional problems in an adolescent population. Furthermore, of the few studies that have examined social cognition in those with DLD, the tasks have been relatively similar. Consequently, two novel tasks are used in the current thesis: The SAT (Chapter 4) has predominantly been used in studies of the autistic population (e.g. Klin, 2000; Klin & Jones, 2006), while the SELT (Chapter 5) has previously been used to test perceptions of the self and other in adults with and without social anxiety (Button, Browning, Munafo, & Lewis, 2012; Button et al., 2015).

By evaluating several different pathways to increased socioemotional problems in a more complex and detailed manner than most previous literature, using novel measures of social cognition that have not been tested on this sample, this thesis will contribute to the literature and is also relevant to the wider world. Recent figures from an NHS survey show that mental health problems in young people aged 5-15 years, particularly emotional disorders, have slightly increased from 9.7% in 1999 to 11.2% in 2017 (NHS Digital, 2018) and mental health expenditures are predicted to cost the UK £14 billion by the year 2026 (McCrone, Dhanasiri, Patel, Knapp, & Lawton-Smith, 2008). While DLD is a subsample of this problem, recent cuts to funding may have an impact on diagnosis and treatment of DLD and the associated difficulties. Indeed, adolescence is a crucial period when individuals may not have the same access to services as younger children, therefore it is imperative that research is conducted for better understanding of the difficulties these young people may face (Dockrell, Lindsay, Letchford, & Mackie, 2006). The Bercow Report (Bercow, 2008) that was originally commissioned by the government has recently been independently reviewed for a ten-year follow-up (ICAN & RCSLT, 2018), revealing a persistent lack of suitable provision for children and young people with speech, language and communication needs (SLCN), which is only set to continue without adequate funding. By highlighting the associated difficulties in DLD and uncovering the processes involved, this thesis could help to raise awareness of the increased risk of mental health difficulties that children and young people with DLD face and aid in future endeavours to prevent these associated difficulties.

Structure of Thesis

To address the proposed research questions this thesis takes the format of “thesis by publication”. Each of the five studies is written up as an individual paper, according to the guidelines of the specific journal to which it is being submitted. Details of the stage of publication are included, along with an introductory paragraph before each chapter. There is a literature review at the beginning and a general discussion at the end to tie the studies together into a cohesive thesis.

Chapter 1 provides an overview of the literature surrounding social and emotional problems in children and adolescents with DLD. Social skill processing is discussed in general before a closer examination of usage-based theory; the theoretical approach of language acquisition within which this thesis is framed. Specific theories examining the relation between DLD and socioemotional difficulties are then explained before outlining the models to be investigated in the thesis.

Chapter 2 analyses the mediating effect of peer problems at age 7 on emotional problems at age 14 using secondary data from the MCS.

Chapter 3 aims to replicate the findings from Chapter 2 using a cross-sectional sample of adolescents with and without a history of DLD and different informants: Parent-rated peer problems are examined as a mediator of concurrent parent-rated emotional problems.

Chapter 4 uses the SAT to examine the social cognition abilities of the cross-sectional sample of adolescents with and without a history of DLD, testing the effect of SAT performance on socioemotional difficulties.

Chapter 5 uses a novel social cognition task (the SELT) to explore the mediating effect of social cognition on social and emotional outcomes in adolescents with DLD.

Chapter 6 presents a cross-lagged analysis of the MCS to investigate the influence of emotion regulation on peer and emotional problems throughout childhood and adolescence and whether DLD group status moderates this relationship.

Chapter 7 summarises the findings from the individual studies and provides a general discussion and conclusion to the overall thesis.

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Chapter 1: Literature Review

Developmental Language Disorder (DLD) affects approximately 7% of the population and is diagnosed when individuals have significant difficulties with expressive and/or receptive language which cannot be accounted for by any other neurodevelopmental disorders, hearing or oromotor impairment, or global intellectual disability (Bishop, Snowling, Thompson, Greenhalgh, & consortium, 2016). It is primarily viewed as a childhood communication disorder which can be ameliorated, at least partially, through speech and language therapy. Recent studies, however, have investigated the relationship between DLD and associated difficulties, such as social and emotional problems, to determine if there are any lasting effects of the disorder. There is evidence to suggest that individuals with DLD are at increased risk for socioemotional problems compared to their typical language developing (TLD) peers; however, there remain gaps in the literature regarding the pathways involved in this relationship (Yew & O'Kearney, 2013). It is unclear whether the increased risk of social and emotional difficulties is a direct result of poor language skills or a consequence of other factors such as social understanding or regulating emotions. That is, do children with DLD have difficulty making friends because they struggle to communicate, leading to feelings of isolation and negative emotional outcomes? Or do they develop weak social cognition or emotion regulation abilities that drive poor social skills, leading to reduced exposure to social situations and an increase in emotional problems?

A Note on DLD Definition

The terminology used to describe clinical language difficulties has had many different permutations throughout the years: Specific Language Impairment (SLI); Developmental Dysphasia; Language Disorder/Delay; and Speech Language and Communication Needs (SLCN) to name a few (Bishop, 2014). SLI has been the preferred term of researchers for a number of years, but there is often confusion about how “specific” a disorder it is (Reilly et al., 2014). This confusion may be responsible for the lack of awareness of the condition. It is important to establish a consensus in order for better understanding of the disorder, not only for researchers but also for clinicians and parents. A consistent label will enable easier searching of the literature and ensure better provision of care for the child when clinicians, parents and teachers are all agreed on the condition they are trying to manage. A recent online Delphi study was conducted with many international researchers and professionals

agreeing upon the term Developmental Language Disorder (DLD) (Bishop et al., 2016). The definition of DLD remains largely the same as SLI, although the discrepancy between verbal and nonverbal IQ is no longer deemed necessary for a diagnosis. Long-term studies that have previously used SLI have changed to DLD (e.g. Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018a). Therefore, to retain consistency, the term Developmental Language Disorder (DLD) is used throughout this thesis when discussing language impairments with no other known cause, even when referencing studies that employ older terminology.

Socioemotional Problems in the DLD Population

Individuals who have persistent language difficulties at five years of age are more likely to experience elevated rates of socioemotional problems compared to their TLD peers or those whose language difficulties have improved (Beitchman et al., 1996; Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006). Children with DLD are less likely to be the preferred playmate in kindergarten (Year 1 primary school), are more likely to experience bullying and are rated as more withdrawn than their peers (Conti-Ramsden & Botting, 2004; Fujiki, Brinton, & Clarke, 2002; Maggio et al., 2014). Children and adolescents with a history of DLD are also more likely to experience feelings of anxiety and depression than their TLD peers as reported by themselves, their parents and their teachers (Conti-Ramsden & Botting, 2008; Wadman, Botting, Durkin, & Conti-Ramsden, 2011b).

However, there is conflict surrounding the contribution of language to these difficulties, with some studies finding no influence of language on negative socioemotional outcomes (Benasich, Curtiss, & Tallal, 1993; Lindsay & Dockrell, 2012). Conversely, other studies have found that receptive language abilities are a significant predictor of socioemotional difficulties (Conti-Ramsden, Mok, Pickles, & Durkin, 2013), while others have found pragmatic language ability is the strongest predictor (St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). Of course, the difference in design, measures and informants may be a factor for conflicting findings. For example, language ability was found to significantly predict teacher ratings of poor socioemotional outcomes but not parent ratings in the same study (Lindsay, Dockrell, & Strand, 2007). Contextual factors should be investigated in order to unravel the relationship between DLD and increased socioemotional difficulties. A recent study, for example, found that while language and nonverbal IQ did not predict depressive symptoms in adolescents and young adults with DLD, patterns of depressive symptoms were linked to a 'transition' variable (i.e.

depression decreased after the age of 16 and increased in those struggling to find employment after leaving school) (Botting, Toseeb, Pickles, Durkin, & Conti-Ramsden, 2016). It is important to consider the different pathways that may be involved when examining increased socioemotional problems in DLD.

Adolescence is another period of key transition, when young people are becoming more independent from their parents, a stronger sense of identity is formed, social relationships become more complex and academic pressures increase along with changing schools. These problems alone could contribute to socioemotional problems that are distinct from childhood difficulties. For adolescents with DLD, these problems could be even more significant given the sophisticated level of language needed to negotiate adolescent friendships (e.g. sarcasm) and cope with increasing academic demands. Indeed, peer problems in children with DLD have been found to change trajectory across development (Lindsay & Dockrell, 2012; Mok, Pickles, Durkin, & Conti-Ramsden, 2014) with some noting an increase during adolescence, while rates of conduct and hyperactivity problems return to normative levels as the individuals mature (St Clair et al., 2011). As social support is associated with positive mental health a difficulty with friends could lead to increased rates of psychopathology (Arseneault, Bowes, & Shakoor, 2010; van Harmelen et al., 2017). Adolescence is also a key period to study because of the links to long-term outcomes. For instance, positive well-being in adolescence is predictive of general health and fewer risk-taking behaviours in adulthood (Hoyt, Chase-Lansdale, McDade & Adam, 2012), while emotional problems in adolescence are at risk of developing into later psychiatric problems (Jones, 2013).

As well as associated socioemotional problems, individuals with DLD entering adulthood may also experience more difficulties with romantic relationships, education, and employment than their TD peers (Clegg, Hollis, Mawhood, & Rutter, 2005; Conti-Ramsden, Durkin, Simkin, & Knox, 2009; Whitehouse, Watt, Line, & Bishop, 2009) and may be more likely to come into contact with the criminal justice system (Brownlie et al., 2004; Winstanley, Webb, & Conti-Ramsden, 2018). Life skills, such as learning to drive, may also be affected, with young people with DLD less likely to hold a valid driver's licence than their age-matched peers at 24 years of age (Durkin, Toseeb, Pickles, Botting, & Conti-Ramsden, 2016), possibly contributing to the already lower feelings of independence that young people with DLD are reported to experience (Conti-Ramsden & Durkin, 2008). These additional difficulties demonstrate the long-term impact of DLD in

many facets of life, which could be exacerbating the already poor socioemotional outcomes experienced by children and adolescents with DLD. Increased mental health difficulties are a significant problem in the general population and are predicted to cost the UK £14 billion by the year 2026 (McCrone, Dhanasiri, Patel, Knapp, & Lawton-Smith, 2008), therefore, it is important to investigate what mechanisms are involved, should any preventative measures be found to reduce the long-term socioemotional consequences of DLD.

Recent studies have examined mediating factors to better explain the relationship between DLD and increased socioemotional difficulties. For example, Wadman et al. (2008) found that shyness partially mediated the relationship between language ability and self-esteem in adolescents with DLD. This finding was replicated among young adults with DLD aged 24 (Durkin, Toseeb, Botting, Pickles and Conti-Ramsden, 2017). Meanwhile, the relationship between language ability and emotional problems (anxiety and depression) at 24 years of age was also mediated by self-efficacy in both the DLD group and the TD group (Botting, Durkin, Toseeb, Pickles & Conti-Ramsden, 2016), with the DLD group reporting lower self-efficacy and higher levels of emotional problems. However, there are still other potential mediating factors that can be investigated to unravel the relationship between DLD and increased socioemotional problems. Additionally, these particular papers, and much of the research in the UK, have focused on the Manchester Language Study (MLS; Conti-Ramsden & Botting, 1999) which consists of individuals with DLD originally recruited from language units at the age of 7 and followed up periodically for approximately twenty years. While the MLS provides robust findings from longitudinal research it is important to examine whether the same effects hold in other samples of participants with language difficulties who may not have had as much access to support (i.e. speech and language therapy) as those in the MLS. Indeed, with the recent change to diagnostic criteria it is important to investigate whether any differences in socioemotional outcomes are seen in adolescents with DLD compared to previous studies now that the discrepancy between nonverbal and verbal IQ is relaxed (Bishop et al., 2017). Furthermore, the discrepancy in findings in the literature encourages the use of moderation analyses to investigate whether different developmental pathways are present between children and young people with and without DLD.

Aim and Objectives

The aim of this review is to evaluate the literature describing the pathways to increased socioemotional problems in adolescents with DLD. Firstly, the review will assess the evidence surrounding existing theories that may explain the relationship, culminating in the outline of the proposed models to be tested in the thesis. The literature from empirical studies of typically developing children and individuals with DLD will then be organised thematically (i.e. social functioning; social cognition; emotion regulation) and discussed in relation to each of the proposed models. Finally, the key points from the literature will be summarised and discussed in reference to the main studies of this thesis, which will test the proposed models.

Theories

This section will evaluate potential theories for the relationship between DLD and associated social and emotional difficulties. The general theory of Social Information Processing is discussed first, which highlights the complex nature of social communication by providing a brief overview of the many stages involved. Next, the usage-based theory of language development, the theoretical framework upon which the thesis is based, is discussed in more detail with reference to the DLD population. Then, using this framework, the specific theories proposed to explain the link between language ability and associated difficulties in individuals with DLD will be evaluated. Finally, the main arguments of the thesis and corresponding models will be presented.

General Social Communication Theory - Social Information Processing (SIP)

The complex nature of engaging in conversation and the problems that arise when one of these processes is impaired can be explained by the Social Information Processing (SIP) model (Crick & Dodge, 1994). SIP theory suggests that the way individuals identify and understand emotions influences their social interaction.

There are six stages involved in the process: encoding of cues; interpretation of cues; clarifying and selecting a goal; accessing possible responses; deciding on the most appropriate response; and acting on that response (Figure 1). The final stage often includes monitoring the dyadic partner's response cues and providing feedback to the system, highlighting the cyclical nature of the process. Indeed, many of these processes are occurring simultaneously, as real-life social interactions are not linear, but they tend to

follow the logical pattern described in the model. Throughout the process, individuals refer to previous experiences and knowledge of others' perspectives, in order to evaluate their interpretation of the cues and eventual behavioural response.

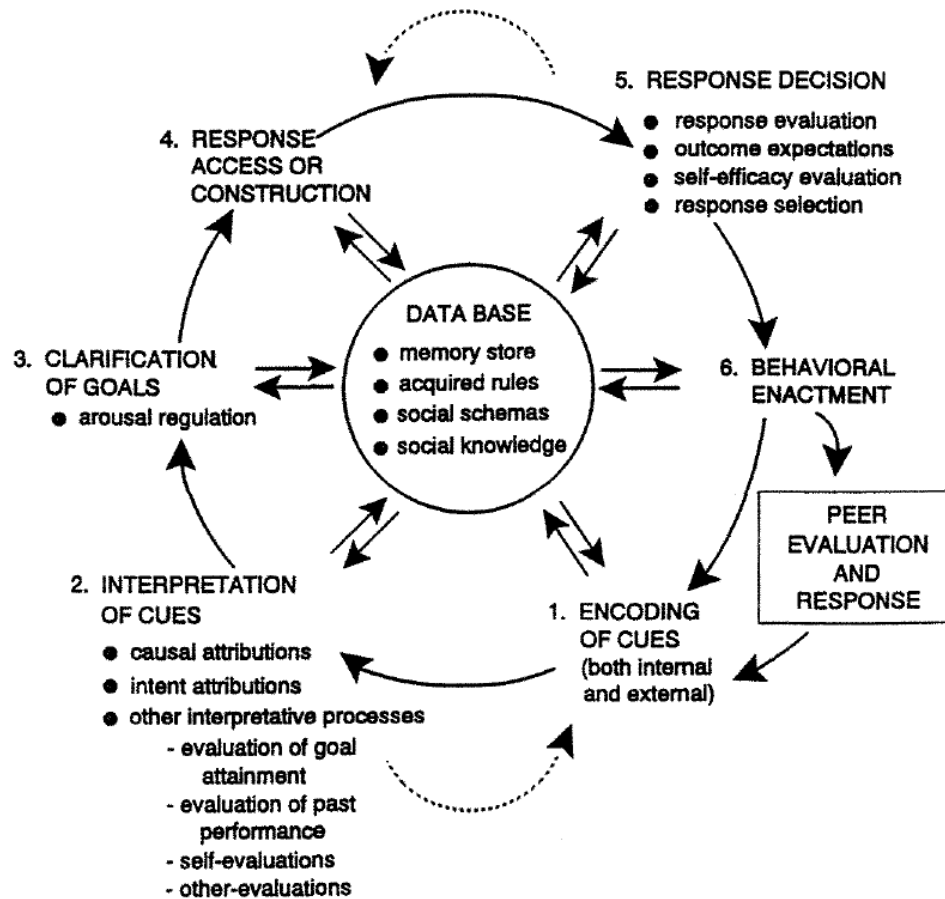


Figure 1. The social information processing model of children's social adjustment.

Note: Taken from p.76 in Crick, N. R. & Dodge, K. A. (1994). A Review and Reformulation of Social Information-Processing Mechanisms in Children's Social Adjustment. *Psychological Bulletin*, 115(1), 74-101. Copyright 1994 by American Psychological Association. Reprinted with permission.

However, this model assumes that the individual has had adequate exposure to social situations and understands the appropriate responses that should be made, either by accessing previous successful responses from their long-term memory store (“latent mental structures”) or by creating an appropriate response based on the immediate social cues of the situation (“on-line processing”). Either way, an individual requires knowledge of social situations in order to progress through this model successfully. For example, socially confident individuals may approach social situations positively because they have a good understanding of how to interact with their peers based on previous experiences, and these positive exchanges encourage further successful interactions. Conversely, those who have had adverse experiences may hold a negative view of social situations and may be biased against, or indeed discouraged from, interacting with others. These limited social interactions will hinder the formation of schemata to aid with the understanding and interpretation of social cues from future interactions.

Individuals with DLD may not have the same quality or quantity of social experiences as their TD peers from which to draw on (Durkin & Conti-Ramsden, 2007), meaning they are at a significant disadvantage according to the Social Information Processing model. The potentially limited knowledge base of social schemas in individuals with DLD means they may rely on one or two schemata which they have found to be effective in the past, without evaluating whether they are appropriate for the current situation. For example, an individual may react aggressively to get a toy from another child because that was a successful solution to a previous problem. The individual may place too much emphasis on the goal without taking into consideration the negative social consequences that may arise from their behaviour (Crick & Dodge, 1994).

The fact that inappropriate responses may become ingrained in the child’s social repertoire highlights why early identification of risk factors for social impairment and timely implementation of interventions is necessary to help facilitate suitable responses. However, this theory does not consider social competence from a developmental perspective and Lemerise and Arsenio (2000) have since called for emotion regulation to be included in the SIP model. Emotions may cloud judgements, influencing decisions and behaviours. Individuals with poor emotion regulation may be more goal-oriented and lack awareness of others’ feelings or perceptions.

The Usage-based Theory of Language Acquisition

Language is inherently social, both in the way it is learned and the way it is used. The usage-based theory of language acquisition describes language learning as an active process; children learn the rules of conversation by constructing their linguistic knowledge from exposure to language from their caregivers (Tomasello, 2009). Parents are communicating in every interaction with their child, both implicitly and explicitly, and these exaggerated movements and facial expressions paired with words and sounds influence children's social understanding at a very young age (Saxton, 2010). Intention-reading and pattern-finding are two general cognitive processes that are key aspects to language acquisition according to the usage-based approach (Tomasello, 2009). Intention-reading describes how children use the skills of joint attention, such as gaze following and pointing, to detect the goals, or intentions, of their caregivers. This allows children to learn the "functional dimensions" of language (Tomasello, 2009, p. 86). Similarly, children use these social cognition skills to direct caregivers' attention when communicating, demonstrating shared understanding and the social nature of language. Pattern-finding describes the process of identifying patterns heard in different utterances (e.g. "the dog wants the bone", "the dog wants the ball") and generalising them to construct new sentences (e.g. "the dog wants the food"). Children use both processes of intention-reading and pattern-finding to extract words from the utterances they hear and apply meaning from the social context to build mental schemata for use in other situations. In this sense, children are deriving meaning from a larger utterance due to understanding of social context and speaker intent, not simply mapping meanings onto words.

Children are not learning the meaning of words and grammatical constructs individually, but from utterances within a social context. This is more of a top-down approach using intention-reading and pattern-finding than a bottom-up approach using association or mapping. To illustrate this point, Tomasello (2009) highlights studies of children learning grammar rules with nonwords. Tomasello (2009) argues this is evidence of intention-reading as the child has to determine the adult's intention when understanding the nonword. As well as learning verbs, intention-reading can also apply to pragmatic choices (e.g. "this" or "that") as children use contextual cues such as distance to understand the reasoning behind why the speaker made that specific choice. Another example of this is the variety of different meanings that can be construed from simple two

word utterances, depending on the context. An understanding of the speaker's intentions will give meaning to the simple utterance which can then be acted upon.

When young children hear language they are trying to discern the “communicative intention” of the statement (Tomasello, 2009, p. 71), indicating that social understanding abilities are needed from an early age. However, language is also used in a social context in order to communicate with others and therefore language ability can strengthen social understanding. Children begin with pointing gestures to communicate with their caregivers, not only to convey their wants but also to bring the adult into their social world (Carpendale & Lewis, 2006).

However, children with DLD may be missing out on these valuable early experiences. For example, Jones and Conti-Ramsden (1997) posit that a difficulty in pattern-finding accounts for the delay in learning verbs that is observed in children with DLD when compared to their younger siblings. Studies of siblings of children with DLD are particularly important to understanding social communication abilities in this population because they demonstrate that the input from the environment is the same but children with DLD are unable to extract information in the same way as their typically developing siblings. Therefore, children with DLD may have difficulty understanding speaker intentions and wider social cues.

Social Communication Models for Children with DLD

Bishop's (1997) theories.

There are few frameworks that have sought to explain the relation between DLD and socioemotional difficulties. Bishop (1997) first suggested three potential models to explain the social communication difficulties in children with DLD. Firstly, there could be an impairment of information processing that is responsible for both language difficulties and problems with social communication. During a conversation listeners have to attend to their partner, keeping track of many utterances and interpreting their meaning, forming a mental image in working memory that they can respond to. Indeed, Hayiou-Thomas, Bishop, and Plunkett (2004) were able to simulate DLD-like grammatical difficulties in children with typically developing language by reducing processing speed and increasing memory load. These difficulties parsing a conversation could result in missing or misinterpreting important social cues. Secondly, the associated social problems could be a direct result of the inevitable distorted social experiences due to the poor communication

abilities of individuals with DLD. Language difficulties are a barrier to social interactions and peers may reject children with DLD because they cannot understand them.

Alternatively, children with DLD may withdraw from social situations because of the frustration of not being able to communicate. However, it is difficult to determine whether children are struggling socially because of their language or because of a general deficit in social understanding. This led Bishop (1997) to propose a third model that suggested an underlying social cognition deficit may prohibit infants with DLD learning language and social skills in the same way as their typically developing peers. Bishop argued that the impairment of interpreting nonverbal cues for communication, which must have occurred because of language, suggests that social cognition is an underlying deficit in children with DLD.

Social Adaptation Model (SAM) Vs. Social Deviance Model (SDM).

Redmond and Rice (1998) proposed two models to describe the relationship between DLD and socioemotional functioning: The Social Adaptation Model (SAM) and the Social Deviance Model (SDM). The SAM (Figure 2) posits that there is an indirect causal link between language and socioemotional symptoms, while the SDM advocates for a comorbid underlying socioemotional difficulty in those with a language impairment. The SAM states that individuals with DLD have intact psychosocial traits, similar to typically developing children, but they adjust their behaviour due to their difficulties communicating. Poor language ability, coupled with the cognitive demands involved in social contexts and the reactions of others, including rejection by peers and judgements from parents and teachers, leads to adaptive behaviour such as withdrawal from social situations. Social support is a protective factor against psychopathology (van Harmelen et al., 2017). Therefore, a difficulty socialising, caused by language difficulties, could lead to negative emotional outcomes. Similarly, there is evidence to suggest that children and adolescents with DLD are at increased risk of victimisation compared to their typically developing peers (e.g. Knox & Conti-Ramsden, 2007; Redmond, 2011). There is a wealth of evidence that suggests being bullied predicts negative mental health outcomes (Hawker & Boulton, 2000). Consequently, socioemotional difficulties could be addressed by strengthening language ability and improving peer, parent and teacher knowledge and attitudes towards DLD.

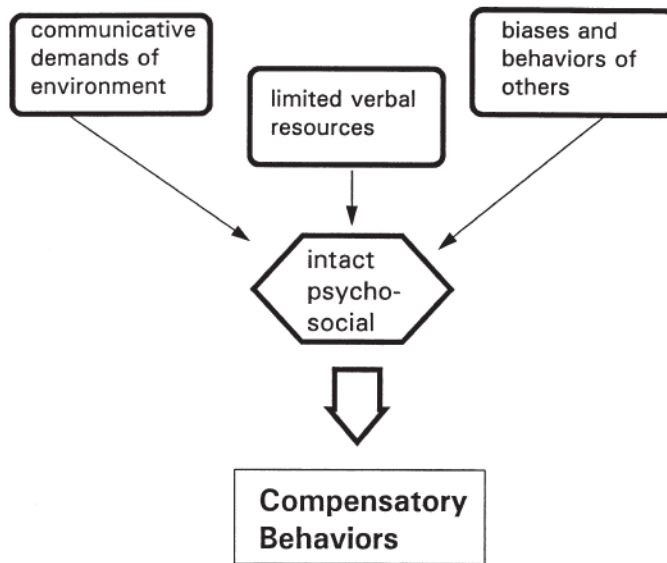


Figure 2. Social Adaptation Model.

Note: Taken from p. 689 in Redmond, S. M., & Rice, M. L., (1998), *The Socioemotional Behaviors of Children with SLI: Social Adaptation or Social Deviance?* *Journal of Speech, Language and Hearing Research*, 41(3), 688-700. Copyright 1998 by the American Speech-Language-Hearing Association. Reprinted with permission.

The SDM (Figure 3), on the other hand, posits that limited verbal resources are linked to an underlying psychosocial deficit, suggesting that children with DLD may have a general vulnerability to social and emotional difficulties. However, the role of language ability in this model is unclear; that is, whether language ability is a cause or consequence of the psychosocial impairment proposed in the SDM is not defined. It may be useful to examine the etiology of DLD, in particular whether there are any comorbid conditions that may be linked to common underlying differences. For example, the SDM could explain the results of Cohen and colleagues' studies of psychiatrically-referred adolescents with undiagnosed language difficulties. It may be that these adolescents have impaired psychosocial mechanisms that have disrupted language acquisition, or that children with language difficulties are predisposed to developing mental health difficulties in adolescence as well. There is also evidence of comorbid ADHD in the DLD population (Beitchman et al., 1996). In this case, Redmond and Rice (1998) argue that psychiatric or pharmacological interventions would be recommended to address the psychosocial deficit in the first instance.

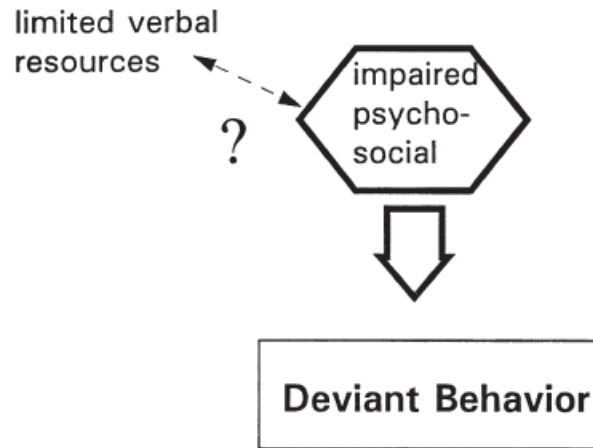


Figure 3. Social Deviance Model.

Note: Taken from p. 690 in Redmond, S. M., & Rice, M. L., (1998), The Socioemotional Behaviors of Children with SLI: Social Adaptation or Social Deviance? *Journal of Speech, Language and Hearing Research*, 41(3), 688-700. Copyright 1998 by the American Speech-Language-Hearing Association. Reprinted with permission.

However, Redmond and Rice (1998) ultimately rejected the SDM, a stance that is consistent with the evidence that there are different trajectories of socioemotional problems over time, with some children and adolescents not experiencing increased rates of socioemotional difficulties compared to their TD peers (Conti-Ramsden et al., 2018b). Redmond and Rice (1998) found that there were significant group differences on withdrawal, internalising, social problems and attention problems, with the DLD group receiving higher ratings on all the scales. There was a significant interaction of group and informant, with teachers reporting higher levels of social problems and internalising behaviours than parents. Only one child with DLD was clinically identified by both parent and teacher at both sampling times on the internalising and attention scales, indicating that socioemotional problems were not consistent over time and context. There were no significant group differences on parent-report of number of friends and how often children played with their friends. These findings led the authors to reject the idea of the Social Deviance Model (SDM), claiming that if there was an underlying impaired psychosocial trait then this would have been apparent through consistent ratings of socioemotional symptoms over time and context (i.e. parent and teacher ratings would be more aligned). Instead, the authors find more support for the SAM because the two groups have the same psychosocial mechanisms but the different behavioural outcomes in the DLD group have manifested as a result of situational social challenges and others' perceptions. That is, they

avoid social interactions which would present a linguistic difficulty. Children with DLD are developing these symptoms as a result of their language difficulties, they are not comorbid.

It should be noted, however, that the rejection of the SDM was based on a very small sample (DLD $n = 17$; TD $n = 20$) that was studied over the course of just one year. It also focused on a critical time period in early development; the transition between kindergarten (Year 1 of primary school) and first grade (Year 2 of primary school). One could argue that there could still be an underlying trait or mechanism responsible for this difference in psychosocial symptoms and also an effect of context with different situations eliciting psychosocial impairments to differing degrees. In addition, in a follow-up study (Redmond & Rice, 2002) the authors found that teachers' ratings converged with parents' ratings, supporting the idea that the SDM may have been rejected too hastily. The authors' decision to accept the SAM may have been influenced by the fact that the model aligns with Rice, Wexler and Cleave's (1995) modular view of DLD in that only language functioning is impaired. However, the SAM can also be viewed within the usage-based framework as exposure, or lack thereof, to different social settings may be contributing to the difference in social skills and behaviours displayed by individuals with DLD.

Proposed Models

This thesis draws on aspects from the above theories when exploring the mediating role of social abilities in the relationship between DLD and increased social and emotional problems. Given how intrinsic language is to social interactions it may be logical to assume that the linguistic difficulties present in children with DLD are responsible for their social difficulties (i.e. Bishop's (1997) second proposed model and one interpretation of the SDM). One way to test this explicitly is to examine whether differences in the severity of language impairment produce differences in socioemotional outcomes. However, previous research suggests that there is not a direct link between severity of language impairment and socioemotional difficulties (Benasich, Curtiss & Tallal, 1993; Hart et al., 2004). Indeed, the fact that some adolescents with DLD do not experience social or emotional difficulties also negates Bishop's (1997) theory of an underlying common deficit and the SDM.

A model of mediation similar to Bishop's (1997) second theory of social experience and the SAM may be more appropriate to describe the relationship between DLD and socioemotional problems. Previous studies have demonstrated that anxiety and depression do not appear to be a direct result of poor communication abilities (Wadman et al., 2011b; Conti-Ramsden & Botting, 2008) and findings of increased rates of withdrawal within the DLD group (e.g. Hart, Fujiki, Brinton, & Hart, 2004; Redmond & Rice, 1998) are consistent with this line of thought. Other factors such as peer relations and attitudes towards school may have an effect on socioemotional difficulties – particularly as depression decreases upon leaving school (e.g. Bao, Brownlie, & Beitchman, 2016; Botting et al., 2016).

Alternatively, in line with the usage based theory and SIP model, the social cognition and emotion regulation processes involved in communicating may be compromised by language difficulties, leading to difficulties learning appropriate social skills. These poor social skills could lead to fewer social interactions, contributing to further deficits in social cognition and emotion regulation and resulting in significant social and emotional problems. Despite the difficulty in determining the causal role of language, this thesis takes the position that language limitations predictive of socioemotional difficulties influence other factors, such as social cognition and emotion regulation difficulties. However, unlike the SDM, the proposed models in this thesis argue that deficits in social cognition or emotion regulation are not an innate difficulty. Instead, they may be exacerbated by language difficulties and fewer opportunities to improve these skills in social settings. In this sense, it may be more appropriate to view the relationship between DLD and socioemotional problems as a combination of both the SAM and SDM frameworks. This more nuanced pathway may explain the discrepancy in findings that language ability is not the strongest predictor of socioemotional problems. As seen in the figures below, social functioning, social cognition and emotion regulation deficits are investigated as predictive factors. The next sections of the literature review will focus on each potential factor in turn, providing evidence of their development in children with and without DLD and how these factors could contribute to the outcomes of social and emotional problems.

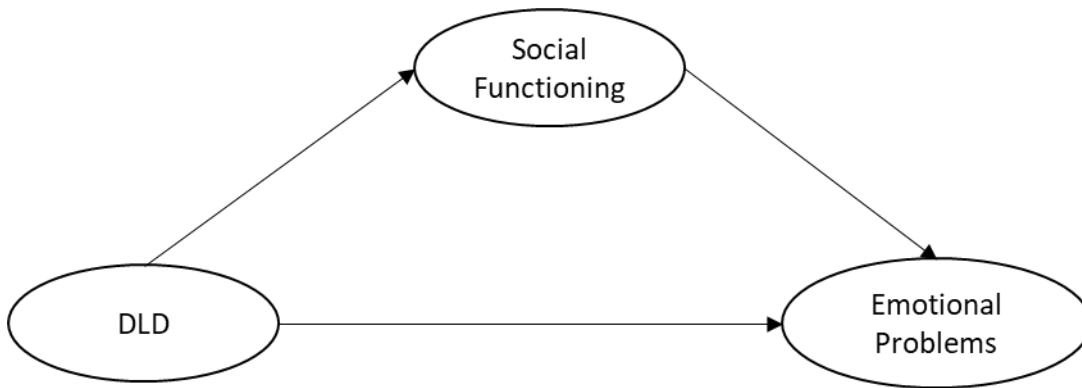


Figure 4a.

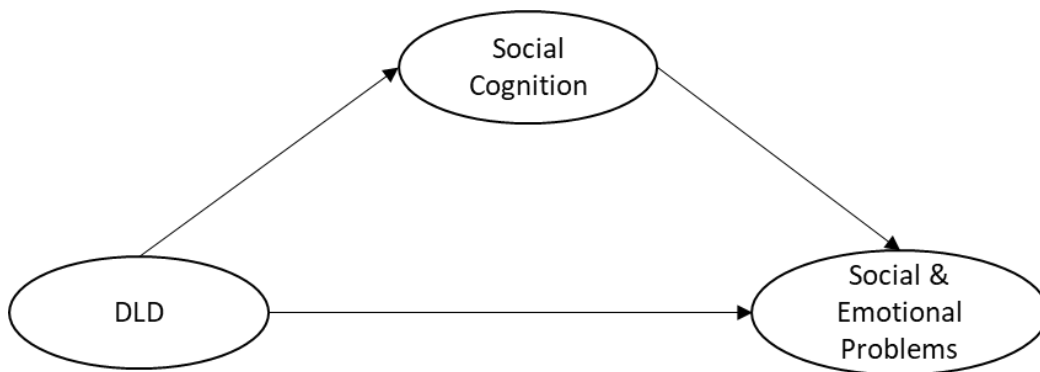


Figure 4b.

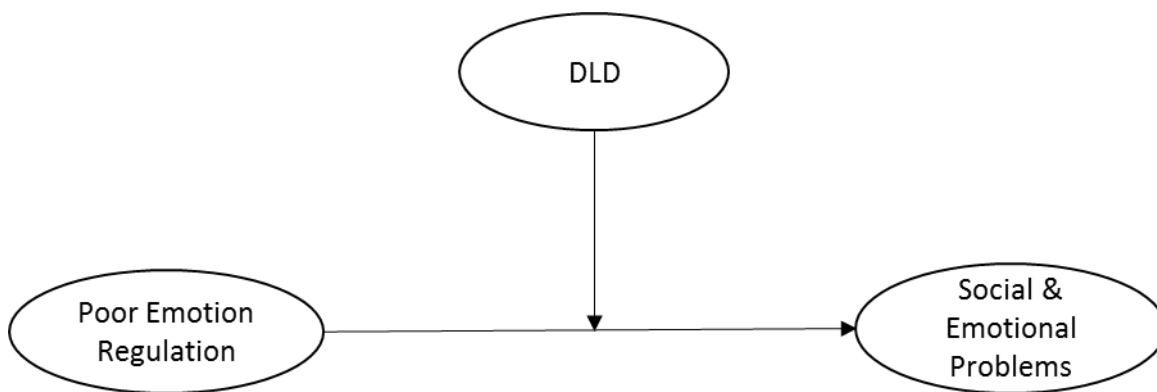


Figure 4c.

Figure 4a-c. Proposed models illustrating the relationship between DLD and increased social and emotional problems. 4a): Proposed model of social functioning difficulties mediating the relationship between DLD and emotional problems; 4b): Proposed model of poor social cognition skills mediating the relationship between DLD and social and emotional problems; 4c): Proposed model of DLD moderating the relationship between poor emotion regulation and social and emotional problems.

Social Functioning as a Mediator

This section examines the relationship between language and social functioning in the typical population and the DLD population. By analysing the relationship first in childhood, and then in adolescence, this section will discuss the compounding effect of poor social functioning across development. In addition, the extent to which language ability has an impact on social outcomes will be analysed, with findings suggesting that there could be other factors such as emotion regulation and social cognition mediating this relationship.

Social Functioning and Language

As previously mentioned, learning language is a social experience that requires engagement with another person (Tomasello, 2009). However, language is also necessary for social interactions so there is a bidirectional link between language and social interactions. As infants progress through childhood, the social skills they have gained from the ‘intersubjectivity’ with their caregivers are tested in a wider audience, including siblings and peers. At first infants imitate their peers but then, with the development of language, comes a period of “complementary play” (Shaffer & Kipp, 2013, p. 569). That is, children are able to use language to have more control over their play and work in partnership with their peers to achieve a common goal. Social interactions are vital for development in general, with both cognitive and social skills, such as problem solving and team-building, improving through play (Cohen, 2001). Children engage in pretend play from a young age and complex pretend play is predictive of social competence (Connolly & Doyle, 1984), highlighting the importance of verbal abilities in the development of adaptive social functioning, in much the same vein as the SAM. Socialising with siblings and peers encourages the social norms of taking turns, sharing and helping others and these prosocial behaviours are in turn linked to better relationships (Berndt, 2002). When difficulties arise, children must use their language to negotiate with others and resolve conflicts. Successful navigation of these challenges will prepare the child for future conflicts and strengthen their relationship with their peers when they are seen as a rational, thoughtful friend (Rubin, Bukowski, & Parker, 1998).

Social Functioning in the DLD Population

Given the inherently social nature of language, both the way in which it is learned and the way it is used to communicate with others, it follows that an impairment in language could

lead to a disconnection from the social world. The externalising or internalising behaviours that manifest in the context of communication difficulties such as DLD may lead to social exclusion, either by peers or by the child themselves. For instance, children may find it easier to communicate their feelings physically rather than verbally, and they may even react aggressively in the heat of the moment when they are frustrated that they are not being understood. This could result in rejection from their peers (Trentacosta & Shaw, 2009). Alternatively, children with DLD may withdraw from social situations to avoid these feelings of frustration or the embarrassment of not being able to communicate effectively. In this sense they are excluding themselves from any social interaction and these early negative experiences could have significant impact as the child develops, resulting in less social interaction in adolescence and poorer social skills compared to their typically developing peers. These different reactions coincide with the SAM viewpoint of children adapting their behaviour depending on the situation. These limited social experiences may contribute more to the variation in the social and emotional problems that adolescents with DLD experience than their language ability.

Withdrawal from social situations.

Poor social functioning in children with DLD starts from an early age, with children as young as two years old being perceived as withdrawn on the Child Behaviour Checklist (CBCL) (Maggio et al., 2014). Maggio et al. (2014) found that these same children were perceived by their teacher to have high levels of anxiety or depression and social problems at age 7. The authors argue that despite the changing nature of the problems, the level of psychosocial difficulties is consistent across the three different age groups suggesting that these behaviours are co-occurring with language impairment and are not a consequence of the disorder, in line with the SDM. A predisposition to poor psychosocial functioning due to language difficulties could result in children with DLD being reluctant to socialise with their peers and they may miss out on learning important social skills. For example, Brinton, Fujiki, Spencer, and Robinson (1997) found that children with DLD were less capable in social situations than younger children matched on language ability, taking longer to initiate conversation with two unknown peers or not integrating at all. The fact that younger, typically developed children were better at integrating with the group supports the argument that poor social skills, and not just lower language abilities, could be responsible for hindering the socialising experience of children with DLD.

A difficulty with initiating conversation may lead to more withdrawn behaviours, resulting in fewer opportunities to learn social skills (e.g., conflict resolution). Children with DLD may be deliberately rejected by their peers when they play alongside them (“solitary-active”) or they may be inadvertently rejected because they seem to prefer playing by themselves (“solitary-passive”) and are reluctant to initiate conversation (“reticence”) (Hart et al., 2004). Hart et al. (2004) found higher ratings of reticence and solitary-passive withdrawal in children with DLD compared to TD children aged 6-9 years and 10-13 years, predicting the social profile of withdrawn behaviour. Children with DLD were rated lower on the two measures of sociability (impulse control/likeability and prosocial behaviour) than TD children. There was no significant relationship between severity of DLD and social profiles. These findings suggest that children with DLD have a significantly different social profile than their TD peers and that it is not solely due to language ability, adding further support to the SAM.

Rejection from peers.

These higher rates of withdrawal may leave children with DLD at a disadvantage from entering social interactions in the future, as they will have less knowledge from previous experiences to draw upon (Crick & Dodge, 1994). Limited knowledge of social skills may lead to inappropriate responses which can result in awkward interactions. This is reflected in relationships with peers as children and adolescents with DLD are rated as less “liked” compared to their classmates. Hart et al. (2004) found that children with DLD were rated by their teachers as lower on likeability and prosocial behaviour than their age-matched peers. Both of these measures predicted sociability. Children with DLD received more ratings of “least liked” from their classmates than those without language difficulties (Andres-Roqueta, Adrian, Clemente, & Villanueva, 2016). Similarly, Gertner, Rice, and Hadley (1994) found that pre-schoolers with typical language received significantly more ‘positive’ ratings than their peers who were non-native English speakers and those who struggled with speech and language. These findings highlight that children prefer classmates who do not have a difficulty with communication, demonstrating the influence of others’ opinions as mentioned in the SAM. Indeed, parents, teachers and young people themselves report significantly higher rates of peer problems in the DLD population compared to their TLD peers and adolescents with DLD have reported significantly higher rates of social stress and social phobia, illustrating that their poor relationships have a substantial impact on their mental health (Voci, Beitchman, Brownlie, & Wilson, 2006;

Wadman et al., 2011). Indeed, there is a wealth of evidence to corroborate the idea that poor rates of social support are linked to increased rates of psychopathology in general (van Harmelen et al., 2017).

Fewer opportunities to learn social skills.

According to the SAM, the adaptive behaviours displayed by children with DLD are a result of the combination of communicative demands of the social situation, verbal difficulties of the child and the biases of others. However, these poor social outcomes may hinder future interactions and learning of social skills in a maladaptive feedback loop. With fewer social interactions, young people with DLD have limited social experiences and fewer opportunities for learning appropriate social skills. In particular, meeting new people and adapting to different viewpoints may prove difficult without the knowledge of appropriate prosocial behaviour or conflict resolution skills.

For example, children with DLD used more nonverbal strategies than their TD peers and displayed passive or withdrawn behaviour when trying to solve a conflict (Marton, Abramoff, & Rosenzweig, 2005). Similarly, Bakopoulou and Dockrell (2016) found that children with DLD were more likely to involve an adult in a hypothetical conflict resolution task, while their chronologically age-matched and language age-matched peers were more likely to ask for clarification of the situation, drawing on their language skills. The DLD group were also more likely to resort to physical aggression than their peers.

Supporting this argument, there is evidence to suggest that exposure to social situations may improve social skills of children with DLD. For example, Farmer (2000) compared the social functioning of two groups of children with DLD. One group attended a special school (SS) while the other group attended Language Units (LU) attached to mainstream schools. Their performance on the tasks was compared to that of chronologically age-matched (CA) and language aged-match (LA) controls. There were significant differences between the TD children and the SS group for ratings of social cognition and social competence, as measured by false belief tasks, strange stories and teacher ratings of SDQ. Individuals in the LU group, however, displayed no differences in social cognition or social competence performance with either control group. The author argues that the LU group had the added benefit of social interactions with TD children in

their mainstream school and this exposure to typical social development improved their social cognition abilities. This finding is in line with one of the principles of SAM that socioemotional problems can be improved with more awareness and understanding. It could be argued that the SS group had worse language and therefore poorer social skills to begin with, but assessments of language development and phonological STM were not related to social cognition and social competence.

Others have claimed that benefits from 1:1 speech and language therapy could extend further than language skills, in the form of social skills and emotional support (Wadman et al., 2011). These findings support suggestions for social skills interventions delivered in conjunction with speech and language therapy and correspond to the recommendations made by Redmond and Rice (1998) in accordance with the SAM.

However, adolescents who do not qualify for speech and language services may miss out on these opportunities for support. As a young person with DLD moves through childhood and into adolescence, the lack of quality interactions with peers may have a compound effect on their social functioning abilities. There is a different structure to interacting with people of a similar age, in informal settings, compared to speaking with adults. There are complex rules and norms that are associated with a peer group and understanding these will aid in socialising. This is where adolescents can further develop their ability to read social cues and gain more skills in higher order language, such as sarcasm. Indeed, Lamblin, Murawski, Whittle, and Fornito (2017) describe the bidirectional relationship between social network size and adolescent brain structure and function. The adolescent brain is still developing, particularly social cognition abilities, and this can be strengthened by exposure to different social situations.

Durkin and Conti-Ramsden (2007) also addressed the changing nature of social functioning in children and adolescents with DLD by using social behaviours and language abilities from age 7 to predict the quality of friendships at age 16. The Social-Emotional Functioning Interview (SEF-I) demonstrated that participants with DLD were more likely to exhibit poorer quality friendships than their TD peers and early language skills predicted friendship quality after controlling for nonverbal IQ, total SDQ difficulties and prosocial behaviour. However, the pathway underlying this relationship is unclear. Language difficulties could have affected the communication skills of participants, hindering their ability to make and keep friends. Or there could be other contributing factors such as the

stigma surrounding having a learning disability discouraging individuals to socialise. Alternatively, the individuals with DLD may have lacked the necessary social cognitive skills to interact with their peers. The authors support the latter idea and posit that poor receptive skills are linked to poor Theory of Mind (ToM) – a difficulty in inferring other people’s points of view and understanding they have different mental states - resulting in poor social skills. However, Durkin and Conti-Ramsden (2007) did not carry out any social cognition tasks to investigate this claim, and they used only one predictor variable to measure one outcome, which does not encompass the developmental pathways involved in this relationship (Yew & O’Kearney, 2015).

The changing nature of socioemotional problems throughout development is investigated more thoroughly by a longitudinal study of children with DLD which found that pragmatic language abilities at age 7 predicted behavioural, emotional and social difficulties at age 16 (St Clair et al., 2011). Behavioural and emotional problems appeared to decrease over time (with emotional problems remaining elevated in adolescence), while social difficulties increased, reflecting the importance of peer relations in adolescence. These findings are further emphasised by a study that discovered four different developmental trajectories when investigating peer relations in a sample of young people with DLD from 7-16 years of age (Mok et al., 2014). The largest developmental trajectory group was for childhood onset and persistent problems and adolescent onset problems. These results demonstrate that the problems that develop in childhood do not necessarily disappear when language ability improves. In fact, the early language difficulties experienced by children with DLD may have hindered the development of social skills, leading to fewer social interactions. Even with improved language skills, these difficulties with social functioning may be hard to overcome, and may remain ingrained in the individual’s disposition, with a continued influence on emotional well-being.

The differences in socioemotional symptoms across time also reflect the changing nature of children’s social development, moving away from play-based activities and into socialisation that relies more heavily on communication and language to build relationships. This reinforces the idea that adolescence is a critical time period to study socioemotional functioning in young people with DLD; a time when individuals strive to become more independent from their parents and forge their own sense of “self”. The influence of peers is very strong when forming identity, therefore difficulties with social functioning could have a significant impact on the individual’s self-concept. This, in turn,

could hinder their willingness to seek out social interaction. Additionally, the instability of socioemotional difficulties reflects the influence of external factors as outlined in the SAM.

Self-esteem and shyness.

Wadman, Durkin, and Conti-Ramsden (2008) aimed to apply Redmond and Rice's (1998) Social Adaptation Model to adolescents and investigated whether DLD predicts outcomes of self-esteem, shyness and low sociability. Controls were matched on age, gender, maternal education and household income. There was a moderate group effect on levels of self-esteem with the DLD group demonstrating lower self-esteem than their peers, while there was a large group effect of shyness (Cohen's $d = .90$). Sixty-two percent of adolescents with DLD rated themselves as shy compared to 20% of the TD group. Self-esteem significantly correlated with shyness, expressive language and receptive language. However, when self-esteem was modelled as an outcome of language, it was found that the direct effect of language was non-significant when shyness was controlled for, suggesting that shyness was acting as a mediator between language ability and global self-esteem. The authors argue that this finding supports an adaptive framework because adolescents may have adapted to their communication difficulty by restricting their social interactions and becoming more withdrawn and shy (Redmond & Rice, 1998).

However, the use of a global measure of self-esteem (Rosenberg Self-Esteem Scale) may not be sensitive enough to measure different factors that affect self-esteem, such as academic proficiency and social functioning (Marton et al., 2005). In addition, the Sociability Scale is lacking in psychometric data and only measures how much participants like being with people/prefer not to be alone but does not measure whether they actually succeed at this (i.e., have friends and have adequate social functioning). A better measure would be the prosocial and peer problems scales on the SDQ or a semi-structured interview to ask questions about friendship quality and frequency of socialising. This may explain why there are no significant group differences on the Sociability scale.

In addition, without longitudinal data the developmental pathways are unknown. It could be argued that, in line with the SDM, young people with DLD are shy to begin with, and therefore less likely to engage in social interactions, which could lead to fewer friendships and lower self-esteem. Analysis from a population cohort suggests that children

at risk for DLD have withdrawal tendencies at 9 months of age (St Clair, Forrest, Yew, & Gibson, in press). Additionally, findings from the clinical cohort of the MLS demonstrate that shyness in late adolescence mediates social self-esteem in early adulthood (Durkin, Toseeb, Botting, Pickles, & Conti-Ramsden, 2017). A higher level of shyness in adolescents with DLD could be preventing them from interacting with others (Wadman, Botting, Durkin, & Conti-Ramsden, 2011a) and adolescents with DLD have reported finding social engagement to be a more stressful experience than their TD peers (Wadman, Durkin, & Conti-Ramsden, 2011).

Conclusion

The finding that some children with DLD have social difficulties while others do not (Fujiki, Brinton, Hart, & Fitzgerald, 1999; Mok et al., 2014) offers more support for the SAM, suggesting that children adjust their behaviour accordingly and this relationship is not a direct result of poor language. Furthermore, there have been studies into the strength of this relationship which show that the severity of language impairment is not significantly related to the severity of socioemotional problems (Fujiki et al., 2002), providing additional arguments against the underlying psychosocial deficit concept of the SDM. However, the SAM can be quite narrow in its view of the linguistic and social deficits faced by children with DLD, with little mention of the emotional problems that are also seen in this population. For this reason, the SAM could be expanded upon with a third factor potentially involved between language difficulties and socioemotional problems. Recent studies have explored the idea of social cognition as a mediator between language difficulties and socioemotional problems (Bakopoulou & Dockrell, 2016; Botting & Conti-Ramsden, 2008; Farmer, 2000) and the next section will discuss these in more detail.

Social Cognition as a Mediator

This section will argue that weaker social cognition skills may be driving the poorer social functioning of children and adolescents with DLD and mediating the relationship between DLD and socioemotional outcomes. Socialising with others relies on a nuanced understanding of others and the social world that strong social cognition abilities can facilitate.

Social Cognition Definition

Social cognition is an “umbrella term” that refers to an individual’s understanding of social interactions. Social cognition draws on skills known as Theory of Mind (ToM) or “mentalizing”, which are the ability to understand others’ thoughts, feelings and motives (Frith & Frith, 2003). These skills are necessary when communicating with others in order to react appropriately in different situations, with ToM ability positively correlated to peer ratings of likeability (Slaughter, Imuta, Peterson, & Henry, 2015). Social cognition is typically measured by tasks which test ToM abilities; specifically, false belief (FB) tasks, where participants have to demonstrate their understanding of another’s understanding or belief that is in conflict with reality. These tasks are passed by typically developing children at three or four years of age, demonstrating that they have ToM skills. However, social cognitive abilities also encompass joint attention, imitation and emotion recognition (Vissers & Koolen, 2016); therefore, there are many different tasks which can measure the different abilities that fall under the umbrella of social cognition.

Tager-Flusberg and Sullivan (2000) argue that there are two components of ToM; the social-perceptual component, which conveys an innate preference for human stimuli and the social-cognitive component, which demonstrates an ability to draw inferences about mental phenomena by integrating different kinds of information. The social-cognitive component may be of more interest when studying the DLD population, given the language skills required to “mentalize”.

Social Cognition and Language

The relationship between language and social cognition is very complex. According to the usage-based theory of language acquisition, children need social cognition skills, such as gaze following and joint attention, to be able to learn language from their caregivers (Tomasello, 2009). Preferential looking studies with infants show children’s understanding of others’ perspectives and intentions before the development of expressive language (e.g. Perner & Ruffman, 2005). At the same time, however, language skills contribute to a more sophisticated representation of ToM. Vissers and Koolen (2016) discuss three possible causal models. It could be that ToM predicts language; language predicts ToM; or a third factor, such as working memory, predicts both language and ToM (in line with Bishop’s (1997) general processing model). Longitudinal studies have provided strong evidence for

the causal model of language influencing ToM. For example, Astington and Jenkins (1999) demonstrated early language ability predicted later social cognitive development but reciprocal relationships were not found.

Taking this causal relationship further, there are three models that describe how social cognition and language are related in more detail (Nilsson & Jensen de Lopez, 2016). Firstly, the lexical-semantic perspective argues that children need to know the meaning of words like “want”, “belief” and “think” in order to be able to ‘mentalize’. For instance, children who displayed higher receptive and expressive abilities when tested on “think”, “know” and “guess” were more likely to pass the FB task than children who had poorer understanding of these terms (Ziatas, Durkin, & Pratt, 1998). The second model is linguistic determinism theory which posits that children need to be able to understand tensed complement clauses (e.g. “Sophie thinks that the ball is under the bed”) to realise that something is a belief and not necessarily a fact. False beliefs are exemplified by the structure of these sentential complements which consist of a main clause (‘Sophie thinks...’) and an embedded complement (‘...[that] the ball is under the bed’) (Milligan, Astington, & Dack, 2007). Even if the ball is not under the bed the statement is true, representing a (false) belief, and children need to have sufficient syntactical skills to be able to understand these statements correctly. Both of these models are in line with the domain-specific theory of DLD, whereas the third model draws on the usage-based theory of language acquisition. The third model claims that language is related to social cognition in the way that communication with others exposes children to many different points of view, thereby gaining an understanding of others’ thoughts and feelings from practical experience.

The relationship between language and social cognition could be a combination of all three models, as studies show that children’s ToM abilities are influenced by parent use of mental state terms. For instance, Ruffman, Slade, and Crowe (2002) found parents’ language to be causally related to children’s social cognitive abilities in a longitudinal study. Mothers described photographs to their children and the number of mental state words used correlated positively with the child’s performance on ToM tasks. This finding held true over three time points and when other factors such as child’s language ability, social understanding and mother’s education were taken into account (Ruffman et al., 2002). Having an older sibling is also positively correlated with the ability to pass theory of mind tasks, reinforcing the idea that more experience of social interactions provides

children with more exposure to key factors for social understanding, such as mentalizing words and different points of view (Lewis & Carpendale, 2006). Indeed, de Villiers and de Villiers (2002) found that deaf children of hearing parents are delayed in false belief tasks because they have not been exposed to mentalizing in the same way as children who share a common language with their parents. That is, the combination of being exposed to mental state terms in different contextual factors and having parents explain the meaning behind the words adds more to the child's understanding. Therefore, it is logical to assume that children with receptive language difficulties, such as those with DLD, may be impaired in the same way. The effect of simple exposure to mentalizing words is not enough as there was no improvement to typically developing children's performance on ToM tasks when cognitive terms were added to children's stories without reinforcement from parents (Peskin & Astington, 2004), highlighting the key role of effective communication in strengthening social cognition abilities and reinforcing the strength of the usage-based theory of language.

Despite the differing models presented to explain the causal relationship, it is clear that language and social cognition are inherently related. A difficulty with language, such as DLD, may therefore correlate negatively with ToM performance. Whether this is a direct result of language difficulties or a comorbid impairment remains to be seen. For instance, Farrar et al. (2009) found grammatical ability was the strongest predictor of performance on ToM tasks in children with DLD. Some studies have adapted the ToM tasks to lessen the linguistic load involved, in order to ascertain whether the lower performance of children with DLD on ToM tasks is a social cognition deficit or due to the confounding language demands of the task. However, Miller (2001, 2004) and van Buijsen, Hendriks, Ketelaars, and Verhoeven (2011) found no group differences when the language demands of the tasks were reduced, suggesting that poor performance on typical ToM tasks may be reflective of language demands and not social cognition abilities, consistent with the modular view of DLD. Furthermore, other studies have found that children with DLD perform similarly to language-age-matched children on ToM tasks, suggesting that social cognition difficulties are a delay, not a deficit (Nilsson & Jensen de Lopez, 2016). Another meta-analysis of ToM abilities in young children with DLD agrees that they have a similar developmental trajectory of these skills to TD children, but at a slower pace (Vissers & Koolen, 2016). These findings add further support to the rejection of the underlying psychosocial deficit portrayed in the SDM. Very few studies have been

carried out on adolescents with DLD but it is important to assess the relationship throughout development as there is evidence to suggest that social cognition is still developing in adolescence (Blakemore & Choudhury, 2006) and the correlation between language and ToM becomes stronger as ToM abilities become more advanced (Nilsson & Jensen de Lopez, 2016).

Social Cognition and Social Outcomes

The Social Information Processing (SIP) Model (Crick & Dodge, 1994) highlights the value of having knowledge of others' thoughts and feelings when engaging in conversation. After encoding information, the listener needs to interpret what the speaker has said. Without a framework from which to reference, applying meaning to the encoded information will be difficult, particularly in syntactically and semantically ambiguous contexts. This will make it harder to respond appropriately if the information has been interpreted incorrectly. In addition, the SIP model argues that choosing an appropriate response is dependent on accessing examples of previous social interactions from the long-term memory. Therefore, if an individual with DLD has limited social situations from which to choose from, there is a higher likelihood of selecting an inappropriate response. With impaired social cognitive abilities, the individual may not pick up on the feedback from the speaker and the cycle of inappropriate responses will continue.

By comparing children with DLD from different educational settings Farmer (2000) aimed to investigate the possible contributions of social experience to social cognition and social functioning, addressing the models proposed by Bishop (1997) and Redmond and Rice (1998). As mentioned in the previous section, children with DLD were recruited from language units attached to mainstream schools (LU; n = 8) and from a special school (SS; n = 8) and were compared to chronologically-age matched (CA; n = 8) and language-age matched (LA; n = 8) peers. There were significant differences between the SS group and both groups of TD children on second-order ToM tasks and social functioning, whereas the children from integrated schools (LU) did not differ significantly from either group. Assessments of language development and phonological STM were not related to social cognition and social competence in the DLD groups.

These deficits in social cognition can lead to impaired social skills, resulting in significant negative outcomes in children's social functioning. For example, Ford and Milosky (2003) showed that children with DLD were able to identify emotions in a similar

way to their TD peers but they had difficulty applying this information in order to conclude how characters felt in hypothetical social situations. As previously mentioned, the ability to predict others' feelings (the skill of "mentalizing") is an aspect of successful social interaction. By anticipating what the partner in a social interaction is feeling and how they may react, interlocutors can avoid faux pas by responding appropriately. However, if children have difficulty picking up on the emotions of their conversational partner they may misinterpret social situations, leading to negative social experiences. Further examples of poor social skills can be seen in Bakopoulou and Dockrell's (2016) study examining the relationship between social cognition and socioemotional problems in children with DLD. Four aspects of social cognition were measured including emotion identification and labelling, inferring the cause of emotions in social situations and the use of conflict resolution strategies. The DLD group performed worse than their age- and language-matched peers on all measures of social cognition. Notably, the DLD group were more likely to involve an adult in the conflict resolution scenario, whereas the other groups would draw on their language skills to clarify the situation with their peers. However, the group matched on language ability performed better than the DLD group, suggesting that these social difficulties are not simply due to lower language skills. Furthermore, social cognition and prosocial behaviour, but not language ability, predicted 44% of the teacher-rated socioemotional difficulties for the DLD group. Therefore, in contrast to the SAM that posits language and social demands lead to social problems, these findings provide evidence to suggest that poor social cognition could be involved as well.

One of the only studies to use a sample of adolescents with DLD when examining the effect of social cognition on social outcomes was Botting and Conti-Ramsden (2008). They found that adolescents with DLD performed worse on the Eyes Task and Strange Stories task than the TD group, even after language ability and nonverbal IQ were taken into account. The DLD group reported more peer problems and lower levels of prosocial ability compared to the TD group and also experienced poorer quality of friendships and fewer social activities compared to the TD group. Language ability and social cognition skills had more of an effect on functional social outcomes for adolescents with DLD than their TD peers, highlighting the different pathways that are involved in social functioning outcomes in adolescents with and without DLD. However, social skills (peer problems and prosocial ability) were the strongest predictors of social functioning in both groups. The

authors argue that language and social cognition develop concurrently in children with DLD, resulting in difficulties with self-reported social outcomes.

These social cognition difficulties have also been found to have an influence on peer perceptions of children with DLD (Andres-Roqueta et al., 2016). Performances on the Smarties Task, Sally-Anne Task and Strange Stories task were combined to form a total social cognition score. The authors justified the use of these tasks because they employ pictures or physical objects and are therefore not entirely dependent on language, enabling them to determine whether social cognition deficits are independent of language skills in children with DLD. Thirty-five children with DLD aged 3-8 years old were compared to their age-matched peers. Peer relations were measured by asking the children to name the three people in the classroom they liked most (LM) and the three classmates they liked least (LL). Children with DLD received significantly more LL nominations and were significantly poorer at social cognition tasks compared to their TD classmates. Both groups' social cognitive skills significantly and positively correlated with age and language. However, when the effect of language was controlled for in a regression model the DLD group still had more difficulty with social cognition tasks, explaining 11% of the variance. This study illustrates the real-world negative impact that social cognition difficulties have on children with DLD. Poor relations with classmates could hinder future learning of social skills, as well as negatively influence the child's self-esteem and academic performance. The authors suggest that improving language skills alone will not necessarily improve peer relations – individuals with DLD need to work on their social cognitive skills too. However, language ability could still be contributing to this, as children with DLD are likely to have fewer social interactions with their peers, creating fewer opportunities for their classmates to get to know them.

It is important to note that social outcomes can be broadly defined and the influence of social cognition may vary. For example, Jester and Johnson (2016) examined the effect of ToM skills on pretend play in children aged 4-6 years with and without DLD. The DLD group performed poorly on ToM tasks but there was no group difference in pretend play ability. There was a positive association between ToM and pretend play in the TD group but no significant relationship in the DLD group. Alternatively, children may avoid social situations due to their uncertainty in how to act, as outlined by the SAM. However, there are few studies investigating the link between ToM ability and withdrawal in children with DLD.

Social Cognition and Emotional Outcomes

Marton et al. (2005) investigated social pragmatics, social self-esteem, and language in children with a clinical diagnosis of DLD and age-matched peers (N = 38, 7–10 years old). The individuals with DLD struggled with social pragmatic skills during the hypothetical social scenarios compared to TD children. For example, they displayed inappropriate behaviour such as aggression or withdrawal, and found it difficult to navigate social situations using speech. They showed low social self-esteem but there were no significant difficulties between the two groups' academic self-esteem, highlighting the impact that DLD has on young people's lives outside the classroom.

Bakopoulou and Dockrell (2016) measured the social cognition skills of 126 children with DLD (6-11 years old), chronological age-matched (CA) and language age-matched (LA) controls aged 5-7:8 years old. They compared the results from social cognition tasks with teacher ratings of the SDQ with the aim to uncover the relationship between DLD and socioemotional problems. The large age range allowed for investigation of developmental pathways across the whole of early education and into the start of adolescence, an area which the authors state lacks research. The study focused on the identification and labelling of emotions, inferring causes of emotions and conflict resolution strategies, arguing that this provides a better real-world example than false-belief tasks. As social cognition is an umbrella term, the false-belief tasks that are typically used do not cover all the different aspects involved in social understanding, such as assessing someone's emotions and responding appropriately to difficult situations like conflicts. The investigation into conflict resolution is important because it has been established that children with DLD have problems regulating their emotions (Fujiki et al., 2002) and are at risk for bullying (Knox & Conti-Ramsden, 2007). Bakopoulou and Dockrell (2016) found significant group differences in social cognitive performance, with the DLD group performing worse than the CA and LA groups on all three measures of social cognition. For instance, children with DLD were more likely to involve an adult in the conflict resolution task, while the CA and LA groups were more likely to ask for clarification of the situation from their peers, drawing on their language skills. The DLD group were also more likely to resort to physical aggression than the other two groups. This supports the idea that children with DLD are more likely to display externalising behaviours compared to their TD peers (Lindsay & Dockrell, 2012). Children with DLD had higher teacher SDQ ratings of socioemotional difficulties than the CA and LA groups,

and lower teacher-ratings on the prosocial scale. Furthermore, social cognition and prosocial behaviour were found to be significant predictors of SDQ difficulties for DLD group, accounting for 44% of the variance. For the LA group, social cognition was the most significant predictor. This finding supports the argument as posited by the SDM that these difficulties in socioemotional functioning are a deficit, not a delay, in children with DLD because even though the LA group had a similar profile according to the regression analysis, they did not resort to aggressive behaviours as much as the children with DLD did in the hypothetical conflict resolution situation.

The authors claim that the strong correlations between the different social cognition tasks illustrate that they are tapping similar social cognitive skills. However, a major limitation of this study is that all the experimental measures involved language. The authors justify this weakness by stating that there was no significant difference between older and younger children with DLD and language ability was not found to be a significant predictor of SDQ difficulties.

Conclusion

There is strong evidence to indicate that children and young people with DLD have poorer social cognition skills than their TD peers (Nilsson & Jensen de Lopez, 2016; Vissers & Koolen, 2016). As Botting and Conti-Ramsden (2008) note, social cognition is an umbrella term; therefore, the varying interpretations used, along with the different tasks, will determine the differing findings in the research. Additionally, social outcomes can be defined in terms of pretend play, peer ratings, prosocial ability or social functioning. Furthermore, the majority of research on the relationship between DLD and social cognition is conducted on children so further research involving adolescents is warranted. However, there could be other factors involved, particularly as emotional understanding is linked to ToM ability (O'Brien et al., 2011). The next section will examine emotion regulation as another potential factor contributing to poor social and emotional outcomes in adolescents with DLD.

Emotion Regulation as a Contributing Factor

While there is compelling evidence that social cognition abilities are poorer in children and young people with DLD, and these deficits may mediate the relationship between DLD and social and emotional problems, they still do not explain the whole picture. Due to the close

relationship between language, social functioning and emotions this thesis proposes that emotion regulation may be an alternative factor driving these poor social and emotional outcomes. There is limited research on emotion regulation in the DLD population; therefore, most of the research discussed in this section will refer to the general population.

Emotion Regulation Definition

Emotion regulation is the ability to monitor, evaluate and modify emotions that arise in different situations (Thompson, 1994). Gross (1998, 2002) has classified emotions as “response tendencies” which can be adapted, or regulated, in order to achieve specific goals. Emotion regulation is the ability to control which emotions are expressed in a certain situation, how they are expressed and to what degree they are expressed (Gross, 1998, 2002). Both positive and negative emotions can be regulated “upwards” or “downwards” depending on the goal in question. According to Gross’s (1998) process model there are five stages: selection of situation; modification of situation; deployment of attention; change of cognitions; modulation of responses. Two of the most commonly researched regulation strategies are reappraisal and suppression. Reappraisal involves reframing the situation in a more positive light during the “change of cognitions” stage. For example, upon receiving a poor grade for an exam an individual can choose to reframe the situation in order to not feel disheartened, focusing instead on the fact that they worked hard and have another chance to resit it later. On the other hand, suppression consists of dampening the emotion expressed during the “modulation of responses” stage. For example, if an individual received a disappointing present but their goal is to make the giver feel better, they can suppress their emotions and say “thank you” with a smile.

Emotion Regulation and Language

While emotion regulation has not been widely studied in the DLD population, the link between emotion regulation and language in the general population is strong. Emotion regulation is one of the earliest skills and can be seen in infancy when babies suck more to self-soothe or avert their gaze to avoid distressing stimuli (Holodynski & Friedlmeier, 2010). In this pre-verbal stage children rely on parent support to develop the regulation of their emotions, known as “interpersonal regulation”. From birth, parents label their children’s cries as they respond to them, giving meaning to the feelings they are expressing and helping children to conceptualise their feelings as emotions (Holodynski &

Friedlmeier, 2010). Receptive language skills allow children to understand emotion labels and coping mechanisms modelled by parents, while expressive language abilities provide children with the ability to communicate the emotions they feel (e.g. Barrett, Lindquist, & Gendron, 2007; Lindquist, MacCormack, & Shablack, 2015). Children enter the “intrapersonal regulation” stage when they become more self-sufficient in regulating their emotions, such as walking away from situations that may make them angry, and they also begin using language in the form of “inner-speech” to control their emotions (Holodynski & Friedlmeier, 2010).

Identifying and labelling emotions helps children to map emotional input onto existing schemata to aid in the understanding and processing of emotions (Cicchetti, Ackerman, & Izard, 1995). In accordance with the usage-based theory of language, children can then use prior experience to guide them in the appropriate response. Barrett et al. (2007) describe the need for “emotional granularity”, the ability to accurately distinguish between specific emotions and identify appropriate responses, in order to advance through the process model of emotion regulation. Having a strong vocabulary that allows for such specificity is an advantage for choosing which response to make and the link between language and emotion regulation has been demonstrated consistently in empirical studies of typically developing children. For example, vocabulary at 24 months predicts self-regulation at 36 months (Vallotton & Ayoub, 2011). Additionally, the frequency of mother-child speech involving feelings at 36 months of age positively correlates with the ability to recognise strangers’ emotions in a listening task at 6 years of age (Dunn, Brown, & Beardsall, 1991) and identifying emotions is a key skill involved in emotion regulation (Fujiki et al., 2002). As previously stated, reappraisal is an effective form of emotion regulation that involves the use of “self-talk” to reframe the situation into something more manageable, and therefore relies heavily on language (e.g. Aldao, Nolen-Hoeksema, & Schweizer, 2010; Gross, 2002; Gross & John, 2003). For example, participants experienced lower negative affect when they were instructed to picture an unpleasant scene further away or during a different time period using lexical cues such as “near/far”, etc., demonstrating the significant influence of language on emotion regulation (Nook, Schleider, & Somerville, 2017).

Given the significance of language development to increasing competence in regulating emotions, children with DLD could exhibit different developmental trajectories. Children with impaired language may be poorer at regulating their emotions because they

find it difficult to understand regulation strategies modelled by their parents (Eisenberg, Sadovsky, & Spinrad, 2005). In turn, they may struggle to express their emotions and could display more frustration. For example, recent evidence from the Millennium Cohort Study shows that poor expressive language at age 3 is linked to increased conduct problems at age 5 (Girard, Pingault, Doyle, Falissard, & Tremblay, 2016). Accordingly, children who are skilled at self-regulation may encourage more interaction from their caregivers and more modelling of appropriate behaviours to manage emotions (Fujiki et al., 2002). Furthermore, strategies to regulate emotions may include reframing thoughts, seeking help from others or conflict resolution (Silk, Steinberg, & Morris, 2003), all of which involve language skills and therefore may not be as accessible to children and young people with DLD. Indeed, private speech is reportedly delayed in children with DLD (Lidstone, Meins, & Fernyhough, 2012) and children with DLD score significantly worse than their typically developing peers on measures of emotion regulation (Fujiki et al., 2002; Fujiki, Spackman, Brinton, & Hall, 2004). For example, Fujiki et al. (2002) issued the Emotional Regulation Checklist (ERC) to teachers for children with DLD and TD matched controls. They found a significant main effect of group, with TD children rated higher than those with DLD, with the effect of group accounting for almost 70% of the variance. Recent findings from the Millennium Cohort Study (MCS) also demonstrate that emotion regulation at age 3 is significantly higher in a group considered at risk of DLD compared to their TD peers (St Clair et al., in press). Taken together, the evidence suggests that emotion regulation may be a significant difficulty for children with DLD and may have consequences for their socioemotional functioning.

Emotion Regulation and Social Outcomes

Emotion regulation can be considered to be social in a number of ways. Firstly, as discussed in the previous section, emotion regulation is social in the sense that infants and children rely on their caregiver to label their vocal and behavioural expressions as emotions; the interpersonal stage requires communication between parent and child. Secondly, emotion regulation is social in the way that individuals need to regulate their emotion in order to pay attention to their conversational partner during social situations. Additionally, poor emotion regulation can have a negative effect on social outcomes.

According to the usage-based theory of language acquisition, communication with caregivers and peers influences the development of emotion regulation strategies, and in

turn, these strategies influence social functioning. For example, longitudinal studies of typically developing children have demonstrated the moderating effect of emotion regulation on increased popularity and social competence (Spinrad et al., 2006). With more exposure to different social situations and viewpoints, children learn new ways to regulate their emotions and gain a wider source of experiences to draw upon when progressing through the process model (Gross, 1998). Children with DLD have difficulties with social functioning (Lindsay & Dockrell, 2012) and therefore may not have the same level of exposure to social situations in order to improve their emotion regulation skills.

During a social interaction each participant in the conversation needs to be able to understand the other's emotions as well as their own, in order for a successful interaction (Eisenberg, Sadovsky & Spinrad, 2005). Keeping their own emotions in check allows the participant to attend to the speaker and gauge their emotions. Reappraisal is considered to be an adaptive strategy, and has been linked to better interpersonal functioning than suppression (Gross & John, 2003). This could be due to the process of reframing the situation putting an individual in a more optimistic mood, leading to more positive behaviours and a more positive social encounter. Additionally, one consequence of suppression is that those who suppress are less likely to share their feelings with others (Gross, 2002). Sharing emotions with others is a key component of social competence (Denham et al., 2003). As children with DLD have difficulty with expressive language they may be more likely to display suppression strategies. Therefore, poor emotion regulation may explain the higher rate of peer problems in the DLD population. Peers may reject overly emotional children, or children with poor emotion regulation skills may withdraw themselves from social interactions as a maladaptive strategy to reduce feeling overwhelmed by the cognitive demands of the conversation, in a similar way to the social avoidance described in the SAM. For instance, Kobak and Cole (1994) described this withdrawal from social situations as "deactivating attachment strategy". Therefore, poor emotion regulation abilities could add another level of explanation to the SAM and provide a deeper understanding of the higher rates of withdrawal behaviours seen in children and adolescents with DLD (e.g. Maggio et al., 2014).

Alternatively, those who are unable to excite or arouse emotion to an appropriate level for the conversation (i.e. not emoting enough) may be seen as more shy and may be "left behind" by their peers. Children with DLD are often hesitant to initiate conversation and end up on the outskirts of social interactions even though they have a desire to engage

with others (Brinton, Fujiki, Spencer, & Robinson, 1997; Hart et al., 2004). Fujiki et al. (2004) examined emotion regulation and reticence in children with and without DLD and found that poor emotion regulation and language ability accounted for 43% of variance in reticence scores of the overall sample. However, this effect was not found when the sample was analysed by group.

Children with DLD's understanding of emotion suppression in relation to social outcomes appears to vary depending on the nature of the task. Brinton et al. (2007; 2015) found that children with DLD performed significantly worse than their TD peers when asked about a hypothetical scenario where a character had to control the expression of their emotions in order to save face or not hurt another's feelings. In a second task, the children with DLD were similar in their ability to hide, or 'dissemble', their own emotions so as not to cause offence to the experimenter in three different scenarios. This may reflect findings of similar prosocial behaviour between groups (Toseeb et al., 2017). However, upon receiving an undesirable prize, children with DLD were more likely to vocalise their disappointment, although not significantly more than the TD group. Still, these findings point to a difference in approach and, given the potential negative consequences to social standing, warrant further investigation.

Emotion Regulation and Emotional Outcomes

As well as poor social functioning, a difficulty regulating emotions is linked to negative emotional outcomes, particularly internalising problems (Aldao et al., 2010). For example, anxiety can be viewed as over-regulation with a need to control every possible scenario to ease excessive worrying, while depression or withdrawal may be regarded as under-regulation, with negative thoughts consuming individuals (Gross, 1998). Rumination, in particular, has been linked to internalising problems (Aldao et al., 2010). This maladaptive strategy involves thinking about the situation intensely, but not necessarily providing solutions which may help to ease emotional discomfort. Indeed, another maladaptive strategy of suppression may in fact increase physiological responses due to the effort applied to dampen the expression of emotions which have already been formed (Gross & John, 2003). Conversely, reappraisal has been positively associated with well-being by reframing the situation in non-emotional terms, decreasing the emotional experience and leading to more positive affect (Gross & John, 2003).

Longitudinal studies in the general population have demonstrated the link between emotion regulation and psychopathological outcomes in adolescents. For example, McLaughlin et al. (2011) found that a latent emotion regulation factor predicted increases in anxiety, aggression and eating disorders, but not depression, in adolescents ($n = 1065$) across a period of seven months. There were no reciprocal relationships and the same effect was not found with emotion understanding. Another study on the emotion regulation abilities of adolescents ($n = 152$) examined their emotional experiences and subsequent regulation strategies across one week, reported at random points throughout the day (Silk et al., 2003). Those with more emotional variability and higher rates of intensity were found to report more depressive symptoms and problem behaviour. Denial and rumination were reported as the least effective measures, positively correlated with higher levels of depressive symptoms (Silk et al., 2003). Although only covering short time periods, these longitudinal studies both provide support for the idea that emotion regulation contributes to negative emotional outcomes in adolescents. Cisler et al. (2010) agree, stating that it is the ability to regulate emotions and not the intensity or variance in emotions that explains anxiety. These studies illustrate the causal direction of the relationship between emotion regulation and psychopathology and suggest that an underlying factor of emotion regulation may be responsible for the increased socioemotional problems in adolescents with DLD.

Until recently, the psychopathology outcomes of emotion regulation had not been examined in the DLD population. However, van den Bedem et al. (2018) examined self-report of emotion regulation in relation to depressive symptoms in a group of children and adolescents with ($n = 114$) and without DLD ($n = 214$) over a period of eighteen months. They found that individuals with DLD used similar emotion regulation strategies compared to their TD peers suggesting there is not an underlying psychosocial deficit, except they used more cognitive avoidant strategies (e.g. 'I tell myself it doesn't matter' or 'I do something else to help me forget about it') (van den Bedem et al., 2018). The authors argue that avoidance in this sense is seen as an adaptive strategy that has been linked to lower levels of depressive symptoms. Indeed, in their own study, these avoidant strategies were linked to lower levels of depressive symptoms, along with approach strategies (including reappraisal). Conversely, maladaptive strategies of worrying and externalising were associated with higher levels of depressive symptoms. Interestingly, these maladaptive strategies mediated the relationship between semantic language ability and depressive

symptoms, suggesting that emotion regulation is making an independent contribution to negative emotional outcomes in children and adolescents with DLD.

Conclusion

Overall, there is extensive evidence that poor emotion regulation abilities predict poor socioemotional outcomes in the general population. There is a similar picture emerging from the data from children and adolescents with DLD but, given the limited number of studies investigating emotion regulation in the DLD population, further research is needed.

Rationale for Current Thesis

The overall aim of this thesis is to examine the relationship between language, social skills and mental health outcomes in adolescents with DLD. The previous sections have outlined the theoretical framework and models which have attempted to explain this relationship. There is convincing evidence for the SAM, suggesting that individuals with DLD adapt their behaviour based on different social settings and there is not an underlying psychosocial deficit. However, given the complex nature of social processing and the strong support for a usage-based theory of language acquisition the relation between DLD and socioemotional problems may not be as straight-forward as the SAM suggests. That is, the SAM in its original formation may be influenced by the modular theory of DLD whereas a domain general approach may be more appropriate to explain the additional socioemotional difficulties that individuals with DLD experience. Instead of language constraints and biases of others influencing socioemotional outcomes there could be other factors mediating these difficulties, such as peer problems or poor social cognition skills, or these problems may be driven by poor emotion regulation abilities. Therefore, this thesis will test the models outlined above to determine which of these possible mechanisms is involved.

The current literature discussing the relationship between DLD and socioemotional outcomes provides a strong rationale for further research into these mediating factors, particularly as a previous study examining social cognition in adolescents was analysed in terms of social, not emotional, outcomes (Botting & Conti-Ramsden, 2008). However, due to the wide scope of social cognition, some of the tasks that are employed to measure this factor have been called into question. The most common task to measure mentalizing abilities – the Sally Anne task – and other false-belief tasks may not be the most

appropriate for testing social cognitive skills in adolescents. Evidence from brain imaging studies suggests that these mentalizing processes are still developing in the adolescent brain as the structure of the brain is still evolving during this period (Blakemore, 2008). Activity in the medial Pre-Frontal Cortex (mPFC), an area that is dedicated to recognising and processing faces and emotions, increases from childhood to adolescence, then decreases in adulthood (Blakemore, 2008). In addition, young people with Autism have been found to pass these tasks, yet still have difficulty with social functioning in their daily lives (Abell, Happé, & Frith, 2000). Therefore, false-belief tasks may not be an adequate measure of the skills that are needed in real-life social situations where interactions involve constant monitoring of another's mental state and updating of information. In order to address this problem, Chapter 4 presents results from the Social Attribution Task (SAT; Klin, 2000), an engaging task which allows for a detailed exploration of the way in which adolescents with DLD conceptualise social situations. Additionally, the Social Evaluation Learning Task (SELT; Button et al., 2015) will be utilised in this thesis to provide an online measurement of responses to judgements in a social situation and results from this study will be presented in Chapter 5.

Despite the increased focus on social cognition in this field, there is a dearth of information on the impact of this mediating factor on the adolescent population. Adolescence is a particularly important time to focus on, as although young people's language skills may have improved there may still be a lingering effect in the form of social, emotional and behavioural difficulties (SEBDs). Due to their growing independence adolescents are less likely to engage with adults and they may have learned coping strategies or they may experience the negative effects of communication difficulties through internalising behaviours, so many difficulties could go unnoticed by parents and professionals.

However, studies that have employed a longitudinal approach with many time points have found that the impact of DLD continues into later adolescence and adulthood. Beitchman and colleagues (Beitchman, Brownlie, & Bao, 2014; Beitchman et al., 1996; Beitchman et al., 2001) have conducted longitudinal studies on the same community cohort from age 5 until age 31. At age 12 they found higher rates of attention deficit hyperactivity disorder (ADHD) (Beitchman et al., 1996), while at age 19 they found significantly higher rates of anxiety (Beitchman et al., 2001) but there were no significant differences in SEBDs between DLD and TD peers at age 31 (Beitchman et al., 2014). These fluctuations

in findings highlight the unique developmental pathway of SEBDs and the need for more research into this relationship across the lifespan. Similarly, Mok et al. (2014) found varying trajectories of peer problems throughout childhood and adolescence, with some children with DLD not experiencing any problems and others only experiencing problems in childhood. While a longitudinal study of the clinical sample in this thesis was not possible due to the length of recruitment, the thesis does investigate potential mechanisms for increased socioemotional problems in a longitudinal population cohort, the Millennium Cohort Study (MCS). Using a group considered at risk of DLD, this thesis examines the mediating effect of social functioning at age 7 on emotional problems at age 14, as well as the moderating effect of DLD group status on the relationship between emotion regulation, peer problems and emotional problems spanning early childhood to mid-adolescence. The combination of a population-based approach with a clinically derived approach extends the literature.

Implications of Thesis

The main aim of this thesis is to provide a better understanding of why young people with developmental language disorder are at an increased risk of socioemotional problems. Understanding the pathways involved will enable researchers to design interventions that are better targeted to individuals with DLD who are also suffering from feelings of anxiety or depression. For example, speech and language therapy could include more social skills training and Cognitive Behavioural Therapy (CBT) tools to address the weak areas of social competence and increase resilience. However, these methods may need to be tailored to suit the needs of adolescents with language difficulties, given that typical methods of therapy rely on talking. Parents and teachers will also have a better understanding of the young people they are supporting and will be better equipped to help them with their problems. The cohort from these studies could also be followed-up at different time points to monitor the progress of socioemotional problems and their impact throughout later life.

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This declaration concerns the article entitled:									
A longitudinal analysis of early language difficulty and peer problems on later emotional difficulties in adolescence: Evidence from the Millennium Cohort Study									
Publication status (tick one)									
draft manuscript		Submitted		In review		Accepted		Published	X
Publication details (reference)	Forrest, C. L., Gibson, J. L., Halligan, S. L. & St Clair, M. C. (2018). A longitudinal analysis of early language difficulty and peer problems on later emotional difficulties in adolescence: Evidence from the Millennium Cohort Study, <i>Autism and Developmental Language Impairments</i> , https://doi.org/10.1177/2396941518795392								
Candidate's contribution to the paper (detailed, and also given as a percentage).	The candidate contributed to the formulation of ideas (50%) and considerably contributed to the design of methodology (70%). The candidate predominantly executed the experimental work, including the analysis and interpretation of the results (90%) and predominantly executed the presentation of the data in journal format (90%).								
Statement from Candidate	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature.								
Signed							Date	17/01/2019	

Chapter 2: Secondary Data Analysis

A longitudinal analysis of early language difficulty and peer problems on later emotional difficulties in adolescence: Evidence from the Millennium Cohort Study.

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Chapter rationale: The literature review revealed that while individuals with DLD are at increased risk of social and emotional problems compared to their typically developing peers, there is a gap in our understanding of how this relationship develops. Several models were proposed to account for the relationship and Chapter 2 aims to evaluate the model whereby social functioning mediates the pathway between DLD and increased emotional problems. This model draws on the premise outlined by the Social Adaptation Model (SAM Redmond & Rice, 1998) that individuals with DLD modify their behaviours due to environmental factors, such as social difficulties, caused by communication deficits. Chapter 2 uses secondary data analysis from the Millennium Cohort Study (MCS), which allows for an examination of the mediation model across three different time-points. Previous longitudinal studies investigating the relationship between DLD and socioemotional outcomes have utilised clinical cohorts of children and young people with a formal diagnosis of DLD, or population cohorts of young children. Therefore, Chapter 2 extends the literature by investigating whether the same association between language difficulties and socioemotional problems is present in a population cohort spanning childhood to mid-adolescence.

Abstract

Background and aim: Individuals with developmental language disorder (DLD) have been found to exhibit increased emotional difficulties compared to their typically developed peers. However, the underlying pathways involved in this relationship are unclear. It may be that poor language leads to social exclusion, resulting in feelings of frustration and isolation. Additionally, previous research has focused on clinical samples or early childhood in population cohorts. Therefore, the current paper examines the mediating effect of childhood peer problems on poor emotional outcomes in adolescence using a population cohort. **Methods:** Data from the Millennium Cohort Study (MCS) were analysed at ages 5, 7 and 14. The rDLD group (children considered at risk of developing DLD based on parental report of difficulties or a score $-1.5SD$ on Naming Vocabulary subtest at age 5) was compared to a General Population (GP) group. A Sobel-Goodman test was used to examine the mediating effect of teacher-reported Peer Problems at age 7 on the association between language difficulties at age 5 and parent-reported Emotional Problems at age 7 and 14. **Results:** Peer problems at age 7 accounted for approximately 14% of the effect of language difficulties at age 5 on emotional problems at age 7, and approximately 17% of the effect of language difficulties at age 5 on emotional problems at age 14. **Conclusions:** This paper supports previous findings that children and adolescents with language difficulties are at increased risk for social and emotional problems as reported by their parents and teachers. Furthermore, the findings show that peer problems partially mediate the relationship between language difficulties and emotional problems, suggesting that better relationships with peers may offer some protection against poor mental health outcomes in adolescents at risk of DLD. **Implications:** This paper adds to the literature that investigates the mechanisms involved in the relationship between DLD and increased emotional problems. Practitioners wishing to reduce risk of emotional difficulties in children with DLD may wish to reflect on what they can do to support a child to develop positive peer relationships.

Introduction

Language ability is a necessary skill for adaptive functioning. Not only do language skills help with reasoning and problem solving abilities, they are also vital for communicating and socialising with others. Children with language difficulties, or who have Developmental Language Disorder (DLD)¹, have been shown to have higher ratings of withdrawal (Beitchman et al., 1996; Hart, Fujiki, Brinton, & Hart, 2004; Maggio et al., 2014), increased feelings of anxiety and depression (Beitchman et al., 2001; Conti-Ramsden, Mok, Pickles, & Durkin, 2013; Voci, Beitchman, Brownlie, & Wilson, 2006) and lower self-esteem (Wadman, Durkin, & Conti-Ramsden, 2008) compared to typically developing (TD) peers. DLD affects approximately 7% of the population and manifests as a difficulty with receptive and/or expressive language that cannot be accounted for by any other hearing, oromotor impairment or global intellectual disability (Norbury et al., 2016). Associated emotional difficulties can persist throughout the lifespan (Clegg, Hollis, Mawhood, & Rutter, 2005). Additionally, there are high rates of previously undiagnosed language difficulties in samples of young people referred to child and adolescent mental health services (Cohen, Barwick, Horodezky, Vallance, & Im, 1998) and youth offenders (Hughes et al., 2017). Therefore, there is a clear need to unravel the close association between language difficulties and increased emotional problems.

Some gaps in the literature exist despite evidence of associations between language difficulties and poor emotional outcomes. For instance, research focuses on cross-sectional studies conducted in childhood, which does not account for the developmental pathways involved in the relationship (Yew & O'Kearney, 2013). Also, there is conflict surrounding the extent to which language ability is the strongest predictor of poor emotional outcomes. For example, some studies have shown that language ability predicts emotional problems in teacher-reports but not parent-reports (Lindsay, Dockrell, & Strand, 2007; Redmond & Rice, 1998, 2002) but this same pattern has not been found in other studies (Lindsay &

¹ As recommended by a recent panel of experts, we have opted to use the term Developmental Language Disorder (DLD) instead of Specific Language Impairment (SLI) (Bishop et al., 2017). The definition remains the same as many recent definitions (in that diagnosis is no longer based on a discrepancy between verbal and nonverbal intelligence) and follows long-term studies' adoption of this term (e.g. Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018). Therefore, we refer to DLD throughout the paper when referencing older studies that discuss children with expressive or receptive language difficulties with no known cause. In the current study, rDLD refers to children who met criteria for low language based on parent report and/or an expressive language subtest and are considered at risk of DLD (see method section for more details).

Dockrell, 2012; Wadman, Botting, Durkin, & Conti-Ramsden, 2011a). Additionally, some young people with DLD have no problems with emotional functioning (Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006) and a recent follow-up study on a cohort with DLD found that previously high levels of social anxiety at age 19 had dissipated by the age of 31 (Beitchman, Brownlie, & Bao, 2014). These inconsistencies in the direct relationship between language ability and emotional outcomes suggest that there may be mediating or third factors involved in the relationship between language difficulties and negative emotional outcomes, perhaps exacerbated by language difficulties but more directly related to the resulting emotional difficulties (Bakopoulou & Dockrell, 2016; Conti-Ramsden & Botting, 2008; Durkin, Toseeb, Botting, Pickles, & Conti-Ramsden, 2017).

One possibility is that poor language skills inhibit social functioning, which in turn increases risk of emotional problems (Redmond & Rice, 1998). It is clear that language plays an integral role in social functioning as the social skills required for effective interactions depend on strong verbal skills. Therefore, individuals with language difficulties may have particular difficulty with social interactions and exhibit poor social functioning. For example, observational studies demonstrate that children with DLD struggle to integrate into conversations and social situations (Brinton, Fujiki, Spencer, & Robinson, 1997). In turn, these social difficulties may lead to poor emotional outcomes as individuals experience loneliness and decreased social support. Consistent with this, children and adolescents with DLD report increased social stress (Wadman, Durkin & Conti-Ramsden, 2011c) and higher levels of social anxiety (Voci et al., 2006) compared to their TD peers.

With less exposure to social situations, children with DLD may have fewer opportunities to develop social skills and, as a result, fewer resources to draw on during social interactions (Crick & Dodge, 1994). Consequently, children may be missing out on learning social skills, such as conflict resolution skills, and instead resort to less adaptive responses such as physical aggression (Bakopoulou & Dockrell, 2016). An inability to solve problems using words may act as a further barrier to social functioning, as children avoid those who are too aggressive or emotional (Wolters, Knoors, Cillessen, & Verhoeven, 2013). Indeed, children with DLD receive more “dislike” ratings than their age-matched peers in classroom rating studies (Andres-Roqueta, Adrian, Clemente, & Villanueva, 2016; Gertner, Rice, & Hadley, 1994). These findings are consistent with parent, teacher and self-reports of increased peer problems compared to TD peers (Conti-

Ramsden et al., 2013; Mok, Pickles, Durkin, & Conti-Ramsden, 2014; St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). Children and young people with DLD are also more prone to victimisation compared to their typically developing peers (Conti-Ramsden & Botting, 2004; Redmond, 2011) which could negatively impact their self-esteem and increase feelings of anxiety or depression (Hawker & Boulton, 2000), illustrating again the impact of social difficulties on the mental health of individuals with DLD. Incidents of bullying may also have a stronger impact on children and adolescents with DLD, with victimisation predicting behaviour problems in children with DLD but not in their typically developing counterparts (Knox & Conti-Ramsden, 2007). However, there are contrasting reports of risk of victimisation in children and young adolescents with DLD, with some studies reporting similar rates to typically developing peers and those with learning disabilities (Lindsay, Dockrell, & Mackie, 2008).

However, these cross-sectional studies do not fully explain the mechanisms involved in the relationship between DLD and emotional outcomes. Longitudinal studies on individuals with DLD have illustrated different trajectories of poor social functioning throughout development (Mok et al., 2014) with some finding that social difficulties tend to increase during adolescence (Lindsay & Dockrell, 2012; St Clair et al., 2011). This increase in peer problems could reflect the general increased complexity of peer relations in adolescence and the growing importance that friendships play in shaping self-esteem and emotional wellbeing by providing social support (Van Harmelen et al., 2017). Early difficulty in friendships and social functioning may snowball across development, potentially even relating more strongly to emotional problems due to the increasingly important role of language in the more complex friendships in adolescence. For example, St Clair et al. (2011) found impaired pragmatic (e.g., social) language skills predicted peer problems and emotional problems at age 11 and 16, while (Wadman et al., 2011a) found that peer problems predicted concurrent depressive symptoms at age 16. Therefore, there is a need to examine these factors throughout childhood and adolescence in order to distinguish the pathways involved.

Current study

The current study analyses the pathways between early language difficulties at age 5 and later emotional difficulties at age 14 in a population cohort, the Millennium Cohort Study (MCS). Previous studies have found increased social and emotional problems in

children and young people with a diagnosis of DLD from a clinical cohort, the Manchester Language Study (e.g. Conti-Ramsden et al., 2013; Mok et al., 2014; St Clair et al., 2011). As highlighted by a recent panel of experts in the field, it is important to examine whether these same patterns of negative outcomes are found in individuals with impaired language from a population cohort (Bishop, Snowling, Thompson, Greenhalgh, & consortium, 2016). There is evidence of associated emotional and behavioural problems from previous population studies of language difficulties, but outcomes are from young children aged four (Bretherton et al., 2014); five (Girard, Pingault, Doyle, Falissard, & Tremblay, 2017; Girard, Pingault, Doyle, Falissard, & Tremblay, 2016); six (Clegg, Law, Rush, Peters, & Roulstone, 2015) and seven years of age (Levickis et al., 2017). The current study is the first in the UK to use a longitudinal population approach from the age of 5 to 14 years focusing on children with language difficulties. Adolescence is a key period to study emotional outcomes due to the potential that emotional problems may develop into psychiatric disorders later in life (Jones, 2013). Therefore, it would be beneficial to examine whether, and how, language difficulties predict emotional and social problems throughout childhood and adolescence.

In addition to extending previous findings into adolescence, the current study will examine whether there is a mediating factor involved in the relationship, to provide more detailed understanding of the pathways between language difficulties at age 5 and later emotional difficulties at age 7 and 14. Specifically, we will examine the mediating effect of social functioning. Social functioning is an umbrella term and is defined in this paper as adaptive social interactions with others, such as quality and quantity of friendships, while difficulties in social functioning are reflected by experiences of peer problems and victimisation. Any group differences in different aspects of social functioning will be included in the mediation model in order to explain the relationship between language and emotional difficulties. A better understanding of how this relationship manifests may help speech and language therapists evaluate interventions to provide a more comprehensive approach that also examines current social functioning. Firstly, it is hypothesised that participants with a language difficulty at age 5 will experience higher rates of emotional difficulties than their age-matched peers at age 7 and 14, as evidenced by parent-report on the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) and self-report on the Short Mood and Feelings Questionnaire (SMFQ; Angold et al., 1995). Secondly, participants with a language difficulty at age 5 are hypothesised to experience poorer social

functioning at age 7 and 14 in comparison to their age-matched peers, as evidenced by higher reports of victimisation and increased rates of teacher-reported peer problems from the SDQ. Finally, social functioning is expected to mediate the relationship between early language difficulties and later emotional difficulties, with those with reports of poorer social functioning experiencing higher levels of emotional problems than their peers.

Method

Ethics

The original study received full ethical approval from the NHS Multi-Centre Research and Ethics Committee (MREC) at each wave (Connelly & Platt, 2014).

Participants

Participants were obtained from waves 1 - 6 of the Millennium Cohort Study (MCS) (University of London., 2018). This birth cohort follows children born between September 2000 and January 2002 at age nine months, and three, five, seven, eleven and fourteen years of age. The full sample size was 19,518 children. In total, 5256 individuals were excluded from this analysis (537 due to multiple births and 4,719 due to missing rDLD status data). The current sample is 14,262 singletons. The sample was 46.8% female ($n = 6675$) (see Figure 1).

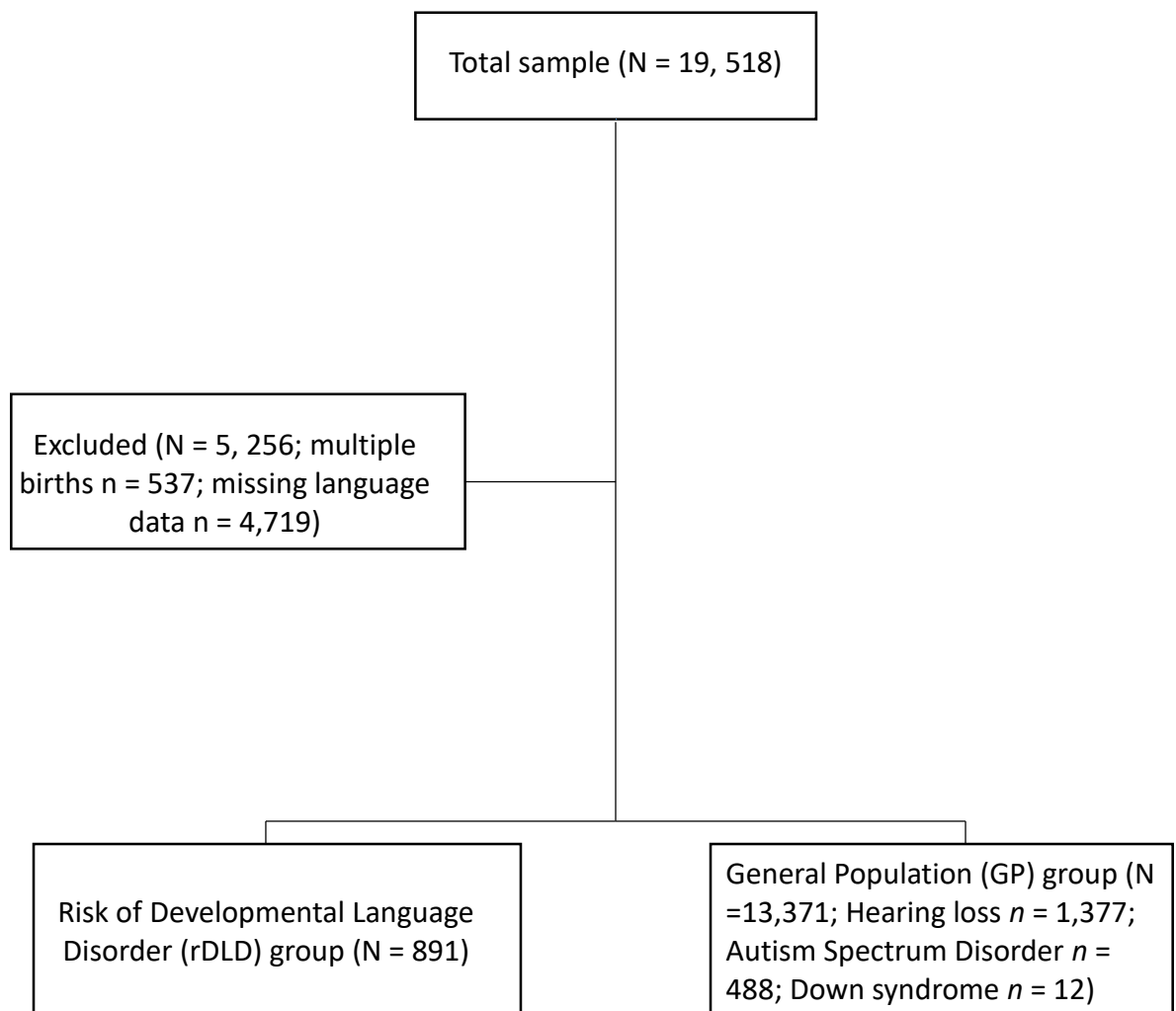


Figure 1. Flow diagram of group allocation.

Measures

Risk of Developmental Language Disorder (rDLD). As recommended by recent literature (Bishop et al., 2016) we employ the term Developmental Language Disorder (DLD) to describe the group with receptive and/or expressive language difficulties at age 5 that cannot be accounted for by any other hearing or cognitive impairment. Consistent terminology enables researchers, parents and professionals to be on the same page when referring to children with significant language difficulties not otherwise explained by other conditions. However, it should be noted that, due to secondary data analysis, there was only one standardised measure of expressive language available and therefore there is no formal diagnosis of DLD in the sample. To this end, we created the 'rDLD' variable as a measure of children considered at risk of developing DLD. This was based on lower language ability as measured by parent report or a standardised test. Both measures were taken from the third wave of data collection at age 5, as children who have low language abilities by this age are likely to continue to have low language as they develop (McKean et al., 2017b). Bishop and McDonald (2009) note that the combination of measures from different sources provides a more comprehensive picture of language abilities. Children had to meet at least one of the following two criteria to be included in the rDLD group. Firstly, participants were included in the rDLD group if they received a positive response to the statements "Language developing slowly" or "Doesn't understand others" from parent report at age 5 ($n = 440$). This provided a measure of functional language in everyday use. Participants were not included if parents endorsed items relating to speech or hearing problems, such as "S/he pronounces words poorly", "S/he doesn't hear well" and "S/he stutters". See Hughes, Sciberras, and Goldfeld (2016) for a similar measure of parental report of language difficulties relating to social and emotional problems. Secondly, participants were included if they scored 1.5 *SD* below the mean (T score of 35 or below) on the British Ability Scales (BAS) naming vocabulary subtest ($n = 529$) (Elliott, Smith, & McCulloch, 1997). This test provides a measure of expressive language ability, requiring participants to name pictures of objects and has a reliability coefficient of .65 at age 5 (Elliott et al., 1997). Reilly et al. (2014) recommend a cut-point of more than 1.25 *SD* below the mean on language tasks. Given that there was only one standardised language test available in the current cohort, we have used the threshold of 1.5 *SD* below the mean to provide a conservative estimate of children at risk of DLD. This decision also follows Law, Rush, Anandan, Cox and Wood's (2012) example of using a 1.5 *SD* cut-point

to define language impairment from the same population cohort. There were 78 children who met both criteria of parent report of language difficulties and low score on the naming vocabulary subtest. Both criteria of rDLD were administered to all parents and children.

In total, 6.3% of the sample (N = 891) were included in the rDLD group at age 5, which is a conservative rate given the recent UK prevalence rate of 7.6% for DLD (Norbury et al., 2016). This is to be expected, given that only one standardised language subtest is used in the current study compared to the more comprehensive language assessments that are employed in Norbury et al.'s (2016) study and others in the literature. Analyses were re-run on separate groups with each inclusion criteria and a strikingly similar pattern of group differences were found for naming vocabulary and parent report individually (see supplementary materials).

As we were interested in those with a primary language difficulty, children who met criteria for the rDLD group but were in a family environment where English was not spoken at least 50% of the time were dropped from the analysis (n = 320). Parent reports of additional support in the classroom and special educational needs were examined for evidence of Autism Spectrum Disorder (ASD) (n = 487), hearing difficulties (n = 1,229) or Down Syndrome at age 7 and age 11 (n = 12) and participants were excluded when they met these criteria. No other reports of additional support or special educational needs related to global intellectual disability were reported in the rDLD group.

All individuals who did not meet criteria for the rDLD group were then entered into the general population (GP) comparison group, even if there was evidence of hearing problems, ASD or Down Syndrome. This is in line with recent recommendations for control groups with developmental disorders as outlined in Fombonne (2016). Of the total sample eligible for the study (after excluding multiple births and missing rDLD data), 93.7% were included in the GP group at age 5 (N = 13,371).

Emotional difficulties outcome. The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) was completed by the main respondent (predominantly the mother) at ages seven and fourteen years. This 25-item scale is comprised of five subscales (Emotional Symptoms, Conduct Problems, Hyperactivity, Peer Problems and Prosocial). Each item is rated on a scale of *Very True*, *Somewhat True* and *Not True*. Scores of 2, 1 or 0 are assigned to each rating. The SDQ has a test-retest reliability of .85 (Goodman, 1999).

The scale of interest was the Emotional Symptoms subscale, which is comprised of five items. Total scores on this subtest can range from 0-10 with a higher score denoting more problems. UK population norms state that a score of 0-3 is 'close to average' while scores of 5-6 are 'high' and scores of 7-10 are 'very high'.

The Short Mood and Feelings Questionnaire (SMFQ; Angold et al., 1995) was completed by adolescents at age fourteen. The SMFQ consists of 13 statements that measure depressive thoughts and feelings over the last two weeks. Participants rate the items as either 0 *Not true*; 1 *Sometimes true*; or 2 *True*, resulting in a total score ranging from 0-26. A higher score denotes increased feelings of depression. The SMFQ has a test-retest reliability of .85 (Angold et al., 1995) and has a moderate diagnostic accuracy (AUC = .73) when compared to the Diagnostic Interview Schedule for Children (DISC) in a community sample of children aged 10-13 years (Rhew et al., 2010).

Social functioning. Social functioning measures were taken from the "Your Friends" section of the MCS at age 7 and 14. Questions about number of best friends (*Do you have any best/close friends?*), victimisation (*How often do other children hurt you or pick on you on purpose?*) and bullying (*How often do you hurt or pick on other children on purpose?*) were included. The victimisation and bullying scales at age 7 used the terms *All of the time*, *Some of the time*, and *Never*, while at age 14 the ratings were *Most days*, *About once a week*, *About once a month*, *Every few months*, *Less often* and *Never*. For ease of comparison, age 14 ratings were recoded into the same scales as the age 7 items. Thus, *Most days* and *About once a week* were recoded as *All the time*; *About once a month* and *Every few months* were recoded as *Some of the time*; and *Less often* and *Never* were recoded as *Never*. The question *How happy are you with your friends?* from the well-being grid in the "Personality and Well-being" module at age 14 was also included as a predictor of social functioning. Participants rated their happiness on a scale of 1 *Completely happy* to 7 *Not at all happy*. The Peer Problems subscale from the teacher-report of the SDQ administered at age 7 was also analysed as a measure of social functioning. This subscale consists of five items that are rated on a scale of *Very True*, *Somewhat True* and *Not True*. Scores of 2, 1 or 0 are assigned to each rating. Scores can range from 0-10 and two of the items are reverse scored so that a higher score denotes higher problems. For example, compared to UK population norms, a score of 0-2 is 'close to average' while a score of 5 is 'high' and a score of 6-10 reflects 'very high' peer problems

Statistical analysis

Data were analysed using Stata 14 (StataCorp, 2015) with the prefix *svy* to adjust for survey data, as recommended for the MCS (Ketende & Jones, 2011). The *svy* prefix accounts for sampling weights, cluster sampling and stratification of the survey design. This procedure also accounts for attrition or non-response rates and adjusts for the sampling design used in this cohort in order to provide accurate estimates for the underlying UK population (finite population correction factor (*fpc*)). Consequently, missing data were treated as missing at random due to attrition or non-response in each wave. Instead of analysing language as a construct, participants were categorised into groups of rDLD and GP status for two reasons. Firstly, children with DLD have disordered language development, not simply a delay, with the majority of the literature investigating DLD and associated socioemotional difficulties examining DLD as an entity based on a clinical cut-off and parental report of poor language functioning (Bishop et al., 2016). Secondly, previous research has suggested an absence of a linear relationship between language ability and severity of socioemotional problems (Fujiki, Brinton, & Clarke, 2002; Hart et al., 2004), therefore analysing language ability as a continuous scale was not deemed useful. Logistic regression was used to examine the influence of language difficulties at age 5 on the presence of best/close friends at age 7 and 14, while ordered logistic regression was used to examine the influence of language difficulties at age 5 on the remaining self-report social functioning measures at age 7 and 14. Odds ratio provide a comparable measure of the effect of these analyses. The SDQ subscales of Emotional Symptoms and Peer Problems were highly skewed, as was the SMFQ, therefore negative binomial regression was used to analyse the relationship between language difficulties at age 5 and each of the SDQ subscales at age 7 and 14, (Peer Problems and Emotional Symptoms) and the SMFQ at age 14. Confidence intervals provide a measure of the strength of the effect for these analyses, as it was not possible to provide effect sizes due to the combination of negative binomial regression with survey estimation techniques. Sex and poverty were covaried for in all analyses. Poverty was defined by the Organisation for Economic Cooperation and Development (OECD) as below 60% of the median income. A Sobel-Goodman test was used to analyse the mediating effect of social functioning at age 7 on the relationship between language difficulties at age 5 and emotional problems at age 7 and 14. The mediation between social functioning at age 7 and emotional problems at age

14 was then analysed while controlling for emotional problems at age 7. For all mediation analyses the *sgmediation* command was used while controlling for OECD and gender.

Results

Demographics

The rDLD group consisted of 891 individuals at age 5, or 6.25% of the sample. Approximately 29% of the rDLD group were female while approximately 49% of the GP group were female, which was a significant difference (see Table 1). Significantly more children were below the OECD poverty line at age 5 in the rDLD group compared to the GP group, and there was a significant group difference in t-scores on the British Ability Scales Pattern Construction subtest administered at age 5 (see Table 1). The Pattern Construction subscale provides a measure of spatial ability by requiring children to copy designs using coloured blocks. More children in the rDLD group were born prematurely (gestation earlier than 37 weeks) but this difference was not significant and there was no difference in age between the groups at Wave 3 (age 5).

Table 1.
Social functioning and emotional problems in Risk of Developmental Language Disorder (rDLD) group and General Population (GP) group at age 7.

	rDLD (<i>n</i> = 891)	GP (<i>n</i> = 13,371)	All (<i>n</i> = 14,262)	rDLD vs. GP
<i>Demographic variables at age 5</i>				
Age (Years; Months)	5;2.4	5;2.5	5;2.5	n.s.
Premature birth (< 37 week gestation) (%)	9.8	7.3	7.5	n.s.
Female (%)	29.4	48.5	46.8	.44(.37, .52)****
Poverty Indicator (%)	55.8	28.4	31	3.21(2.69, 3.83)****
BAS Pattern Construction at age 5	40.50 (.62)	51.19 (.18)	49.58 (.21)	-7.33(-8.43, -6.23)***
<i>Age 7 predictors</i>				
Best friend				n.s.
Yes (%)	94.8	94.8	94.8	-
No (%)	5.2	5.2	5.3	-
Number of friends				n.s.
Lots (%)	59.5	64	63.3	-
Some (%)	28.2	25.5	25.9	-
Not many (%)	12.2	10.5	10.8	-
Victim of bullying				n.s.
All of the time (%)	13.7	8.7	9.2	-
Some of the time (%)	35.9	39.5	39.5	-
Never (%)	50.4	51.8	51.3	-
Bully others				n.s.
All of the time (%)	7	2.5	2.8	-
Some of the time (%)	11	13	13.1	-
Never (%)	82	84.6	84.1	-
SDQ subscales				
Parent-rated Emotional problems	2.19 (.11)	1.48 (.02)	1.56 (.02)	.32(.21, .43)***
Close to Average (%) ^a	75.5	87.4	86.0	-
Slightly Raised (%)	10.7	5.7	6.2	2.01(1.45, 2.81)****
High/Very High (%)	13.8	6.9	7.9	1.78(1.32, 2.39)****
Teacher-rated Peer problems	1.71 (.11)	1.09 (.02)	1.19 (.02)	.37 (.24,.50)***
Close to Average (%) ^a	71.7	84.4	82.6	-
Slightly Raised (%)	19.3	11.1	11.9	1.71(1.21, 2.40)****
High/Very High (%)	9.0	4.5	5.5	2.09(1.37, 3.17)****

Statistics are *b* coefficients or odds ratio where marked ^ (95% confidence interval), controlling for poverty indicator (below 60% median income) and gender.

^a Proportion of each SDQ category by rDLD and GP group, compared to the “Close to Average” reference category. “High” and “Very High” categories were combined into “High/Very High” given the low numbers in the “Very High” group. **p* < .05, ** *p* < .01, *** *p* < .001

Table 1 demonstrates that there is a significantly higher rate of parent-reported emotional problems in the rDLD group compared to the GP group at age 7, $b = .32$, 95% CI (.21, .43), $p < .001$. When the cut-off categories are analysed, it is clear that both the majority of the rDLD group and GP group are rated within the 'Close to Average' category (75.5% and 87.4% respectively). Using the 'Close to Average' category as a reference point, logistic regression shows that being categorised as having 'Slightly raised' emotional problems (OR = 2.02, 95% CI (1.45, 2.81), $p < .001$) or 'High/Very High' emotional problems (OR = 1.78, 95% CI (1.32, 2.39), $p < .001$) is more likely for members of the rDLD group than the GP group. A similar pattern of higher parent-reported emotional problems in the rDLD group compared to the GP group was found at age 14, $b = .23$, 95% CI (.11,.34), $p < .001$ (see Table 2). Again, the majority of individuals were 'Close to average' in both groups (68.5% in the rDLD group and 78.3% in the GP group). Logistic regression shows that being categorised as having 'Slightly raised' emotional problems (OR = 1.69, 95% CI (1.15, 2.49), $p < .01$) or 'High/Very High' emotional problems (OR = 1.59, 95% CI (1.15, 2.21), $p < .01$) is more likely for members of the rDLD group than the GP group. By contrast, self-reported depression scores as measured by the SMFQ did not differ between the GP and rDLD groups, $b = -.09$, 95% CI (-.24,.06), $p = .24$.

Group difference in social functioning

There was no significant group difference in self-reported social functioning at age 7. Approximately 95% of the rDLD group and the GP group stated that they had a best friend. However, at age 14 the number of individuals reporting that they had close friends differed significantly between the groups, $b = .88$, 95% CI (.41,1.34), $p < .001$.

Approximately 9% of the rDLD group reported having no close friends, compared to only 3% of the GP group. Nonetheless, when asked how happy they were with their friends, there was no significant difference between the rDLD group ($M = 2.02$, $SE = .07$) and the GP group ($M = 2.11$, $SE = .02$), $b = -.04$, 95% CI (-.11,.04), $p = .32$.

There was no significant difference between the rDLD group and the GP group in overall experiences of bullying at either time point. There was no significant group difference in reports of being bullied at age 7, $b = -.03$, 95% CI (-.27,.21), $p = .80$, nor at age 14, $b = -.23$, 95% CI (-.57,.11), $p = .19$. Similarly, there was no significant group difference in reports of bullying others at age 7, $b = -.01$, 95% CI (-.29,.27), $p = .96$ nor at age 14, $b = -.22$, 95% CI (-.66,.21), $p = .31$.

At age 7, the rDLD group was rated by teachers as having significantly more peer problems, $b = .37$, 95% CI (.24,.50), $p < .001$. The majority of individuals were within the 'Close to average' category for both the rDLD group (71.7%) and the GP group (84.4%). Using the 'Close to Average' category as a reference point, logistic regression shows that being categorised as having 'Slightly raised' peer problems (OR = 1.71, 95% CI (1.21, 2.40), $p < .01$) or 'High/Very High' peer problems (OR = 2.09, 95% CI (1.37, 3.17), $p < .01$) is more likely for members of the rDLD group than the GP group.

Table 2. Social functioning and emotional problems in Risk of Developmental Language Disorder (rDLD) group and General Population (GP) group at age 14.

	rDLD (n = 891)	GP (n = 13,371)	All (n = 14,262)	rDLD vs. GP
<i>Age 14 predictors</i>				
Close friends	91.4	96.9	96.3	-
	No (%)	3.1	3.7	-
Wellbeing grid				
Happiness with friends	2.02(.07)	2.11(.02)	2.11(.02)	n.s.
Victim of bullying ^a				
All of the time (%)	13.6	10.7	11.0	n.s.
Some of the time (%)	4.6	11.1	10.2	-
Never (%)	81.8	78.2	78.8	-
Bully others ^a				
All of the time (%)	3.3	2.5	2.8	n.s.
Some of the time (%)	3.3	4.7	4.4	-
Never (%)	93.3	92.8	92.8	-
SDQ subscale				
Parent-rated Emotional problems	2.58 (.13)	2.06 (.04)	2.14 (.03)	.23(.11, .34)***
Close to Average (%) ^b	68.5	78.3	77.1	-
Slightly Raised (%)	11.2	7.7	8.0	1.69(1.15, 2.49)^**
High/Very High (%)	20.3	13.9	14.9	1.59(1.15, 2.21)^**
Mood and Feelings Questionnaire	4.87(.33)	5.81(.09)	5.72(.08)	n.s.

Statistics are *b* coefficients (95% confidence interval), controlling for poverty indicator (below 60% median income) and gender.

* $p < .05$ ** $p < .01$ *** $p < .001$

a The scales for "Victim of bullying" and "Bully others" at age 14 were originally *Most days, About once a week, About once a month, Every few months, Less often and Never* but were recoded to remain consistent with the ratings at age 7.

^b Proportion of each SDQ category by rDLD and GP group, compared to the "Close to Average" reference category. "High" and "Very High" categories were combined into "High/Very High" given the low numbers in the "Very High" group.

Peer problems as a mediator for age 7 emotional problems

The association between language difficulties at age 5 and parent reported emotional problems at age 7 was partially mediated by teacher reported peer problems at age 7. Figure 2 illustrates that language difficulties at age 5 significantly predicted peer problems at age 7, $b = .47$, $SE = .11$, $p < .001$, and these peer problems were significantly related to concurrent emotional problems, $b = .16$, $SE = .02$, $p < .001$. The effect of language difficulties on emotional problems at age 7, $b = .56$, $SE = .14$, $p < .001$, was reduced after controlling for peer problems, $b = .49$, $SE = .14$, $p < .001$, consistent with partial mediation. A Sobel-Goodman, $z = 3.9$, $SE = .02$, $p < .001$, test found that approximately 14% of the relationship between language difficulties at age 5 and emotional problems at age 7 was mediated by peer problems at age 7.

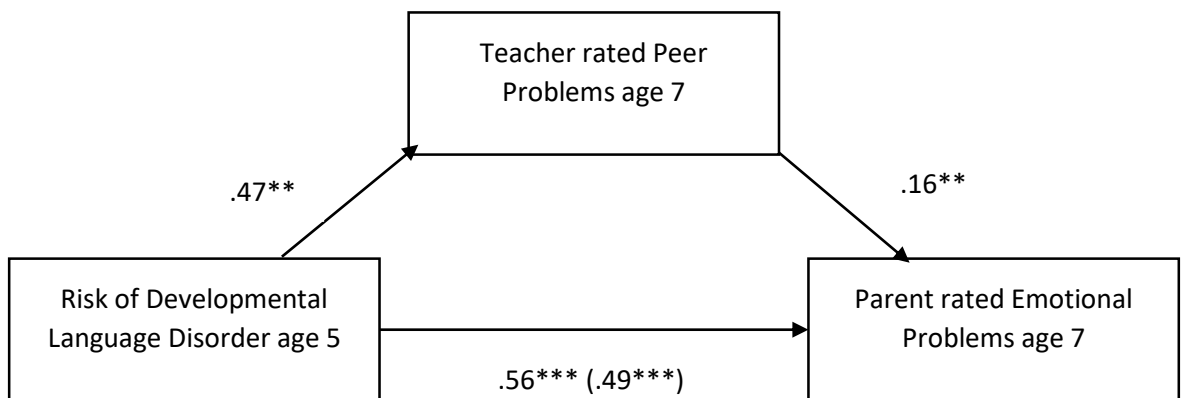


Figure 2. Regression coefficients for the relationship between Developmental Language Disorder (rDLD) at age 5 and emotional problems at age 7 as mediated by peer problems at age 7. The regression coefficient for the effect of rDLD grouping on emotional problems after controlling for peer problems is shown in parentheses.

Peer problems as a mediator for age 14 emotional problems

The association between language difficulties at age 5 and emotional problems at age 14 was partially mediated by peer problems at age 7. Figure 3 illustrates that language difficulties at age 5 was a significant predictor of peer problems at age 7, $b = .62$, $SE = .13$, $p < .001$, and that peer problems at age 7 were a significant predictor of emotional problems at age 14, $b = .17$, $SE = .02$, $p < .001$. The effect of language difficulties on emotional problems at age 14, $b = .62$, $SE = .19$, $p < .001$, was significantly reduced after controlling for peer problems at age 7, $b = .51$, $SE = .18$, $p < .01$. This finding is consistent with partial mediation. A Sobel-Goodman test was used to analyse the mediating effect of peer problems, $z = 3.92$, $p < .001$, demonstrating that approximately 17% of the relationship between language difficulties at age 5 and emotional problems at age 14 was mediated by peer problems at age 7.

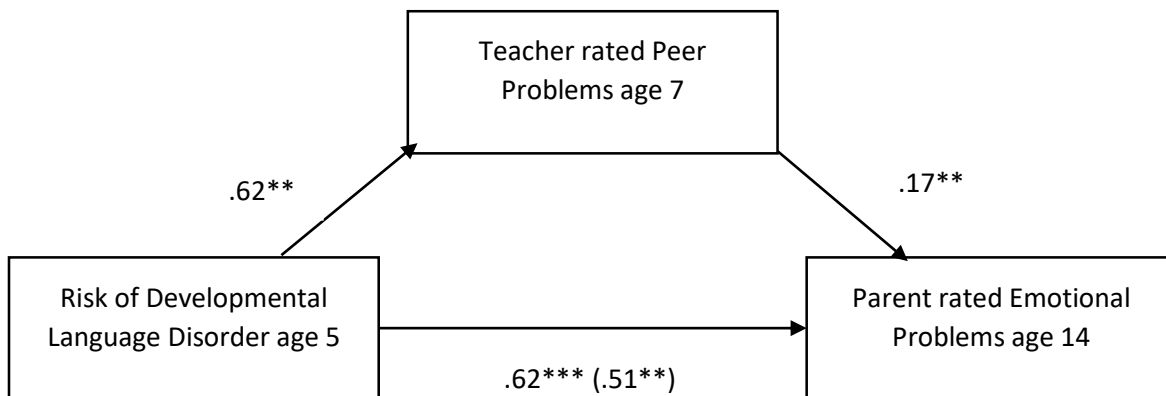


Figure 3. Regression coefficients for the relationship between risk of Developmental Language Disorder (rDLD) at age 5 and emotional problems at age 14 as mediated by peer problems at age 7. The regression coefficient for the effect of rDLD grouping on emotional problems after controlling for peer problems is shown in parentheses.

However, when emotional problems at age 7 were controlled for, the relationship between language difficulties and emotional problems at age 14 was not significant, $b = .28$, $SE = .19$, $p = .134$ (see Figure 4). This result is unsurprising given previous research within the MCS has found that the increase in emotional difficulties between the rDLD and GP groups stays consistent across development (St Clair et al., under review).

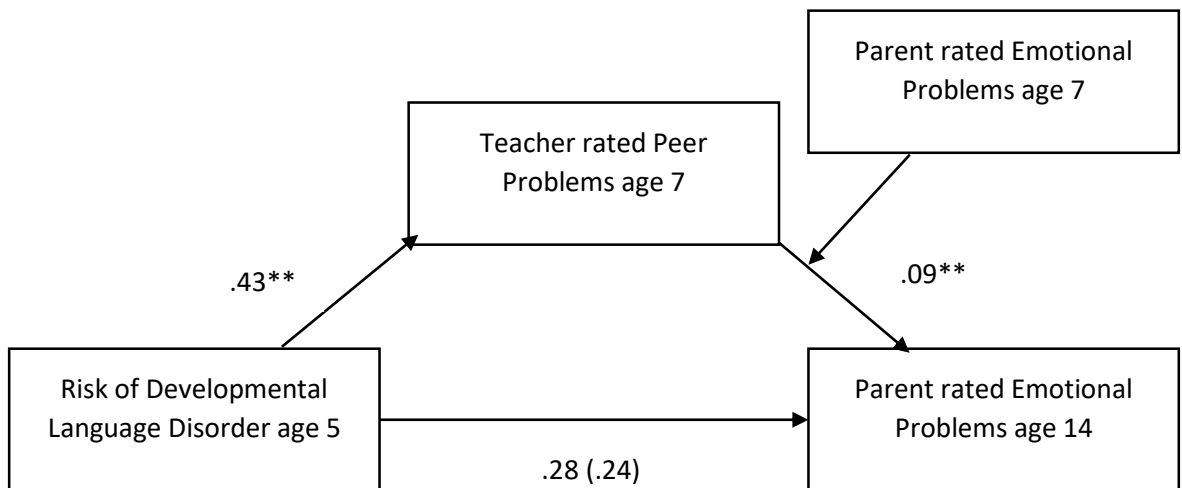


Figure 4. Regression coefficients for the relationship between risk of Developmental Language Disorder (rDLD) at age 5 and emotional problems at age 14 as mediated by peer problems at age 7, while controlling for emotional problems at age 7. The regression coefficient for the effect of rDLD grouping on emotional problems after controlling for peer problems is shown in parentheses.

Discussion

The aim of this paper was to examine the mediating effect of social functioning on the relationship between early language difficulties and later emotional difficulties in a population cohort. Again, it should be noted that the rDLD group in the current paper is not a clinically diagnosed sample and the variable is comprised of an expressive language measure and parent report of language difficulties. Therefore, results should be interpreted with caution when compared to clinical samples and studies using more in-depth language assessments. However, the participants in this group may be at risk of persistent DLD. As hypothesised, parent-reported emotional problems were significantly higher in the rDLD group compared to the GP group, but there was no group difference in self-reported emotional problems. Similarly, the prediction of poorer social functioning in the rDLD

group compared to the GP group was partially supported; a significant group difference in teacher-reported peer problems was found but there were very few differences in self-reports of social functioning. Teacher-reported peer problems at age 7 partially mediated the relationship between language difficulties at age 5 and parent-reported emotional problems at age 7 and age 14. However, the relationship at age 14 was not significant after controlling for parent-reported emotional problems at age 7.

The findings support previous research with clinical samples (St Clair et al., 2011), suggesting that even in non-clinical groups children and adolescents who are at risk of developing DLD are more at risk for emotional difficulties, as there was a higher rate of parent-reported emotional problems in the rDLD group compared to the GP group at age 7 and 14. Additionally, these findings extend previous community-based research that has focused on young children with language difficulties and found increased rates of behavioural problems but no group differences in emotional outcomes (Bretherton et al., 2014; Girard et al., 2016; Levickis et al., 2017; McKean et al., 2017a), highlighting that adolescence is a key time to study emotional difficulties. However, it is worth noting that the mean ratings from clinical samples are higher and a greater proportion reflect scores in the 'High' or 'Very high' category, although these scores are obtained from self- and teacher-reports respectively (Conti-Ramsden et al., 2013; St Clair et al., 2011). Conversely, self-report of depressive symptoms from the SMFQ at age 14 was not significantly different between the groups, and in fact showed a trend for higher scores in the GP group compared to the rDLD group. These findings contradict previous studies that found increased emotional problems from both parent- and self-report (e.g. Conti-Ramsden & Botting, 2008; Wadman et al., 2011a), and suggest that in non-clinical samples with participants who are at risk of DLD, depressive symptoms may not be associated with language difficulties, at least according to adolescents' own reports at age 14.

Self-reports of social functioning were also similar between groups. There was no significant difference in the prevalence of victimisation between groups at either time point, supporting Lindsay, Dockrell and Mackie's (2008) findings that demonstrated no difference in victimisation between groups of children with language difficulties, special educational needs, or their TD peers. There was also no evidence of group differences on the other self-report measures of social functioning, except for a significantly lower number of close friends at age 14 in the rDLD group. However, the rate of close friends for both groups at age 14 was over 90%, similar to previous reports for adolescents (Wadman,

Durkin, & Conti-Ramsden, 2011b). Importantly, despite the difference in number of friendships, both groups reported feeling satisfied with their friends, which contrasts previous reports of poorer quality friendships in DLD samples (Botting & Conti-Ramsden, 2008; Durkin & Conti-Ramsden, 2007). Social support has a strong association with mental health outcomes (Parker, Rubin, Erath, Wojslawowicz & Buskirk, 2015) and the finding that rDLD group participants are able to develop close friendships despite their language difficulties may account for the lack of group difference in self-reported depressive symptoms.

In contrast to self-report suggesting intact social functioning, the rDLD group received higher ratings of peer problems from teacher-reported SDQ at age 7. The group difference in teacher-reported peer problems is consistent with previous literature from longitudinal clinical samples, but again is lower in severity (Mok et al., 2014; St Clair et al., 2011). Different patterns of findings according to the informant is also common in the literature. For example, Lindsay and Dockrell (2012) reported teacher-ratings of peer problems in young people with DLD increasing from 12-16 years of age but self-reports of social functioning over the same period showed a more positive trend and were not significantly different from the norm. Lindsay, Dockrell and Strand (2007) also found different patterns of ratings between parent and teacher SDQs and suggested that context may play a role in teachers' ratings, which may account for the discrepancy between teacher-ratings and self-report in the current study.

On the other hand, the lack of group difference in self-reported social problems may be due to young people at risk of DLD having lower expectations about social relationships and being more content with their social situation, whereas parents and teachers expect equivalent social skills and friendships in these children as they find in children with typical language development. This has been demonstrated in previous research that shows adolescents with DLD perceive themselves to have adequate social functioning, similar to their TD peers (Wadman et al., 2011c). It is important to remember that social cognition abilities are still developing during this period (Blakemore, 2008) and as children progress through adolescence, their perception of social and emotional problems may be influenced by the general increased complexity of peer relations and their importance in shaping self-esteem and emotional wellbeing (La Greca & Harrison, 2005). More research into this age range should be encouraged to give adolescents an opportunity to report their own experiences and allow for greater insight into these issues.

Finally, teacher-reported peer problems at age 7 were found to partially mediate the relationship between language difficulties at age 5 and parent-reported emotional problems at age 7 and age 14, supporting previous research that found peer problems predict concurrent depressive symptoms at age 16 (Wadman et al., 2011a). These findings suggest that early language difficulties limit social interactions, leading to peer problems and increased emotional problems in both middle childhood and adolescence. Therefore, individuals with better relationships with peers may be somewhat protected from emotional problems even with substantial language difficulties. This should be considered by speech and language therapists as using a therapy approach that integrates language and social understanding may lead to an improvement in emotional outcomes.

However, it should be noted that peer problems only partially mediated the relationship, suggesting that there are other factors involved. Indeed, when emotional problems at age 7 were controlled for, the relationship between language difficulties and emotional problems at age 14 was not significant. This suggests that emotional problems at age 7 have a much greater influence on the relationship between language and emotional problems at age 14 and warrants further research. As emotional problems tend to decrease or stabilise in later adolescence (St Clair et al., 2011, 2012), it would be interesting to examine whether this pattern holds true for the current population cohort when later waves of the MCS are released. Additionally, other predictors such as social cognition (Conti-Ramsden & Botting, 2008) or early emotion regulation problems could be examined.

This study has both strengths and limitations. Analysing a population cohort, such as the MCS, allows for a large sample to be investigated without the potential overestimation of mental health problems that may arise from using a clinical cohort (Girard et al., 2016). The fact that the current study has partially replicated previous findings through parent- and teacher-report suggests that previous studies using clinical cohorts present a reliable picture of the emotional and social functioning of young people with DLD.

The longitudinal nature of the MCS also allows for different time points to be examined with a variety of informants. The SDQ is a standardised measure of social, emotional and behavioural functioning that is commonly used in the literature. The current study had access to both teacher-report and parent-report, which, along with self-report of social functioning and depressive feelings, allowed for a wider range of input into the

child's social and emotional functioning. Data collection was conducted at three time points, covering childhood and adolescence. Adolescence is under-researched in this area (Botting & Conti-Ramsden, 2008) and is a critical period to study when the risk for development of later psychiatric disorders is increased (Jones, 2013). Additionally, we used both parent report and a standardised test in the form of the BAS Naming Vocabulary subscale, which adds more weight to the rDLD grouping in the present study as performance on a singular test does not provide adequate information about whether the child has significant difficulties with language (Bishop & McDonald, 2009; Law, Rush, Schoon, & Parsons, 2009). Previous research using parent report of language difficulties has also found a positive relationship with social and emotional problems (Hughes et al., 2016). The distribution of 6.25% in the rDLD grouping was similar to the 7.58% prevalence of DLD found in a recent community study (Norbury et al., 2016) and similar patterns were found when the analyses were re-run with only parent report and BAS naming vocabulary as predictors, suggesting that the rDLD variable is an adequate measure of children who are at risk of developing DLD. Furthermore, the rDLD group appeared to fit the known risk factors for DLD, with a higher rate of males and a higher percentage of children below the poverty line (Tomblin et al., 1997). However, due to the nature of the cohort study it is impossible to determine whether all children included in this group would meet criteria for DLD if tested individually.

The GP control group used in this study was also a strength compared to previous research employing typically developing (TD) groups as comparison. A TD control group may hinder research by underestimating the level of emotional problems that are present in the comparison group and inflating the association between emotional problems and DLD by creating an artificially "clean" group without any difficulties (Fombonne, 2016). In the current study, the only exclusion criteria believed to be of importance for the GP group was language difficulty, as the presence of other disorders is a better representation of the general population.

One clear limitation when analysing secondary data, particularly a large cohort such as the MCS, is the potential for high attrition rates. However, this was taken into account by using the *svy* prefix for survey data in Stata (StataCorp, 2015), to adjust for weighting and attrition in the different waves as recommended for the MCS (Ketende & Jones, 2011). Additionally, there is less control over variables in secondary data compared to designing a study from the very beginning. For example, there is no measure of teacher-

rated peer problems at age 14 which would have been beneficial to compare to parent-reports of emotional problems at age 14. Furthermore, there was no standardised measure of social functioning reported by the young people in the study. Finally, in a data set this large, small differences can be classed as significant and without a suitable measure of effect size it is important to bear this in mind when interpreting the results. However, odds ratios (which allow comparison across findings) and confidence intervals are provided.

Conclusion

The rDLD group of children considered to be at risk of developing DLD was found to experience increased emotional and social difficulties compared to the general population group. However, these differences were noted by parents and teachers, but generally not by the children and adolescents themselves. Peer problems at age 7 were found to partially mediate the relationship between language difficulties at age 5 and emotional problems at age 14; however, this was not significant once emotional problems at 7 were controlled for. To the authors' knowledge, this is the first time that peer problems have been examined as a mediating factor in the relationship between language difficulties and emotional problems in a population cohort. However, these results are not based on a comprehensive assessment of language difficulties and therefore should be interpreted with caution. It is important to obtain a better understanding of the underlying mechanisms involved in the relationship between DLD and emotional problems in order for the most appropriate support to be given. Analysing a protective factor such as social functioning is beneficial as these results could have an impact on interventions. For example, the Social Communication Intervention Project (Adams et al., 2012) has demonstrated improvements in parent-reported social communication problems. Further research on the MCS is encouraged to investigate the full impact of emotional problems at age 7 and whether the mediating effect of peer problems at age 7 remains in later adolescence and adulthood.

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Chapter 2 Supplementary Materials

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Table 1.

Social functioning and emotional problems in Naming Vocabulary (NV) group and General Population (GP) group at age 7.

	NV (n = 787)	GP (n = 13,976)	All (n = 14,763)	DLD vs. GP
<i>Demographic variables at age 5</i>				
Age (Years; Months)	5;3.1	5;2.5	5;2.5	16.88(8.77, 24.99)***
Premature birth (< 37 week gestation) (%)	5.3	6.4	6.7	n.s.
Female (%)	37.9	47.4	46.8	.68(.56, .82)^***
Poverty Indicator (%)	69.7	29.0	31.0	5.86(4.60, 7.46)^***
BAS Pattern Construction at age 5	40.83 (.57)	50.80 (.19)	49.58 (.21)	-7.45(-8.45, -6.45)***
<i>Age 7 predictors</i>				
Best friend				n.s.
Yes (%)	94.7	94.8	94.7	-
No (%)	5.3	5.2	5.3	-
Number of friends				n.s.
Lots (%)	60.4	63.6	63.3	-
Some (%)	30.3	25.7	25.9	-
Not many (%)	9.3	10.8	10.8	-
Victim of bullying				n.s.
All of the time (%)	13.4	9.0	9.2	-
Some of the time (%)	36.4	39.5	34.5	-
Never (%)	50.2	51.5	51.3	-
Bully others				n.s.
All of the time (%)	6.5	2.6	2.8	-
Some of the time (%)	12.4	12.9	13.1	-
Never (%)	81.1	84.5	84.1	-
SDQ subscales				
Parent-rated Emotional problems	2.20 (.14)	1.52 (.02)	1.56 (.02)	.24(.11, .37)***
Close to Average (%) ^a	75.6	86.7	86.0	-
Slightly raised (%)	10.6	5.9	6.2	1.62(1.02, 2.58)*
High/Very High (%)	13.8	7.4	7.9	n.s.
Teacher-rated Peer problems	1.61 (.10)	1.31 (.02)	1.19 (.02)	.23(.10, .35)**
Close to Average (%)	77.1	83.5	82.6	-
Slightly raised (%)	13.8	11.6	11.9	n.s.
High/Very High (%)	9.1	4.8	5.5	1.64(1.06, 2.53)*

Statistics are *b* coefficients or odds ratio where marked ^ (95% confidence interval), controlling for poverty indicator (below 60% median income) and gender.

* $p < .05$ ** $p < .01$ *** $p < .001$

^a Proportion of each SDQ category by DLD and GP group, compared to the "Close to Average" reference category. "High" and "Very High" categories were combined into "High/Very High" given the low numbers in the "Very High" group.

Table 2.

Social functioning and emotional problems in Naming Vocabulary (NV) group and General Population (GP) group at age 14.

	All (n = 14,763)	GP (n = 13,976)	NV (n = 787)		Age 14 predictors
Close friends	1.82(1.06, 3.13)*	96.7	92.9	Yes (%)	
	-	3.3	7.1	No (%)	
Wellbeing grid	-1.15(-.23, -.07)***	2.11(.02)	1.85(.07)	Happiness with friends	
Victim of bullying ²	.47(.32, .69)***	11.2	5.9	All of the time (%)	
	-	10.1	5.4	Some of the time (%)	
	-	78.0	88.7	Never (%)	
Bully others ³	n.s.	2.7	1.8	All of the time (%)	
	-	4.6	2.7	Some of the time (%)	
	-	92.7	95.5	Never (%)	
SDQ subscale	.17(.05, .29)***	2.09 (.03)	2.62(.14)	Parent-rated Emotional problems	
	-	77.8	68.9	Close to Average (%) ^b	
	n.s.	7.8	11.2	Slightly raised (%)	
	n.s.	14.4	19.9	High/Very High (%)	
Mood and Feelings Questionnaire	-29(-.46, -.13)***	5.80 (.08)	4.12 (.30)		

Statistics are *b* coefficients (95% confidence interval), controlling for poverty indicator (below 60% median income) and gender.

* $p < .05$ ** $p < .01$ *** $p < .001$

a The scales for "Victim of bullying" and "Bully others" at age 14 were originally *Most days, About once a week, About once a month, Every few months, Less often and Never* but were recoded to remain consistent with the ratings at age 7.

^b Proportion of each SDQ category by DLD and GP group, compared to the "Close to Average" reference category. "High" and "Very High" categories were combined into "High/Very High" given the low numbers in the "Very High" group.

Table 3.

Social functioning and emotional problems in Parent Report (PR) group and General Population (GP) group at age 7.

	PR (n = 474)	GP (n = 15,003)	All (n = 15,477)	DLD vs. GP
<i>Demographic variables at age 5</i>				
Age (Years; Months)	5;1.8	5;2.1	5;2.5	-22.61(-32.24, -12.97)***
Premature birth (< 37 week gestation) (%)	6.2	6.3	6.7	n.s.
Female (%)	23.7	49.3	46.8	.32(.25, .41)^***
Poverty Indicator (%)	47.5	52.5	31.0	2.15(1.72, 2.69)^***
BAS Pattern Construction at age 5	40.80 (.97)	50.02 (.21)	49.58 (.21)	-5.61(-7.15, -4.07)***
<i>Age 7 predictors</i>				
Best friend				n.s.
Yes (%)	96.0	94.7	94.7	-
No (%)	4.0	5.3	5.3	-
Number of friends				n.s.
Lots (%)	57.3	63.4	63.3	-
Some (%)	27.8	25.9	25.9	-
Not many (%)	14.9	10.7	10.8	-
Victim of bullying				n.s.
All of the time (%)	13.3	9.1	9.2	-
Some of the time (%)	35.2	39.6	34.5	-
Never (%)	51.5	51.3	51.3	-
Bully others				n.s.
All of the time (%)	6.1	2.6	2.8	-
Some of the time (%)	9.3	13.1	13.1	-
Never (%)	84.6	84.3	84.1	-
SDQ subscales				
Parent-rated Emotional problems	2.24 (.13)	1.53 (.02)	1.56 (.02)	.34(.22, .47)***
Close to Average (%)	74.5	96.6	86.0	-
Slightly raised (%)	10.7	5.8	6.2	2.18(1.42, 3.34)***
High/Very High (%)	14.8	7.6	7.9	1.93(1.37, 2.73)***
Teacher-rated Peer problems	1.84 (.16)	1.17 (.03)	1.19 (.02)	.39(.22, .55)***
Close to Average (%)	68.3	83.0	82.6	-
Slightly raised (%)	21.4	11.4	11.9	2.13(1.43, 3.19)***
High/Very High (%)	10.4	5.5	5.5	1.94(1.14, 3.31)*

Statistics are *b* coefficients or odds ratio where marked ^ (95% confidence interval), controlling for poverty indicator (below 60% median income) and gender.* $p < .05$ ** $p < .01$ *** $p < .001$

Table 4.

Social functioning and emotional problems in Parent Report (PR) group and General Population (GP) group at age 14.

<i>Age 14 predictors</i>	PR (<i>n</i> = 474)	GP (<i>n</i> = 15,003)	All (<i>n</i> = 15,477)	DLD vs. GP
Close friends				2.33(1.23, 4.39) ^{^***}
Yes (%)	91.2	96.6	96.3	-
No (%)	8.8	3.4	3.7	-
Wellbeing grid				
Happiness with friends	2.16(.11)	2.11(.02)	2.11(.02)	n.s.
Victim of bullying ^a				n.s.
All of the time (%)	19.9	10.9	11.0	-
Some of the time (%)	3.1	10.8	10.2	-
Never (%)	77.0	78.3	78.8	-
Bully others ^a				n.s.
All of the time (%)	4.6	2.7	2.8	-
Some of the time (%)	3.2	4.5	4.4	-
Never (%)	92.2	92.7	92.8	-
SDQ subscale				
Parent-rated Emotional problems	2.67 (.17)	2.09 (.03)	2.14 (.03)	.28(.13, .43) ^{***}
Close to Average (%) ^b	64.5	78.0	77.1	-
Slightly raised (%)	14.0	7.6	8.0	2.45(1.60, 3.75) ^{***}
Very High (%)	21.5	14.3	14.9	1.90(1.24, 2.91) ^{**}
Mood and Feelings Questionnaire	5.39 (.44)	5.74 (.09)	5.72 (.08)	n.s.

Statistics are *b* coefficients (95% confidence interval), controlling for poverty indicator (below 60% median income) and gender.

* $p < .05$ ** $p < .01$ *** $p < .001$

^a The scales for “Victim of bullying” and “Bully others” at age 14 were originally *Most days, About once a week, About once a month, Every few months, Less often* and *Never* but were recoded to remain consistent with the ratings at age 7.

^b Proportion of each SDQ category by DLD and GP group, compared to the “Close to Average” reference category. “High” and “Very High” categories were combined into “High/Very High” given the low numbers in the “Very High” group.

Table 5. *Demographics of excluded participants in comparison to those included in the DLD sample.*

	Excluded from sample (n = 5,402)	Included in sample (n = 14,262)	Excluded vs. included
Age (Years; Months)	5;2.4	5;2.5	n.s.
Premature birth (< 37 week gestation) (%)	28.5	6.8	.45(.38, .54) ^{***}
Female (%)	52.2	49.4	.90(.81, .99) [*]
Poverty Indicator (%)	42.9	28.5	.53(.47, .60) ^{***}
BAS Pattern Construction at age 5	46.19 (.52)	50.82 (.18)	7.48(5.97, 9.00) ^{***}

Statistics are *b* coefficients or odds ratio where marked [^] (95% confidence interval).

* *p* < .05 ** *p* < .01 *** *p* < .001

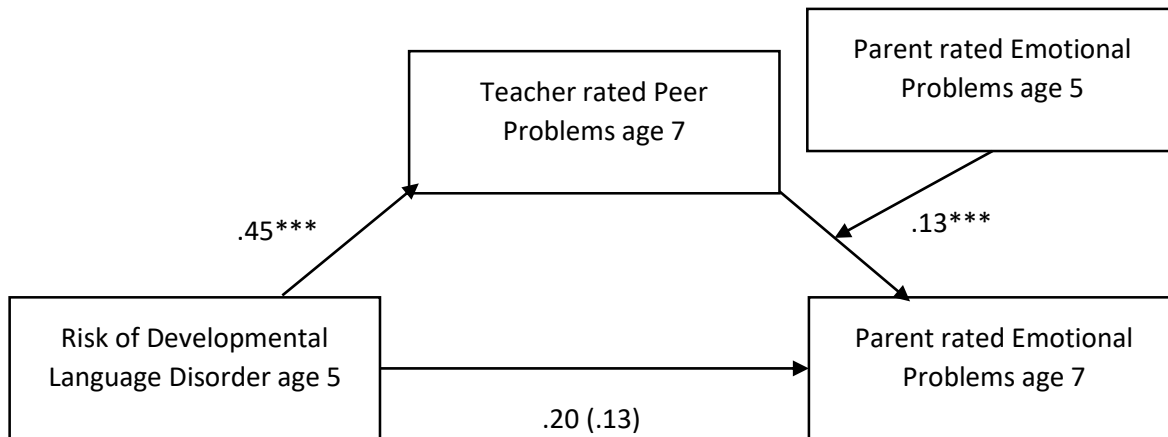



Figure 4. Regression coefficients for the relationship between risk of Developmental Language Disorder (rDLD) at age 5 and emotional problems at age 7 as mediated by peer problems at age 7, while controlling for emotional problems at age 5. The regression coefficient for the effect of rDLD grouping on emotional problems after controlling for peer problems is shown in parentheses.

This declaration concerns the article entitled:									
Social functioning as a mediator between Developmental Language Disorder (DLD) and emotional problems in adolescents.									
Publication status (tick one)									
draft manuscript	X	Submitted		In review		Accepted		Published	
Publication details (reference)	Forrest, C. L., Gibson, J. L., Halligan, S. L., & St Clair, M. C. (in preparation). Social functioning as a mediator between Developmental Language Disorder (DLD) and emotional problems in adolescents.								
Candidate's contribution to the paper (detailed, and also given as a percentage).	The candidate contributed to the formulation of ideas (50%) and considerably contributed to the design of methodology (70%). The candidate predominantly executed the experimental work, including the analysis and interpretation of the results (90%) and predominantly executed the presentation of the data in journal format (90%).								
Statement from Candidate	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature.								
Signed						Date	17/01/2019		

Chapter 3: Cross-sectional Study

Social functioning as a mediator between Developmental Language Disorder (DLD) and emotional problems in adolescents.

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Chapter rationale: Chapter 2 revealed that teacher-rated peer problems partially mediated parent-reported emotional problems in adolescents with language difficulties in a population cohort. These findings suggest that the increased rates of social and emotional difficulties reported in the literature from clinical cohorts are also found in population cohorts of children at risk of DLD (rDLD). Additionally, the results indicate that social difficulties in middle childhood may explain emotional problems in adolescence, demonstrating the influence of peer problems on emotional problems longitudinally in the rDLD group, even when reported by different informants. The mediation effect supports the premise of the Social Adaptation Model (SAM) discussed in Chapter 1, suggesting that external environmental factors, such as peer problems, may be implicated in the poor socioemotional outcomes in children and young people with language difficulties. However, it remains to be seen whether the same causal pathway is found in a clinically diagnosed sample of adolescents with DLD. Therefore, Chapter 3 aims to examine whether social functioning mediates emotional problems in a clinically-diagnosed sample of adolescents with DLD in a cross-sectional study. The benefit of conducting a cross-sectional study compared to secondary data analysis is that there is more control over the variables. Furthermore, Chapter 3 examines additional self-report measures of social and emotional functioning compared to Chapter 2 to provide a more comprehensive account of the difficulties that adolescents with DLD may face in these areas.

Abstract

Background: Adolescents with Developmental Language Disorder (DLD) are at risk for increased feelings of anxiety and depression compared to their typically developing (TD) peers. However, the underlying pathways involved in this relationship are unclear. Here we examine peer problems as a mediator of emotional problems in a cross-sectional sample of adolescents with DLD and age- and sex-matched controls. **Method:** Twenty-seven participants with DLD and 27 typical language developed (TLD) participants (11-17 years) were compared on self- and parent-reported measures of social functioning and emotional outcomes. The Sobel-Goodman test was used to examine the mediating effect of SDQ Peer Problems on Emotional Problems. **Results:** There were no significant group differences in self-report of social functioning and emotional outcomes, but parent-report of SDQ Peer Problems and Emotional Problems in the DLD group was significantly higher than in the TLD group. Parent-reported peer problems mediated parent-reported emotional problems, accounting for approximately 64% of the relationship between DLD status and emotional problems. **Conclusion:** Parents of adolescents with DLD, but not adolescents themselves, report significantly higher peer and emotional problems compared to TLD peers. Addressing peer problems may help to reduce emotional difficulties in this population. Further investigation into adolescents' perceptions of socioemotional difficulties should be examined.

Adolescence is a time of increased peer and emotional difficulties in general (St Clair et al., 2012), but individuals with developmental language disorder (DLD)¹ may struggle even more than their typically developing (TD) peers (St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). DLD is a difficulty with receptive and/or expressive language that cannot be accounted for by any other neurodevelopmental disorders, hearing impairments or global intellectual difficulties, and affects approximately 7-8% of the population (Norbury et al., 2016). Studies have shown that adolescents with a history of DLD are at increased risk for anxiety (Beitchman et al., 2001), depression (Conti-Ramsden & Botting, 2008) and social problems (Durkin & Conti-Ramsden, 2010) and that these difficulties persist throughout the life-span (Clegg, Hollis, Mawhood, & Rutter, 2005). However, it is still unclear what mechanisms are responsible for these additional socioemotional difficulties (Yew & O'Kearney, 2013). Given that adolescence is a critical period for the onset of later psychiatric problems (Jones, 2013) it is crucial to examine potential pathways to these increased emotional problems that may lead to better interventions and care.

There are conflicting findings about the extent to which language ability influences mental health outcomes in children and young people with DLD. Lindsay, Dockrell, and Strand (2007) found that language ability predicted teacher-ratings of socioemotional difficulties, but not parent-ratings. Similarly, St Clair et al. (2011) investigated pragmatic language skills and found that they predicted teacher-reported emotional problems at age 11. However, Conti-Ramsden and Botting (2008) did not find a direct link between language ability and self- or parent-report of emotional problems, and Lindsay and Dockrell (2012) found no association between earlier language abilities and teacher-rated socioemotional difficulties at age 16, suggesting that other factors may be involved. Wadman, Botting, Durkin, and Conti-Ramsden (2011a), for instance, found that peer problems linked to DLD predicted depression at age 16. There is a wide range of evidence suggesting that peer problems and victimisation lead to mental health difficulties in the general population (Arseneault, Bowes, & Shakoor, 2010; Hawker & Boulton, 2000) and indeed that social support can act as a protective factor against depression (van Harmelen

¹As recommended by a recent panel of experts, we have opted to use the term Developmental Language Disorder (DLD) instead of Specific Language Impairment (SLI) (Bishop et al., 2017). The definition remains the same as many recent definitions (in that diagnosis is no longer based on a discrepancy between verbal and nonverbal intelligence) and follows long-term studies' adoption of this term (e.g. Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018). Therefore, we refer to DLD throughout the paper when referencing older studies that discuss children with expressive or receptive language difficulties with no known cause.

et al., 2016); therefore, this area warrants further investigation. Due to the increase in social problems in adolescents with DLD (Lindsay & Dockrell, 2012; St Clair et al., 2011), and in line with the Social Adaptation Model (Redmond & Rice, 1998), we propose that social functioning may be mediating the relationship between DLD status and emotional problems in this population.

Social functioning is defined in this paper as quality of friendships and social activities, assessing both positive and negative aspects to provide a comprehensive picture of adolescents' abilities. It is clear that language plays an integral role in social functioning, with verbal skills being necessary for effective interactions even from a very young age. For example, Longobardi, Spataro, Frigerio, and Rescorla (2016) found that language ability significantly predicted social competence in typically developing children aged 18-35 months. Furthermore, those who were 'late-talkers' demonstrated lower social competence than their age-matched peers. These verbal skills may play an even larger role in adolescence as peer relationships become more complex and move away from the play-based activities of childhood. Therefore, it is logical to assume that children and young people with DLD will have more difficulties with friendships and social skills due to their communication impairment. According to the Social Adaptation Model (SAM; Redmond & Rice, 1998) children and young people with DLD alter their behaviour due to a combination of their language difficulties, the verbal demands of the situation and the biases of people around them. Thus, their impaired language skills may hinder them from approaching others, with teachers rating students with language difficulties as more withdrawn than their typically developing classmates (Hart, Fujiki, Brinton, & Hart, 2004; Maggio et al., 2014) and observational studies demonstrating children with DLD struggle to initiate conversation with their peers (Brinton, Fujiki, Spencer, & Robinson, 1997). In turn, these limited social interactions could exacerbate social problems by providing fewer opportunities to learn and practice social skills, leading to a depleted social repertoire from which to draw upon in future interactions (Crick & Dodge, 1994). For example, children with DLD have difficulty with conflict resolution tasks (Bakopoulou & Dockrell, 2016) and may struggle with dissembling emotions to protect others' feelings (Brinton, Fujiki, Hurst, Jones, & Spackman, 2015; Brinton, Spackman, Fujiki, & Ricks, 2007).

These difficulties with social skills could have negative consequences for individuals' social standing, as children with DLD receive more "dislike" ratings than their typically developed peers (Andres-Roqueta, Adrian, Clemente, & Villanueva, 2016;

Gertner, Rice, & Hadley, 1994). Children and young people with DLD are consistently rated by different informants (e.g. parent, teacher and self) as experiencing more peer problems than others their age (Conti-Ramsden, Mok, Pickles, & Durkin, 2013; Lindsay et al., 2007; Mok, Pickles, Durkin, & Conti-Ramsden, 2014). These poor peer relations could develop into victimisation, which children with DLD have been found to be at increased risk for compared to their typically developing peers (van den Bedem, Dockrell, van Alphen, Kalicharan, & Rieffe, 2018) and compared to those with other developmental disorders such as Attention Deficit Hyperactivity Disorder (Redmond, 2011). However, there is conflicting evidence as Lindsay, Dockrell and Mackie (2008) found similar rates of victimisation in children with DLD to their TD peers and to those with other learning disabilities. These findings demonstrate that their language difficulties, coupled with social difficulties, put children and young people with DLD at increased risk for peer problems and victimisation.

The overall lower social competence experienced by children and adolescents with DLD may have detrimental effects on their mental health. For instance, findings from the general population demonstrate poor social competence at 4 years of age predicts later internalising and externalising problems at 10 and 14 years of age (Bornstein, Hahn, & Haynes, 2010). Victimisation has also been shown to predict behaviour problems in children with DLD but not in their TD peers (Knox & Conti-Ramsden, 2007). Higher rates of emotional problems have been found in adolescents with DLD compared to their TD peers (Conti-Ramsden & Botting, 2008) and there is evidence to suggest that peer relations predict concurrent depressive symptoms (Wadman et al., 2011a). Indeed, some adolescents with DLD report higher feelings of social stress (Wadman, Durkin, & Conti-Ramsden, 2011b) and social phobia (Voci, Beitchman, Brownlie, & Wilson, 2006), highlighting the psychological impact of poor social competence. In order to unravel this relationship further, researchers have examined potential mediating factors that may explain the association between DLD and poor socioemotional outcomes. For example, shyness has been found to mediate the relationship between language ability and self-esteem in adolescents and young adults with DLD (Durkin, Toseeb, Botting, Pickles, & Conti-Ramsden, 2017; Wadman, Durkin, & Conti-Ramsden, 2008), highlighting the link between sociability and mental health.

Longitudinal studies have demonstrated that social and emotional problems in young people with DLD persist throughout development, with some finding an increase in

peer problems in adolescence (Lindsay & Dockrell, 2012; St Clair et al., 2011). However, the mechanisms involved in this relationship are unclear given the conflicting reports of the influence of language ability. Furthermore, while these longitudinal studies examine the developmental trajectories of socioemotional difficulties in children and adolescents with DLD they often do not include a comparison group of typically developing individuals to fully investigate the mechanisms involved. Added to the fact that adolescence is a critical time for the onset of later psychiatric disorders (Jones, 2013), this is a key period to study. The current paper will examine an adolescent sample and use both self-report and parent-report to give a comprehensive overview of the difficulties that young people with DLD may face, in comparison to an age- and sex-matched control group with typical language development. It is expected that adolescents with DLD will experience higher levels of emotional problems than their age- and sex-matched peers, as reported by their parents and themselves. In addition, it is hypothesised that the young people with DLD will report fewer successful experiences of social functioning than the control group, as evidenced by higher rates of victimisation and lower perceived social support. Furthermore, poorer social functioning is expected to mediate the relationship between language ability and emotional outcomes.

Method

Participants

There were two recruitment streams for the study; participants with a diagnosis of DLD were recruited through referrals from professionals and online support groups, whereas a screening procedure identified the TLD comparison group. Any participants with a history of language difficulties identified through the screening procedure were included in the DLD group. All participants attended mainstream schools, although three participants were recruited from a specialised language unit within a mainstream school. Exclusion criteria consisted of parent-report of hearing impairments, intellectual disabilities and diagnoses of autism spectrum conditions. The Autism Quotient (AQ; Baron-Cohen, Hoekstra, Knickmeyer, & Wheelwright, 2006; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) was also included as an exclusionary measure. Sixteen participants were excluded due to exceeding the cut-off on the AQ.

Participants were included in the DLD group if they were aged 11-18 years old, native English speakers and had a history of DLD. Participants were recruited either through referrals from a local speech and language therapy service employed by the local authority to provide services to schools, referrals from Special Educational Needs Coordinators (SENCOs) within schools, or from flyers posted in online support groups for DLD. Forty individuals with a diagnosis of DLD were initially identified as potential participants via these routes. Four participants did not respond to invitation emails. One participant was excluded due to a hearing impairment, twelve participants were excluded due to a diagnosis of autism or exceeding the cut-off on the AQ and one participant withdrew from the study.

A screening procedure was used to recruit typical language developed (TLD) participants matched on age (within six months) and sex. Participants were recruited from flyers displayed in local schools, at the University of Bath or on social media. Screening packs consisting of background questionnaires for parents and self-report measures of language and communication skills for participants were sent to 258 participants, of which 109 were completed by both parent and participant. Participants who were matched on age and sex to the DLD group were invited to the testing stage. Five participants with parent report of language difficulties, including one participant with a low score on the self-report measure (CC-SR – see methods), were identified through the screening procedure and were included in the DLD group. Thus, twenty-seven participants were invited to the testing stage as part of the DLD group, with twenty-seven matched controls forming the TLD group. One further participant was excluded after scoring more than 2 SDs below the mean on the nonverbal IQ measure. This resulted in a total sample of 26 adolescents with DLD and 27 TLD participants matched on age and sex. Further details of the sample characteristics are included in the results section.

Measures

Parent/guardian-reported questionnaires for direct recruitment and screening sample.

Background questionnaire. This was designed for the current study and consisted of twenty-four questions regarding the child's early development and language spoken at home. Questions included the speed at which developmental milestones in language, motor skills and self-help were met and whether the child had any learning difficulties (suspected

or diagnosed), including specific difficulties in language development. Family history of learning difficulties and mental health difficulties (suspected or diagnosed) was also asked, with the latter providing information about parental psychological distress. Postcode information was also gathered which provided a measure of socioeconomic status based on the Income Deprivation Affecting Children Index (IDACI) Rank. The IDACI Rank is based on the percentage of children living in families that are income deprived in Lower-layer Super Output Areas (LSOAs) across England, where 1 = most deprived neighbourhood and 32,844 = least deprived neighbourhood. School postcodes were used when home postcodes were missing (n = 5) and two participants in the DLD group had neither information available.

The Strengths and Difficulties Questionnaire (SDQ). The parent report form of the SDQ (Goodman, 1997) consists of 25 items which form five scales (Peer Problems; Emotional Problems; Hyperactivity; Conduct Problems and Prosocial scale), the first four of which are totalled to produce the Total Difficulties score. Each item is rated on a scale of *Not True*, *Somewhat True* and *Certainly True* with scores of 0, 1 or 2 assigned to each rating respectively. The SDQ is a well-established measure with a test-retest reliability of .85 (Goodman, 1999) and acceptable reliability ($\alpha = .73$; Goodman, 2001). The scales of interest were the Emotional Problems and Peer Problems subscales, each consisting of five items. Total scores for each subscale range from 0-10 with a higher score indicating more problems.

The Autism Spectrum Quotient (AQ). The adolescent version of the AQ was administered to parents of children aged 12-15 years old (Baron-Cohen et al., 2006), while the adult version was completed by participants aged 16 years or over (Baron-Cohen et al., 2001). Both scales consist of 50 items referring to the domains of: social skills (e.g. “I prefer to do things with others rather than on my own”); attention switching (e.g. “I prefer to do things the same way over and over again”); attention to detail (e.g. “I often notice small sounds when others do not”); communication (e.g. “Other people frequently tell me that what I’ve said is impolite, even though I think it is polite”) and imagination (e.g. “I find making up stories easy”). Items are rated as ‘Definitely agree’, ‘Slightly agree’, ‘Slightly disagree’ or ‘Definitely disagree’ and responses that endorse autistic-like

behaviours are scored 1 point. A sum score of 30 or more on the parent-report, or 32 or more on the self-report is classified as a cut-off for ASD symptoms, and was used as an exclusion criterion for participants in the current study.

Adolescent-reported questionnaire for screening sample only.

The Communication Checklist Self-Report (CC-SR). The CC-SR (Bishop, Whitehouse & Sharp, 2009) was completed by the participant. This questionnaire consists of 70 questions about communication abilities. The participant rated the items on a scale of 0 – Less than once a week (or never); 1 – About once a week; 2 – Once or twice a day or 3 – Several times a day (or all the time). These items form three composite scales. The Structural Language composite describes aspects of language such as grammar and meaning. For example, “I mix up ‘he’, ‘she’, ‘it’ and ‘they’” and “I use short sentences”. The Pragmatic Skills composite contains items relating to language use in social contexts. For instance, “People tell me I talk too much” and “I give detailed information when a more general comment would be fine”. Finally, the Social Engagement composite is comprised of items regarding nonverbal communication and social functioning. For example, “I feel anxious when I am with other people” and “I find it hard to know when people are upset or annoyed”. Positive items are reverse scored and a scaled score lower than 5 on the Structural Language composite and greater than 7 on the Pragmatic Skills composite is indicative of DLD ($M = 10$, $SD = 3$). Internal consistency for each of the composites is greater than .85 (Bishop, Whitehouse & Sharp, 2009).

Adolescent assessment.

Cognitive measures.

Clinical Evaluation Language Functioning – 4 (CELF-4). In order to measure language ability, two subtests from the CELF-4 (Semel, Wiig, & Secord, 2006) were administered. The Recalling Sentences subtest requires participants to listen to sentences of increasing length and complexity and repeat verbatim, providing a measure of expressive language. The Word Classes subtest requires participants to pick two words out of a list of four that are best matched and provide a definition for how the two words are similar. This subtest provides a measure of receptive language abilities in the current study. Both

subtests have an excellent rating of reliability ($\alpha = .92$ and $.91$ respectively; Semel, Wiig & Secord, 2006).

Wechsler Intelligence Scale for Children (WISC). The Block Design subtest was administered to provide a measure of nonverbal ability (Wechsler, 2004). This task requires participants to use 3D blocks to recreate 2D patterns of increasing complexity. Block Design is a measure of spatial awareness and contributes to fluid reasoning. Participants scoring more than 2 SDs below the mean ($M = 10$, $SD = 3$) were excluded from the study.

Adolescent-reported social functioning outcomes.

Friendship and victimisation questions. Questions about relationships with peers ('Do you have any best friends?' 'How often do you argue with your friends?'); victimisation (How often do other children hurt you or pick on you on purpose?) and bullying ('How often do you hurt or pick on other children on purpose?') were adapted from the "Your Friends" section of the fifth wave of the Millennium Cohort Study (University of London, 2018). The victimisation and bullying questions were rated on scales of *Most days*, *About once a week*, *About once a month*, *Every few months*, *Less often* and *Never*. Some scales were combined due to low frequency of responses (less than 5% of the total sample). For instance, on the victimisation item *About once a month* (3.8%) and *Every few months* (1.9%) were combined into *About once a month*, while *Most days* (1.9%) and *Less often* (13.2%) on the bullying item were combined into the new category of *Occasionally*.

Perceived Social Support – Friendship (PSS-Fr). The PSS-Fr (Procidano & Heller, 1983) consists of 20 statements about friendship quality and measures how well participants believe their support needs are met by their relationships with friends. Participants answer *Yes*, *No* or *Don't Know* depending on how true they feel each statement is. Ratings of 'Yes' are scored 1 while ratings of 'No' and 'Don't Know' receive scores of 0. The PSS-Fr has good internal consistency ($\alpha = .88$) and items are summed to create a total score ranging from 0-20, with a higher score indicating higher perceived social support (Procidano & Heller, 1983).

Adolescent-reported emotional outcomes.

Warwick Edinburgh Mental Well-being Scale (WEMWBS). The WEMWBS (Tennant et al., 2007) consists of 14 items focusing on positive attributes, and previous research indicates this is both a good measure of mental wellbeing as well as mental health difficulties (St Clair et al., 2017). Participants rate statements on a scale of 1 *None of the time* – 5 *All of the time*, according to how they felt in the past two weeks. Scores range from 14-70 with a higher score reflecting a better state of mental wellbeing. Internal consistency is good or excellent, ranging from $\alpha = .89$ to $.91$ based on university student and population samples (Tennant et al., 2007).

Revised Children's Manifest Anxiety Scale (RCMAS). The RCMAS (Reynolds & Richmond, 1978) consists of 28 statements regarding feelings of anxiety. The current study uses an adapted four-category version from St Clair et al. (2017) where participants are asked to rate each item according to how they have been feeling in the past two weeks on a scale of 'Never', 'Sometimes', 'Mostly' and 'Always'. Answers were assigned scores of 0-4 respectively, resulting in a total score ranging from 0-84. A higher score indicates more feelings of anxiety. Internal consistency for this study was excellent ($\alpha = .94$).

Mood and Feelings Questionnaire (MFQ). The MFQ (Costello & Angold, 1988) consists of 33 statements that measure depressive thoughts and feelings over the last two weeks. The current study uses an adapted four-category version obtained from St Clair et al. (2017), where participants respond to each item how often they have felt or acted in this way over the past two weeks on a scale of 'Never', 'Sometimes', 'Mostly' and 'Always'. Scores of 0-4 are assigned to each rating, resulting in a total score ranging from 0-99, with higher scores indicating more depressive symptoms. Internal consistency for this study was excellent ($\alpha = .94$).

Procedure

Ethical approval was granted by the University of Bath Psychology Ethics Committee (REF: 15-245). Questionnaires were hosted online (Qualtrics.com) or

administered via paper copy. Informed consent and assent was obtained from parents/guardians and participants. Parents/guardians in the DLD group completed the consent, background questionnaire, AQ and SDQ online or returned the forms in a freepost envelope. Participants from the DLD group were then invited to the assessment stage either at the University, their school or their home. Participants who were recruited through schools gave assent and were screened with the CC-SR while their parents gave consent and completed the SDQ and AQ. In order to reduce time and encourage screening completion a shortened version of the background questionnaire was administered to parents/guardians during this stage. Any participants from this screening group meeting the DLD criteria on the CC-SR or a history of language difficulties as reported in the background questionnaire were invited to the assessment stage and included in the DLD group. Those that had no language difficulties were individually matched on age (within six months) and sex to form the comparison group. Again, the assessment stage was completed wherever was convenient for the participant. Parents/guardians recruited through screening completed online consent forms for the assessment stage, along with the remaining background questionnaire. Participants completed online assent forms at the beginning of the assessment. Participants were administered the two language tasks, the four socioemotional questionnaires and the Block Design task. The tasks in the current paper were part of a larger study lasting 1.5 hours in total. In the event of a participant reporting suicidal ideation on the MFQ a safety protocol was followed which involved a structured interview to ascertain how often the participant experienced those feelings and whether or not they were likely to act upon them. The participant's parent was notified of these findings and was sent a referral letter for their GP. Participants received £15 on completion of the assessment stage and any travel expenses were reimbursed. As an incentive to complete the screening process participants recruited through this manner were entered into a prize draw to win a £50 shopping voucher. Brief reports of individuals' results were sent to parents/guardians and findings from the overall study were shared with parents/guardians in the form of a newsletter.

Statistical analysis

Stata 14 (StataCorp., 2015) was used to analyse the data. Instead of analysing language as a construct, participants were categorised into groups of DLD and TLD status for two reasons. Firstly, children with DLD have disordered language development, not simply a delay, with the majority of the literature investigating DLD and associated

socioemotional difficulties examining DLD as an entity based on a clinical cut-off and parental report of poor language functioning (Bishop et al., 2016). Secondly, previous research has suggested an absence of a linear relationship between language ability and severity of socioemotional problems (Fujiki, Brinton, & Clarke, 2002; Hart et al., 2004), therefore analysing language ability as a continuous scale was not deemed useful. Following tests for assumptions, chi squares and ordered logistic regression were used to analyse group differences in the demographic variables. The variables of age and IDACI Rank were significantly skewed and therefore transformed before running regression analyses. Measures of Spatial Reasoning (Block Design subtest) and Receptive Language (Word Classes – Receptive subtest) were also significantly skewed and transformed before regression analysis. In each case, the *ladder* function in Stata was used to determine the most appropriate transformation. As the friendship and victimisation questions were categorical variables, ordered logistic regression was used to compare group differences while controlling for sex, age and mean IDACI Rank (a measure of socioeconomic status). Group differences in WEMWBS and PSS-Fr were analysed using regression, while the variables of RCMAS, MFQ and SAS-A were transformed due to significant skew before regression analysis. Group differences in the SDQ subscales of Peer Problems and Emotional Problems were analysed using negative binomial regression due to the most frequent responses being zero. The mediating effect of social functioning was analysed using the *sgmediation* command in Stata, which tests the significance of indirect effects, and bootstrapping with case resampling was used to generate confidence intervals. Both of these methods are recommended by Preacher and Hayes (2004) as a more robust measure of mediation. Covariates of age, sex and socioeconomic status (measured by IDACI Rank) were included in all analyses.

Results

Demographics

The total sample had an average age of 13 years and 6 months ($SE = 2.26$ months) and approximately 36% were female. English was the only language spoken at home the majority of the time, although one participant in the DLD group spoke German as well, and two participants in the TLD group also spoke German and Spanish. As expected, the DLD group were significantly more delayed in speech and language development compared to the TLD group. They were also more delayed in reaching early self-help

milestones compared to the TLD group. Level of parental education significantly differed between the two groups, with more parents in the TLD group completing postgraduate studies compared to the DLD group. Additionally, the DLD group had a significantly lower socioeconomic status as measured by the Income Deprivation Affecting Children Index (IDACI) Rank. In the current sample, the IDACI Rank ranged from 303 to 32662 in the DLD group and from 13021 to 32489 in the TLD group, with an overall group mean of 22388.47 ($SE = 1030.57$). On average, the TLD group consisted of individuals from less deprived areas than the DLD group.

Demographics of sample.

Table 1.

	DLDD (n = 26)	TLDD (n = 27)	Total (n = 53)	DLDD vs TLDD
Mean age in yrs:months (SE months)	13;6 (3.15)	13;6 (3.30)	13;6 (2.26)	--
Female %	34.6	37.0	35.8	$\chi^2_{.03}$
Language spoken				$\chi^2_{.31}$
English only %	96.2	92.6	94.3	
English plus other %	3.8	7.4	5.7	
Motor development				.49(.15, 1.59) $\sqrt{}$
Delayed %	26.9	3.7	15.01	
Typical %	53.8	81.5	67.9	
Fast %	19.2	14.8	17.0	
Speech and language development				.05(.01, .21) $\sqrt{***}$
Delayed %	69.2	7.4	37.7	
Typical %	26.9	70.4	49.1	
Fast %	3.8	22.2	13.2	
Self-help development				.17(.05, .63) $\sqrt{***}$
Delayed %	46.2	3.7	24.5	
Typical %	42.3	85.2	64.2	
Fast %	11.5	11.1	11.3	
Biological parents				$\chi^2_{2.25}$
Yes %	92.0	100.0	96.2	
No – adopted %	8.0	0	3.8	
Parental marital status				3.85(.89, 16.55) $\sqrt{}$
Married %	68.0	88.9	78.8	
Separated %	16.0	7.4	11.5	
Divorced %	16.0	3.7	9.6	
Parental psychological distress ^a				$\chi^2_{.01}$
Yes %	16.0	14.8	15.4	
No %	84.0	85.2	84.6	
Parental education				.19(.06, .58) $\sqrt{***}$
Secondary school %	44.0	18.5	30.8	
Diploma %	12.0	0	5.8	
Undergraduate degree %	36.0	44.4	40.4	
Postgraduate degree %	8.0	37.0	23.1	
Mean IDACI Rank ^b (SE)	19602.17 (1640.43)	24865.19 (1113.82)	22388.47 (1030.57)	-6.789-1.21-1.42) $\sqrt{**}$

Statistics are *b* coefficients or odds ratio where marked $\sqrt{}$ (95% confidence interval) and chi square where marked χ^2 . Regressions for age and IDACI Rank are performed on transformed data.

^a As measured by endorsement of suspected or diagnosed mental health difficulties in background questionnaire.

^b n = 51.

Cognitive and Language Measures

Table 2 illustrates that there was a significant group difference on all cognitive and language measures. The DLD group scored significantly lower on the Block Design subtest, $b = -67.64$, [CI = -100.68, -34.60], $p < .001$. However, it should be noted that the overall mean score for the DLD group was still within the normal range for the Block Design subtest ($M = 10$, $SD = 3$). As expected, the DLD group performed significantly worse than the TLD group on the measure of expressive language, $b = -4.71$, [CI = -6.53, -2.89], $p < .001$ and on the measure of receptive language, $b = -1.10$, [CI = -1.40, -.80], $p < .001$.

Table 2.

Mean (SD) scaled scores from cognitive and language tasks for the Developmental Language Disorder (DLD) group and Typical Language Developed (TLD) group.

	DLD (n = 26)	TLD (n = 27)	DLD vs TLD
Spatial Reasoning ^a	8.15 (2.84)	11.89 (2.47)	-67.64(-100.68,-34.60)***
Expressive Language ^b	4.92 (2.92)	9.93 (2.96)	-4.71(-6.53,-2.89)***
Receptive Language ^c	6.04 (2.92)	13.00 (2.39)	-1.10(-1.40,-.80)***

Statistics are b coefficients (95% confidence interval), controlling for age, sex and IDACI Rank. Regressions for Spatial Reasoning and Receptive Language are performed on transformed data.

^a Wechsler Intelligence Scale for Children – fourth edition UK (WISC-IV) Block Design subtest.

^b Clinical Evaluation of Language Fundamentals – fourth edition UK (CELF-4) Recalling Sentences subtest.

^c Clinical Evaluation of Language Fundamentals – fourth edition UK (CELF-4) Word Classes – Receptive subtest.

***. $p < .001$

Social and Emotional Outcomes

Table 3 shows the social outcomes in each group from self- and parent-report. There was a significant group difference in membership of social clubs, with fewer participants in the DLD group attending social clubs compared to the TLD group. There were no significant group differences in report of best friends or frequency of arguments with friends. Participants in the DLD group reported being bullied more frequently than the TLD group, whereas the TLD group reported more incidences of bullying others than the DLD group but these differences were not statistically significant. The DLD group and TLD group reported receiving similar levels of social support from their friends. As

expected, the DLD group received significantly higher ratings than the TLD group on the parent-rated SDQ subscale of Peer Problems.

Table 3.

Mean (and standard error) ratings of social functioning outcomes from self-report and parent-report.

	DLD	TLD	DLD vs TLD	Cohen's <i>d</i> [95% CI]
<i>Self-report</i>				
Best Friend				
Yes (%)	84.6	63.0	.28[.06,1.31]^, <i>ns</i>	-
No (%)	15.4	37.0		
Argue with friends			2.37[.73, 7.53]^, <i>ns</i>	-
At least once a month (%)	15.4	11.1		
Less often (%)	30.8	66.7		
Never (%)	53.8	22.2		
Member of social clubs			12.71[1.30,124.29]^* [*]	-
Yes (%)	65.4	96.3		
No (%)	34.6	3.7		
Victim of bullying			.48[.15, 1.48]^, <i>ns</i>	-
Most days (%)	19.2	3.7		
About once a week (%)	15.4	7.4		
About once a month (%)	3.8	7.4		
Less often (%)	23.1	29.6		
Never (%)	38.5	51.9		
Bully others			4.34[.63,29.99]^, <i>ns</i>	-
Occasionally (%)	7.7	22.2		
Never (%)	92.3	77.8		
Perceived Social Support – Friendship Scale (PSS-Fr)	11.15 (.73)	11.22 (.51)	-.09[-1.97, 1.80], <i>ns</i>	-
<i>Parent-report</i>				
SDQ Peer Problems	3.31 (.50)	1.04 (.30)	1.04[.34, 1.73]**	-1.09[-1.67, -.51]

Statistics are *b* coefficients or odds ratio where marked ^ [95% confidence interval], controlling for age, sex and IDACI Rank.

SDQ Peer Problems = Strengths and Difficulties Questionnaire (SDQ) Peer Problems subscale.

***p* < .01, **p* < .05

Table 4 demonstrates self-report and parent-report of emotional outcomes in each group. Self-reports of anxiety and depression were higher in the DLD group compared to the TLD group, but these differences were not significant. Similarly, the DLD group reported lower feelings of mental wellbeing than the TLD group but this was not a statistically significant difference. However, as expected, the DLD group received

significantly higher ratings than the TLD group on the parent-rated SDQ subscale of Emotional Problems.

Table 4.

Mean (and standard error) ratings of mental health outcomes from self-report and parent-report.

	DLD	TLD	DLD vs TLD	Cohen's <i>d</i> [95% CI]
<i>Self-report</i>				
Warwick Edinburgh Mental Wellbeing Scale (WEMWBS)	51.96 (1.82)	54.22 (1.26)	-1.96[-6.86, 2.94], <i>ns</i>	.28[-.26, .82]
Revised Children's Manifest Anxiety Scale (RCMAS)	20.54 (3.09)	12.93 (2.03)	.80[-.22, 1.83], <i>ns</i>	-.57[-1.16, .02]
Moods and Feelings Questionnaire (MFQ)	14.65 (2.77)	9.00 (1.82)	.42[-.68, 1.53], <i>ns</i>	-.47[-1.07, .12]
<i>Parent-report</i>				
SDQ Emotional Problems	3.54 (.58)	1.63 (.40)	.92[.30, 1.55]**	-.75[-1.30, -.20]

Statistics are *b* coefficients [95% confidence interval], controlling for age, sex and IDACI Rank. Regressions for RCMAS and MFQ are performed on transformed data.

***p* < .01

Social Functioning as a Mediator

The association between DLD and parent-reported emotional problems was mediated by parent-reported peer problems. Figure 1 illustrates that DLD group status predicted parent-rated peer problems, and these peer problems were significantly related to emotional problems. The effect of DLD on emotional problems was not significant after controlling for peer problems, consistent with full mediation. A Sobel-Goodman test, $z = 2.54$, $SE = .52$, $p < .05$, found that approximately 64% of the relationship between DLD and emotional problems was mediated by peer problems.

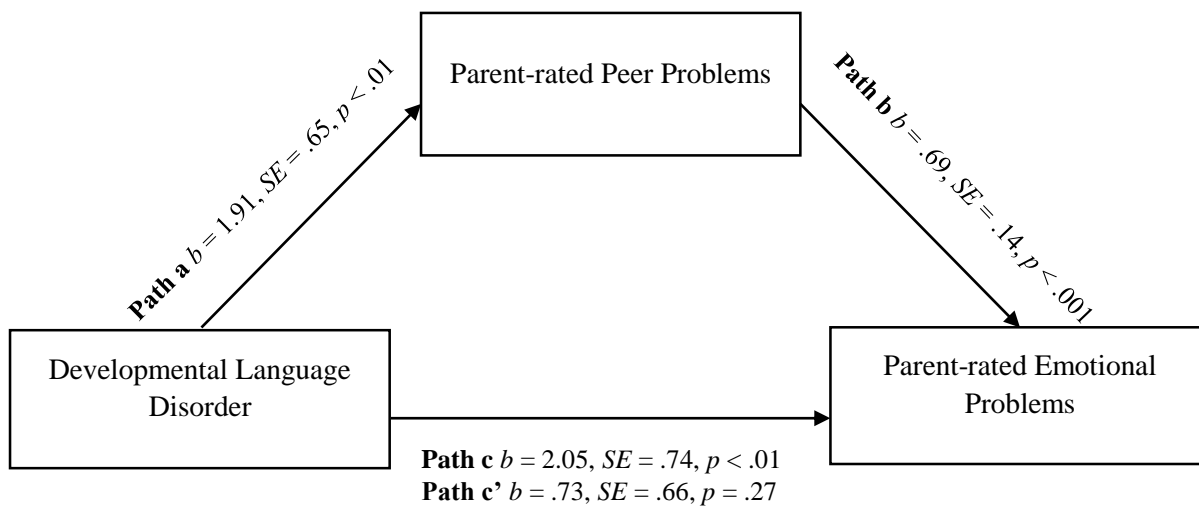


Figure 1. Regression coefficients for the relationship between Developmental Language Disorder (DLD) and parent-rated emotional problems as mediated by parent-rated peer problems.

Discussion

The current paper examined social functioning differences as a potential mediator of emotional problems in adolescents with DLD. By using a mediation analysis in an adolescent sample matched on age and sex, we aimed to further the research into the pathways involved in the relationship between language difficulties and poor emotional outcomes in this population. Furthermore, by using self-report and parent-report of social and emotional problems, we aimed to provide a comprehensive account of the additional difficulties that adolescents with DLD may face as self-reports in this area are not as frequently examined as parent or teacher reports (Conti-Ramsden et al., 2013).

Contrary to expectations, the DLD group and TLD group were largely similar in their self-report of social functioning, with the only significant difference being a smaller proportion of the DLD group attending social clubs compared to the TLD group. This could reflect a greater difficulty in facilitating group interactions and socialising with others that is seen in children and young people with DLD (Brinton, Fujiki, Spencer, & Robinson, 1997; Voci et al., 2006; Wadman et al., 2011b). Both groups reported similar rates of arguing with their friends and there was no significant difference in reports of victimisation or bullying others, similar to the findings from Lindsay et al. (2008).

Furthermore, both groups reported experiencing similar levels of social support from their friendships, and the majority of each group reported the presence of a best friend. These findings are consistent with Wadman et al. (2011b) who found no significant difference between adolescents with and without DLD in perceived social competence or acceptance amongst peers. Moreover, longitudinal research has highlighted that not all adolescents with DLD have peer problems, with approximately a third of the cohort reporting no difficulties or having peer problems resolved by adolescence (Mok et al., 2014).

While these non-significant results are encouraging in that adolescents with DLD do not appear to be experiencing higher rates of social difficulties compared to their TLD peers, it is important to consider alternative interpretations given that the majority of previous literature suggests adolescents with DLD are at greater risk for social difficulties. Admittedly, both Wadman et al. (2011b) and the current study used small samples of 28 or 26 adolescents with DLD compared to the larger samples from the Manchester Language Study (MLS) cohort which found significant group differences in self-report of social difficulties (Conti-Ramsden et al., 2013; Durkin & Conti-Ramsden, 2007). However, it should also be noted that the MLS papers used the SDQ self-report of peer problems whereas the current study and Wadman et al. (2011b) used more positive measures of social competence and support. Specifically, the SDQ taps into problems with peer relationships such as playing alone or being bullied by others, while the PSS-Fr provides more insight into the quality of friendships and how much emotional support is shared. This difference in measurement of social functioning may explain the difference in findings.

Conversely, it may be that reports of a 'best friend' in the current study indicate one close friend, but not a larger group of friends. Indeed, many participants in the TLD group asked for clarification on this item as they could not choose only one best friend out of their friendship group. Moreover, it is of note that there was a significant difference in parent-report of peer problems between groups. This discrepancy between parent- and self-report could be indicative of a difficulty with conceptualising social competence in adolescents with DLD. For instance, there was a significant group difference in the 'concrete' measure of social club attendance but the groups responded similarly when asked about the more 'abstract' and subjective measure of social support. It may be that adolescents with DLD have a difficulty conceptualising social functioning due to their language deficit or there could be other factors besides communication difficulties driving

the social difficulties. For example, van den Bedem et al. (2018) recently showed that a better understanding of emotions is related to less victimisation in adolescents with DLD. Perhaps a difficulty with emotion recognition or social cognition is responsible for the lack of significant social difficulties reported by the DLD group as they are less able to distinguish their feelings and less aware of any differences between them and their peers. Alternatively, the lack of significant self-reported social difficulties in the current sample could be an example of ‘self-preservation’, with adolescents with DLD under-reporting any issues in order to save face, whereas parents are concerned for their children’s wellbeing. As previously stated, the literature suggests that adolescents with DLD experience increased rates of social difficulties compared to their TLD peers; however, the majority of this research has been conducted on the clinically-diagnosed MLS cohort. It may be that, unlike the MLS, the current sample is not used to completing psychometric testing batteries and therefore not as comfortable reporting any issues.

There were no significant group differences in self-reported emotional problems, which contrasts previous findings of increased feelings of anxiety and depression in adolescents with DLD compared to TLD peers (Conti-Ramsden & Botting, 2008). However, the direction of results was as expected, with the DLD group reporting higher mean scores than the TLD group for negative outcomes such as feelings of anxiety and depression and lower mean scores for the positive outcome of mental wellbeing. The current study used the same standardised self-report measures of emotional outcomes as previous literature; therefore, the difference in these findings compared to previous studies is likely due to the smaller sample size in the current study and the potential for reduced power to find significant differences. However, the reduced sample size does not explain the significantly higher ratings of parent-reported emotional problems in the DLD group compared to the TLD group, which are similar to previous studies (Conti-Ramsden & Botting, 2008; Lindsay et al., 2007). Again, adolescents may be lacking in the perceptual skills necessary for this self-reflection while the difficulties may be more salient for parents. Or, indeed, there is potential for parental concerns about language abilities to bias their reporting in other domains. Qualitative studies investigating adolescents’ attitudes towards DLD and how this shapes their identity could help further unravel the relationship with associated socioemotional difficulties.

When parent-rated peer problems were entered into a mediation model the relationship between DLD and parent-rated emotional problems was non-significant, with

peer problems accounting for approximately 64% of the relationship. In other words, the increased emotional problems found in the DLD group can be explained by increased peer problems. This is consistent with previous research that found peer problems predicted depressive feelings in adolescents with DLD (Wadman et al., 2011a). When emotional problems were entered as the mediator and peer problems as the outcome, the mediation effect was reduced to approximately 51% of the relationship, suggesting that there is a stronger effect of peer problems predicting emotional problems than vice versa. This is in line with the body of literature from the general adolescent population examining victimisation as a causal factor in psychopathology (e.g. Arseneault et al., 2010; Geoffroy et al., 2018) and findings that show friendship support is a positive predictor of adaptive psychosocial functioning (van Harmelen et al., 2017).

This study extends the literature by examining the mediating effect of peer problems on emotional problems in an adolescent DLD sample. By employing a cross-sectional design and using a typical-language comparison group matched on age and sex we were able to directly compare between adolescents with and without a language difficulty, contrasting previous studies which have relied on comparison to normative means (St Clair et al., 2011). Additionally, social and emotional measures were collected from adolescents themselves, as well as parents. This allowed for first-person report of the difficulties that this population are said to experience, which is often lacking in studies centred on younger children. The focus on adolescents in the current study is useful for determining the pathways involved in socioemotional difficulties during a time when peer relationships become more influential and when peer problems are likely to increase. The scales used to measure social and emotional functioning were validated measures which are frequently cited in the literature. In addition, we included questions about friendships and social activities to measure social functioning to provide more detailed information about the ‘lived experiences’ of adolescents. Furthermore, the PSS-Fr provides a measure of positive aspects of friendship while the WEMWBS provides a general overview of mental wellbeing. It is important to provide a report of strengths as well as difficulties that adolescents with DLD may face in order to ascertain any protective factors.

Moreover, the current study provided further details on how the relationship between language ability and emotional problems may manifest. By examining peer problems as a mediator we have proposed that the increased rates of emotional difficulties are a result of the difficulties with friendships that adolescents with DLD experience. This

gives insight into the pathways involved in the poor mental health outcomes in this population and provides suggestions on how to address these problems through interventions, potentially by using strategies to improve social relationships to help remediate emotional difficulties.

The current study is not without its limitations. The sample size is relatively small and therefore may not be an accurate representation of the population. As a result, the study may be lacking in statistical power and the conclusions drawn are at risk of being based on type II error. Additionally, with the exception of the PSS-Fr and Peer Problems subscale from the SDQ, the social functioning questions were taken from surveys administered in the Millennium Cohort Study (MCS) and not from standardised scales. However, the TLD participants were matched on age and sex so comparisons could be made between young people with DLD and their typically developed peers at a group level.

Conclusion

Overall, the DLD group do not report any significant social or emotional difficulties when compared to their TLD peers. This is in contrast to parent-reports and previous literature. Additionally, parent-reported peer problems were found to mediate parent-reported emotional problems, suggesting that a difficulty interacting with others explains variance in emotional problems. It could be that adolescents with DLD are not perceiving the same difficulties as their parents due to a deficit in social cognition abilities. Given the long-term effects of emotional difficulties the proposed area of social cognition warrants further investigation in order to uncover the mechanism driving the difference in emotional outcomes between adolescents with DLD and their typically developing peers.


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This declaration concerns the article entitled:									
Social cognition differences in adolescents with Developmental Language Disorder (DLD) using the Social Attribution Task									
Publication status (tick one)									
draft manuscript	<input checked="" type="checkbox"/>	Submitted	<input type="checkbox"/>	In review	<input type="checkbox"/>	Accepted	<input type="checkbox"/>	Published	<input type="checkbox"/>
Publication details (reference)	Forrest, C. L., Lloyd, V., Gibson, J. L., Halligan, S. L. & St Clair, M. C. (in preparation). Social cognition differences in adolescents with Developmental Language Disorder (DLD) using the Social Attribution Task								
Candidate's contribution to the paper (detailed, and also given as a percentage).	The candidate considerably contributed to the formulation of ideas (70%) and to the design of methodology (80%). The candidate predominantly executed the experimental work, including the analysis and interpretation of the results (80% due to the requirement of a second rater for inter-rater reliability) and predominantly executed the presentation of the data in journal format (90%).								
Statement from Candidate	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature.								
Signed							Date	17/01/2019	

Chapter 4: Cross-sectional Experimental Study

Social cognition differences in adolescents with Developmental Language Disorder (DLD) using the Social Attribution Task.

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Chapter rationale: Both Chapter 2 and 3 found that, contrary to teacher-and-parent-report, there was no group difference in self-report of social and emotional problems in children and adolescents with language difficulties. It could be that individuals with DLD have impaired social cognition which hinders their social skills and their awareness of any socioemotional difficulties. There is a large body of research investigating the link between theory of mind (ToM) tasks and language abilities, with most arguing that language ability predicts social cognition. Therefore, it is logical to assume that children and young people with DLD may struggle with social cognition. Indeed, there is evidence to support this view and there is also research demonstrating how impaired social cognition relates to social difficulties in children and adolescents with DLD. However, with the exception of Botting and Conti-Ramsden (2008), the research mainly focuses on children due to ToM tasks (e.g., false belief tasks) being passed by the age of four years. Therefore, Chapter 4 aims to investigate social cognition abilities in a sample of adolescents with DLD using the Social Attribution Task (SAT; Klin, 2000) and whether performance on this task relates to socioemotional difficulties. The SAT has not previously been investigated in the DLD population and provides an interactive and engaging format in which to study social cognition.

Abstract

Background: Recent research has suggested that individuals with Developmental Language Disorder (DLD) may have impairments in social cognition, which could explain their social and emotional difficulties. However, these studies have focused on children and used false belief tasks or emotion recognition tasks that are limited in their measurement of social cognition. Here we examine the social cognitive performance of adolescents with DLD using the Social Attribution Task (SAT; Klin, 2000) and how this relates to their socioemotional functioning. **Method:** Participants watched a short, silent animation of three shapes and verbally described what they saw. Narratives were coded according to five indices designed to measure abilities in the domains of: attributing social meaning (Animation Index); identifying salient social aspects of the story (Salience Index); describing the shapes as people (People Index); and the frequency of emotional (Theory of Mind – Affective Index) and cognitive (Theory of Mind – Cognitive Index) mental state words used. The SAT performance of 26 adolescents with DLD was compared to the performance of 27 typical language developed (TLD) adolescents who were matched on age and sex. Parent-reports of social and emotional difficulties were also compared between groups and the influence of SAT performance on these socioemotional outcomes was tested. **Results:** Adolescents with DLD were poorer across all indices but were significantly worse than their TLD peers at describing salient social aspects of the story, describing the shapes as people and using emotional words. Compared to the TLD group, adolescents with DLD had significantly more peer and emotional problems as rated by their parents but these higher rates of socioemotional difficulties were not predicted by performance on the SAT. In the DLD group, expressive language predicted scores on the Person and Animation Indices, while receptive language predicted performance on the Salience Index. **Conclusion:** This paper provides further evidence that individuals with DLD have poorer social cognition abilities compared to their TLD peers, but this impairment does not appear to be related to socioemotional outcomes. Given the novelty of this task and the evidence that social cognition is still developing in adolescence, further research is encouraged.

Developmental Language Disorder (DLD)¹ affects approximately 7% of the population, presenting as a difficulty with expressive and/or receptive language that cannot be accounted for by any other cognitive impairment or neurodevelopmental condition (Norbury et al., 2016). Research has shown that this population is more at risk for additional social and emotional problems, with increased rates of anxiety, depression and victimisation compared to their typically developing (TD) peers (Conti-Ramsden & Botting, 2008; van den Bedem, Dockrell, van Alphen, Kalicharan, & Rieffe, 2018). What is less clear, however, is how the relationship between DLD and poor socioemotional outcomes manifests. One suggestion is that there may be a comorbid social cognition deficit responsible for negative outcomes such as social skills difficulties (Bishop, 1997). However, with the exception of Botting and Conti-Ramsden (2008), most research has focused on children. Given that findings from longitudinal studies indicate an increase in peer problems in adolescents with DLD (St Clair, Pickles, Durkin, & Conti-Ramsden, 2011), and evidence from the general population indicates that social cognition is still developing in adolescence (Blakemore & Choudhury, 2006), it is important to continue examining social cognition abilities in the DLD population throughout childhood and adolescence. To do this, the current study employs the Social Attribution Task (Heider & Simmel, 1944), which has previously not been used in the DLD population.

Social cognition can be defined as the ability to understand others' thoughts, feelings and motives (Marton, Abramoff, & Rosenzweig, 2005), skills which are necessary for responding appropriately in social situations. These skills are highly correlated with language abilities (Dunn, Brown, & Beardsall, 1991); therefore, individuals with a language difficulty may be at a disadvantage in this domain. Indeed, a recent meta-analysis demonstrates that children with DLD have lower social cognition abilities than their TD peers (Nilsson & Jensen de Lopez, 2016). Social cognition is important to study as it may explain the increased social difficulties that children and adolescents with DLD are known to experience (Mok, Pickles, Durkin, & Conti-Ramsden, 2014). Specifically, individuals with DLD have deficits in social skills such as initiating a conversation (Brinton, Fujiki,

¹ As recommended by a recent panel of experts, we have opted to use the term Developmental Language Disorder (DLD) instead of Specific Language Impairment (SLI) (Bishop et al., 2017). The definition remains the same as many recent definitions (in that diagnosis is no longer based on a discrepancy between verbal and nonverbal intelligence) and follows long-term studies' adoption of this term (e.g. Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018). Therefore, we refer to DLD throughout the paper when referencing older studies that discuss children with expressive or receptive language difficulties with no known cause.

Spencer, & Robinson, 1997) and resolving conflicts (Bakopoulou & Dockrell, 2016; Marton et al., 2005), which require awareness and understanding of others' mental states.

Recent research has examined impaired social cognition as a predictor for these social problems seen in individuals with DLD. For example, children with DLD performed worse than their TD peers on emotion recognition tasks and hypothetical social scenarios, which was significantly associated with higher teacher-rated socioemotional problems (Bakopoulou & Dockrell, 2016). Similarly, poor performance on false belief (FB) tasks such as "Unexpected Contents" and the "Change of Location" task among children with DLD predicted more "dislike" sociometric ratings from their classmates (Andres-Roqueta, Adrian, Clemente, & Villanueva, 2016).

However, there are considerable methodological issues that arise when examining social cognition. As social cognition is an umbrella term it is difficult to measure all aspects of this concept, and many studies rely on FB tasks which are not entirely reflective of the skills required in daily social interactions. This is exemplified by the numerous children with autism who are able to pass these tasks but who still experience unsuccessful social lives (Abell, Happé, & Frith, 2000). Additionally, the instructions for the Change of Location task (or "Sally-Anne task") place a high demand on receptive language skills, which may not be appropriate for assessing social cognition in children and young people with language difficulties. For instance, Miller (2001) demonstrated that children with DLD performed similarly to their chronologically-age-matched peers on the Sally-Anne task when the language demands were low, but their ability to pass the task was similar to language-age-matched controls when the instructions imposed a greater linguistic load. It is important to consider the appropriateness of the task when testing social cognition in individuals with DLD in order to ensure the task is measuring social cognition and not language ability.

Other studies have used visual tasks such as emotion labelling of photographs to demonstrate poor theory of mind abilities in children with DLD (Bakopoulou & Dockrell, 2016), although the static nature of this task does not reflect real-life social situations. There are also varying findings depending on the design of the task. For example, there was no group difference in emotion recognition between children with DLD and their TD peers on tasks using cartoons (Ford & Milosky, 2003; McCabe & Meller, 2004). Nevertheless, Ford and Milosky (2003) found that children with DLD performed worse

than their TD peers when asked to identify emotions using contextual cues. However, this could be a result of the verbal demands of the task as there was no language-age-matched control group for comparison.

A final critique of the literature is that many studies investigating social cognition in individuals with DLD have focused on children. While Bakopoulou and Dockrell (2016) featured an older group aged 8-11 years and Farmer (2000) had one group of participants with a mean age of 11, only one study has examined social cognition in an adolescent sample. Botting and Conti-Ramsden (2008) examined performance on the “Eyes Task” (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001a) and the “Strange Stories” task (Happé, 1994) in a group of 16-year-olds with and without DLD. They found that adolescents with DLD performed worse on the social cognition tasks and this predicted poorer social outcomes (Botting & Conti-Ramsden, 2008). The lack of research into social cognition abilities among adolescents with DLD is somewhat concerning given that DLD is a pervasive condition with long-term effects. Children do not “grow out of” DLD, but maintain their reduced language ability in comparison to peers throughout development (Conti-Ramsden, St Clair, Pickles, & Durkin, 2012; Norbury et al., 2017). More specifically, there are increased peer problems in adolescence (St Clair et al., 2011). This increase is in line with findings from the general population that peer relations become much more important during adolescence, with social functioning influencing mental health outcomes (Geoffroy et al., 2018; van Harmelen et al., 2017). Although FB tasks are usually passed by age 4 for TD children and age 7 for autistic children (Frith & Frith, 2003), there is evidence to suggest that adolescents are still not as good as adults at ToM tasks, such as perspective taking (Symeonidou, Dumontheil, Chow, & Breheny, 2016). The idea that social cognition is still developing in adolescence is corroborated by brain imaging studies that show different areas of the brain are involved at different ages (Blakemore & Choudhury, 2006). Therefore, it is necessary to conduct more research during this time period using tasks that are appropriate for adolescents and for the DLD population.

Current study

The current study will compare the SAT performance of adolescents with DLD to their typical language developed (TLD) peers. The SAT consists of a silent animation of simple line drawings of a rectangle, large triangle, small triangle and small circle which

participants are asked to describe. The original study found that typically developed adults would attribute emotions and behaviours to the shapes in the short film clip, usually describing the big triangle as bullying the smaller triangle and circle (Heider & Simmel, 1944). Since then, it has been used to compare the social cognitive abilities of children, young people and adults with autism spectrum disorders (ASD) in comparison to their typically developing peers (Abell, Happé & Frith, 2000; Klin, 2000; Klin & Jones, 2006). To the authors' knowledge, this is the first study to use the SAT with participants with DLD and we believe it is an appropriate task to investigate social cognition in this population. This task places a very low demand on verbal comprehension as the participant is simply asked to describe what they see after watching a silent animation of moving shapes. The video format of the SAT provides a more interactive and engaging measure of social cognition than typical ToM tasks and is suitable for all ages. Indeed, the SAT could be argued to be more accessible than other ToM tasks as it provides more data about participants' understanding of social information than the Eyes Task (Baron-Cohen et al., 2001a) but does not pose as heavy a load on receptive language abilities as hypothetical scenarios such as the Strange Stories task (Happé, 1994). In contrast to the dichotomous scoring of typical 'pass/fail' FB tasks, the SAT has more opportunities to be correct and therefore provides a broader measure of social understanding (Klin, 2000). In particular, the Animation Index is scored based on the level of social attribution from each category, such as behaviours, perceptions, emotions, relationships, etc., that the participant mentions when describing the scene, not the frequency of each specific word (see Appendix A for more details). Therefore, participants are judged on the quality of social attribution in their response and are not penalised for giving a shorter answer, which may be expected from individuals with a language difficulty.

The aim of the current study is to determine whether there are group differences in social cognition abilities between adolescents with a history of DLD and their age-and-sex-matched peers (TLD group). Social cognition abilities are measured by performance on five indices: Animation Index (attributing social meaning to the animation); Person Index (describing the shapes as people); Saliency Index (identifying key social features of the animation); Theory of Mind (ToM) – Affective Index (ascribing emotional terms to the shapes) and ToM – Cognition Index (ascribing mental state terms to the shapes). Secondly, the study aims to investigate whether performance on the SAT is related to peer and

emotional problems, as measured by the parent-rated Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). It is predicted that participants with DLD will perform worse across all the SAT indices than their TLD age-and-sex-matched peers. In particular, it is predicted that participants with DLD will score lower in their ability to attribute social meaning to the animation and in their descriptions of shapes as people. In addition, they will mention fewer key social points (showing a poorer understanding of the story) and use fewer cognitive and affective mental state terms than the TLD group when describing the actions of the shapes (demonstrating poorer social cognition). It is also predicted that adolescents with DLD will receive higher ratings of peer and emotional problems than the TLD group and these difficulties will be predicted by performance on the SAT. Associations between language ability and each of the indices will also be explored.

Method

Participants

There were two recruitment streams for the study. Participants with a diagnosis of DLD were recruited by referral from professionals and online support groups. In addition, the TLD comparison group were identified via flyers displayed in local schools, at the University of Bath or on social media and screened for suitability. Any participants with a history of language difficulties identified through the screening procedure were included in the DLD group. Participants were all aged 11-18 years old, and were native English speakers. All participants attended mainstream schools, although three participants were recruited from a specialised language unit within a mainstream school. Exclusionary criteria for the study consisted of parent-report of hearing impairments, intellectual disabilities and diagnoses of autism spectrum disorder (ASD). Additionally, the Autism Quotient (AQ; Baron-Cohen, Hoekstra, Knickmeyer, & Wheelwright, 2006; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001b) was administered to parents or participants to provide a standardised screening measure of ASD symptoms, and a low score (more than 2 SD below the mean) on the nonverbal IQ measure in the testing phase provided further exclusionary criteria.

Participants were included in the DLD group if they had a history of DLD. Participants were recruited either through referrals from a local speech and language therapy service

employed by the local authority to provide services to schools, referrals from Special Educational Needs Coordinators (SENCOs) within schools, or from flyers posted in online support groups for DLD. A screening procedure was used to recruit typical language developed (TLD) participants matched on age (within six months) and sex, as well as additional DLD participants. Participants were recruited from flyers displayed in local schools, at the University of Bath or on social media. Screening packs consisting of background questionnaires for parents and self-report measures of language and communication skills for participants were sent to 258 participants, of which 109 were completed by both parent and participant.

Forty participants with a diagnosis of DLD were initially identified for the study by direct referral. Five participants with parent report of language difficulties or with a low score on the self-report measure (CC-SR) identified through the screening procedure were included in the DLD group. Four participants did not respond to invitation emails. One participant was excluded due to a hearing impairment, twelve participants were excluded due to a diagnosis of autism or exceeding the cut-off on the AQ and one participant withdrew from the study.

Twenty-seven participants were invited to the testing stage as part of the DLD group, with twenty-seven matched controls identified via the screening process forming the TLD group matched on age and sex. One further participant was excluded from the DLD group after scoring more than 2 SDs below the mean on the nonverbal IQ measure. This resulted in a total sample of 26 adolescents with DLD and 27 TD participants matched on age and sex. Further details of the sample characteristics are included in the results section.

Measures

Questionnaires for direct recruitment and screening samples.

Background questionnaire. This was completed by the parent/guardian of the participant and consisted of seventeen questions regarding the child's early development, academic history, physical/mental health history and family mental health history. Questions included the speed at which developmental milestones in language, motor skills and self-help were met and whether the child had any learning difficulties (suspected or diagnosed). Postcode information was also obtained to provide a measure of socioeconomic status, the Income Deprivation Affecting Children Index (IDACI) Rank. The IDACI Rank is based on the percentage of children living in families that are income deprived in Lower-layer Super

Output Areas (LSOAs) across England, where 1 = most deprived neighbourhood and 32,844 = least deprived neighbourhood. School postcodes were used when home postcodes were missing (n = 5) and two participants did not have either information available.

The Strengths and Difficulties Questionnaire (SDQ). The SDQ (Goodman, 1997) was completed by the participant's parent/guardian. This questionnaire consists of 25 items which form five scales (Peer Problems; Emotional Problems; Hyperactivity; Conduct Problems and Prosocial scale), the first four of which are totalled to produce the Total Difficulties score. The SDQ is a well-established measure and has a test-retest reliability of .85 (Goodman, 1999). The scales of interest were the Emotional Problems and Peer Problems subscales, each consisting of five items rated on a scale of *Not True* (0), *Somewhat True* (1) and *Certainly True* (2). Total scores for each subscale range from 0-10.

The Autism Spectrum Quotient (AQ). The adolescent version of the AQ was administered to parents of children aged 12-15 years old (Baron-Cohen et al., 2006), while the adult version was completed by participants aged 16 years or over (Baron-Cohen et al., 2001b). Both scales consist of 50 items referring to the domains of: social skills (e.g. "I prefer to do things with others rather than on my own"); attention switching (e.g. "I prefer to do things the same way over and over again"); attention to detail (e.g. "I often notice small sounds when others do not"); communication (e.g. "Other people frequently tell me that what I've said is impolite, even though I think it is polite") and imagination (e.g. "I find making up stories easy"). Items are rated as 'Definitely agree', 'Slightly agree', 'Slightly disagree' or 'Definitely disagree' and responses that endorse autistic-like behaviours are scored 1 point. A sum score of 30 or more on the parent-report, or 32 or more on the self-report is classified as a cut-off for ASD symptoms.

Questionnaire for screening sample.

The Communication Checklist Self-Report (CC-SR). The CC-SR (Bishop, Whitehouse & Sharp, 2009) was completed by the participant. This questionnaire consists of 70 questions about communication abilities. The participant rates the items on a scale of 0 – Less than once a week (or never); 1 – About once a week; 2 – Once or twice a day or 3 – Several times a day (or all the time). These items form three composite scales. The Structural Language composite describes aspects of language such as grammar and meaning. For example, "I mix up 'he', 'she', 'it' and 'they'" and "I use short sentences". The Pragmatic Skills composite contains items relating to language use in social contexts. For instance,

“People tell me I talk too much” and “I give detailed information when a more general comment would be fine”. Finally, the Social Engagement composite is comprised of items regarding nonverbal communication and social functioning. For example, “I feel anxious when I am with other people” and “I find it hard to know when people are upset or annoyed”. Positive items are reverse scored and a scaled score lower than 5 on the Structural Language composite and greater than 7 on the Pragmatic Skills composite is indicative of DLD ($M = 10$, $SD = 3$). Internal consistency for each of the composites is greater than .85 (Bishop, Whitehouse & Sharp, 2009).

Assessment.

Cognitive measures.

Clinical Evaluation Language Functioning – 4 (CELF-4). In order to measure language ability, two subtests from the CELF-4 (Semel, Wiig, & Secord, 2006) were administered. The Recalling Sentences subtest requires participants to listen to sentences of increasing length and complexity and repeat verbatim, providing a measure of expressive language. The Word Classes – Receptive subtest requires participants to pick two words out of a list of four that are best matched, providing a measure of receptive language ability in the current study. Both subtests have an excellent rating of reliability (internal consistency coefficient of .92 and .91 respectively; Semel, Wiig & Secord, 2006).

Wechsler Intelligence Scale for Children (WISC). The Block Design subtest was administered to provide a measure of nonverbal ability (Wechsler, 2004). This task requires participants to use 3D blocks to recreate 2D patterns of increasing complexity. Block Design is a measure of spatial awareness and contributes to fluid reasoning. One participant scoring more than 2 SD below the mean ($M = 10$, $SD = 3$) was dropped from analysis. Additionally, any participants with parent-report of cognitive problems from the background questionnaire were excluded from the study.

Social cognition measure.

Social Attribution Task (SAT). The SAT (Klin, 2000) was administered to participants on a laptop. Participants watched a silent video of three animated shapes (large triangle, small triangle, and small circle), lasting 1 minute 16 seconds. They were asked to describe what happened in the video, answering as completely as they can (narrative 1). Next they were shown the same animation separated into six shorter clips and asked, “What happened

here?” after each one (narratives 2-7). Finally, the participants were asked to think of the shapes as people (if they had not already done so) and describe “What kind of person is the... (big triangle/ little triangle/ circle)?” (narratives 8-10). Examples of responses from participants in each group are provided in Appendix B. The number of words used in all ten narratives was recorded, as was the number of independent clauses (‘T-Units’). The following indices were examined in this study: *Animation Index*; *Person Index*; *Saliency Index*; *Theory of Mind (ToM) - Affective Index* and *ToM – Cognition Index*. *Animation Index*: Based on narratives 1-7 this index measures the participant’s ability to attribute social meaning on a scale of 0-6, ranging from no social attribution to very high levels of social attribution. *Person Index*: Based on narratives 8-10 this index measures the participant’s ability to ascribe psychological properties to the shapes on a scale of 0-9, where 0 indicates no response and 9 indicates human characteristics for each of the three shapes. *Saliency Index*: This index is based on narratives 1-7 and provides a measure of the proportion of the twenty key social features that are most often noticed by typically developed participants (e.g. stating that there are three agents (big triangle, small triangle and circle), observing the direction of hostility is from the large triangle towards the small triangle and circle, noticing that the circle hides because it is afraid, etc.). Each response that matches the scoring criteria is awarded one point out of a possible twenty and converted to a percentage score. *ToM – Affective Index*: Based on narratives 1-7 this index provides a measure of the proportion of T-Units containing emotional terms (e.g. scared, angry, celebrating, jealous, etc.). *ToM – Cognition Index*: Again, based on narratives 1-7 this index measures the proportion of T-Units containing cognitive mental state terms, such as wants, hiding, tries, bullying, etc. See Appendix B for further details.

Procedure

Ethical approval was granted by the University of Bath Psychology Ethics Committee (Ref: 15-245). Informed consent and assent was obtained from parents/guardians and participants. Parents/guardians in the DLD group completed the consent form, background questionnaire, AQ and SDQ online or returned the forms in a freepost envelope. Participants from the DLD group were then invited to the assessment stage in a quiet room either at the University, their school or their home. Participants who were recruited through schools completed informed assent forms and were screened with the CC-SR while their parents/guardians gave informed consent and completed the AQ, SDQ and an abridged version of the background questionnaire, either online or via paper

copies. Any participants from this screening process who met criteria for the DLD profile on the CC-SR or who received reports of language difficulties in the background questionnaire were invited to the assessment stage and included in the DLD group. Those that had no language difficulties were matched on age (within six months) and sex to form the TLD group. Again, the assessment stage was completed wherever was convenient for the participant. Parents/guardians screened through schools completed online consent forms for the assessment stage and the remaining background questionnaire and participants completed online assent forms at the beginning of the assessment. Participants were administered the two language tasks, the Block Design task and the SAT. These tasks formed part of a larger study which lasted approximately 90 minutes in total. Participants received £15 on completion of the assessment stage and any travel expenses were reimbursed. Entry into a prize draw to win a £50 shopping voucher was offered as a reward to complete the screening questionnaires. Brief reports of individuals' results were sent to parents/guardians and findings from the overall study were shared with parents/guardians in the form of a newsletter.

Statistical analysis

Stata 14 (StataCorp., 2015) was used to analyse the data. Instead of analysing language as a construct, participants were categorised into groups of DLD and TLD status for two reasons. Firstly, children with DLD have disordered language development, not simply a delay, with the majority of the literature investigating DLD and associated socioemotional difficulties examining DLD as an entity based on a clinical cut-off and parental report of poor language functioning (Bishop et al., 2016). Secondly, previous research has suggested an absence of a linear relationship between language ability and severity of socioemotional problems (Fujiki, Brinton, & Clarke, 2002; Hart et al., 2004), therefore analysing language ability as a continuous scale was not deemed useful. Following tests for assumptions, chi squares and ordered logistic regression were used to analyse group differences in the demographic variables. The variables of age and IDACI Rank were significantly skewed and therefore transformed before running regression analyses. Measures of Spatial Reasoning (Block Design subtest) and Receptive Language (Word Classes – Receptive subtest) were also significantly skewed and transformed before regression analysis. In each case, the *ladder* function in Stata was used to determine the most appropriate transformation. Group differences in the SDQ subscales of Peer Problems and Emotional Problems were analysed using negative binomial regression due to the most frequent

responses being zero. Age, sex and IDACI Rank were entered as covariates in all analyses. SAT responses were transcribed by CLF. CLF and a second rater who was blind to group status (VL) coded the transcripts in a random order, following an adapted version of Klin's (2000) protocol obtained from the University of Cambridge from JLG. When raters were unsure or when large discrepancies in ratings were encountered, the raters convened and discussed the scores until agreement was reached. Intra-class correlations (ICC) were calculated to determine inter-rater reliability. A two-way mixed effects model was used to calculate intra-class correlations, treating the rater as a fixed effect and index as random effects, as each index was scored by the same set of raters. Consistency of agreement (CA-ICC) was used to determine whether scores differed by the same constant value for all the targets, as recommended by McGraw and Wong (1996) when the rater is random. Table 1 shows the intra-class correlations for each of the indices. Inter-rater reliability coefficients ranged from good (.8) to excellent (.9) (Cicchetti, 1994). Scores from the 'blind' rater (VL) were used for analysis. The number of words, T-Units, ToM – Affective Index and ToM – Cognitive Index were transformed to account for the highly skewed data and independent t-tests were used to analyse group differences. Group differences in the Animation Index and the Person Index were analysed using a Wilcoxon-Mann-Whitney ('*ranksum*') test to account for ordinal data. Hierarchical regression was then used to test the effect of SAT performance on the outcome of peer problems. Group status, age, sex and IDACI Rank were entered first, followed by the seven SAT indices.

Table 1.

Intra-class correlations for SAT scoring.

SAT Index	<i>r</i>
Number of T-Units	.95
Animation Index	.87
Person Index	.96
Saliency Index	.91
ToM - Affective Index	.84
ToM - Cognitive Index	.93

Results

Demographics

Participants were matched on age (within 6 months) and sex (Table 2). The total sample had an average age of 13 years and 6 months ($SE = 2.26$ months) and approximately 36% were female. English was the only language spoken at home in the majority of cases, although one participant in the DLD group spoke a second language and two participants in the TLD group spoke a second language. As expected, the DLD group were significantly more delayed in speech and language development compared to the TLD group. They were also more delayed in reaching early self-help milestones compared to the TLD group as reported in the background questionnaire. Level of parental education significantly differed between the two groups, with more parents in the TLD group completing postgraduate studies compared to the DLD group. Additionally, the DLD group had a significantly lower socioeconomic status as measured by the Income Deprivation Affecting Children Index (IDACI) Rank. In the current sample, the IDACI Rank ranged from 303 to 32662 in the DLD group and from 13021 to 32489 in the TLD group, with an overall group mean of 22388.47 ($SE = 1030.57$). On average, the TLD group consisted of individuals from less deprived areas than the DLD group.

Demographics of sample.

	DLID (n = 26)	TLID (n = 27)	Total (n = 53)	DLID vs TLID
Mean age in yrs; months (SE months)	13;6 (3.15)	13;6 (3.30)	13;6 (2.26)	--
Female %	34.6	37.0	35.9	$\chi^2_{.03}$
Language spoken				$\chi^2_{.31}$
English only %	96.2	92.6	94.3	
English plus other %	3.8	7.4	5.7	
Motor development				.49(.15, 1.59) $\sqrt{\chi^2}$
Delayed %	26.9	3.7	15.01	
Typical %	53.8	81.5	67.9	
Fast %	19.2	14.8	17.0	
Speech and language development				.05(.01, .21) $\sqrt{\chi^2}$
Delayed %	69.2	7.4	37.7	
Typical %	26.9	70.4	49.1	
Fast %	3.8	22.2	13.2	
Self-help development				.17(.05, .63) $\sqrt{\chi^2}$
Delayed %	46.2	3.7	24.5	
Typical %	42.3	85.2	64.2	
Fast %	11.5	11.1	11.3	
Biological parents				$\chi^2_{2.25}$
Yes %	92.0	100.0	96.2	
No – adopted %	8.0	0	3.8	
Parental marital status				3.85(.89, 16.55) $\sqrt{\chi^2}$
Married %	68.0	88.9	78.8	
Separated %	16.0	7.4	11.5	
Divorced %	16.0	3.7	9.6	
Parental psychological distress ^a				$\chi^2_{.01}$
Yes %	16.0	14.8	15.4	
No %	84.0	85.2	84.6	
Parental education				.19(.06, .58) $\sqrt{\chi^2}$
Secondary school %	44.0	18.5	30.8	
Diploma %	12.0	0	5.8	
Undergraduate degree %	36.0	44.4	40.4	
Postgraduate degree %	8.0	37.0	23.1	
Mean IDACT Rank ^b (SE)	19602.17 (1640.43)	24865.19 (1113.82)	22388.47 (1030.57)	-6.789(-1.21, -1.42)*

Statistics are *b* coefficients or odds ratio where marked $\sqrt{\chi^2}$. Regressions for age and IDACT Rank are performed on transformed data. ^a As measured by endorsement of suspected or diagnosed mental health difficulties in background questionnaire. ^b *n* = 51.

Table 2.

Group Differences in Cognitive, Language and Socioemotional Measures

Table 3 illustrates that there was a significant group difference on all cognitive, language and socioemotional measures. The DLD group scored significantly lower on the Block Design subtest; however, it should be noted that the overall mean score for the DLD group was still within the normal range for the Block Design subtest ($M = 10$, $SD = 3$). As expected, the DLD group performed significantly worse than the TLD group on the CELF-4 Recalling Sentences subtest which provides a measure of expressive language, and on the CELF-4 Word Classes – Receptive subtest which provides a measure of receptive language. Parent-ratings of emotional and peer problems were significantly higher for the DLD group compared to the TLD group.

Table 3.

Mean (SD) scaled scores from cognitive, language and socioemotional tasks for the Developmental Language Disorder (DLD) group and Typical Language Developed (TLD) group.

	DLD (n = 26)	TLD (n = 27)	DLD vs TLD	Cohen's d [95% CI]
Spatial	8.15	11.89		-
Reasoning ^a	(2.84)	(2.47)	-67.64(-100.68,-34.60)***	-
Expressive Language ^b	4.92 (2.92)	9.93 (2.96)	-4.71 (-6.53, -2.89)***	-
Receptive Language ^c	6.04 (2.92)	13.00 (2.39)	-1.10(-1.40,-.80)***	-
Emotional Problems ^d	3.54 (.58)	1.63 (.40)	.92(.30, 1.55)**	-.75[-1.30, -.20]
Peer Problems ^e	3.31 (.50)	1.04 (.30)	1.04(.34, 1.73)**	-1.09[-1.67, -.51]

Statistics are *b* coefficients (95% confidence interval), controlling for age, sex and IDACI Rank. Regressions for Spatial Reasoning and Receptive Language are performed on transformed data.

^a Wechsler Intelligence Scale for Children – fourth edition UK (WISC-IV) Block Design subtest.

^b Clinical Evaluation of Language Fundamentals – fourth edition UK (CELF-4) Recalling Sentences subtest.

^c Clinical Evaluation of Language Fundamentals – fourth edition UK (CELF-4) Word Classes – Receptive subtest.

^d Strengths and Difficulties Questionnaire (SDQ) for parents – Emotional Problems subscale

^e Strengths and Difficulties Questionnaire (SDQ) for parents – Peer Problems subscale

***. $p < .001$; **. $p < .01$

Group Differences in SAT Performance

Table 4 shows the differences in mean ratings between the DLD group and TLD group for each of the SAT indices. As expected, the DLD group responded with a significantly lower number of words than the TLD group; however, the number of independent clauses ('T-Units') was not significantly different between the two groups. This is important to note as the ToM Affective and Cognitive Indices are calculated as a proportion of this number. Both groups scored similar levels of social attribution, with an average score of approximately 4 in the Animation Index. Scores range from 0-6 and are based on cut-offs that increase in complexity of social attribution. For example, the maximum score of 6 indicates the participant has mentioned at least one instance from each of the following categories: allusion to a person; higher level mental state terms expressing belief, thoughts, imagination, etc.; emotional terms resulting from a social situation (e.g. envious, jealous, sulking, etc.) or behaviours that are uniquely human by way of attempting to alter another character's mental state (see Appendix A). A score of 4 corresponds to at least two instances of the above examples, but not two from the same category. The DLD group scored significantly worse on the Person Index compared to the TLD group, indicating that they made fewer mentions of psychological attributes (3 points) when asked to think of the shapes as people, and instead mentioned relative (2 points) or physical (1 point) properties. For example, participants in the DLD group were more likely to describe physical properties of the shapes (e.g. describing the big triangle as "a strong person") or relative properties of the shapes (e.g. describing the big triangle as "a man" and the small triangle as "a girl"). The DLD group also scored significantly lower on the Saliency Index, identifying approximately 43% of the twenty salient social features of the animation, compared to the 58% identified by the TLD group. For example, participants in the DLD group were more likely to describe the erratic movements of the small triangle as "bouncing around" instead of attributing emotions of fear or panic to the shape based on the storyline. Finally, there was a significant group difference in the proportion of emotional mental state words used to describe the actions of the shapes, with the DLD group using fewer emotional mental state words than the TLD group. For example, participants in the DLD group were less likely to describe the big triangle as "angry" and the little triangle as "scared".

Table 4.

Comparison of mean scores (SE) on SAT Indices between Developmental Language Disorder (DLD) group and Typical Language Developed (TLD) group.

SAT Index	DLD (<i>n</i> = 24)	TLD (<i>n</i> = 27)	DLD vs. TLD
Number of words	209.50 (21.16)	321.52 (25.78)	3.67***
Number of T-Units ^a	19.50 (1.90)	23.15 (1.54)	1.93
Animation Index (0-6) ^b	3.58 (.24)	3.93 (.21)	1.13
Person Index (0-9) ^c	7.04 (.37)	8.19 (.30)	3.10**
Saliency Index (%) ^d	44.81 (3.04)	55.56 (2.76)	2.62*
ToM – Affective Index (%) ^e	.07 (.02)	.19 (.04)	2.42*
ToM - Cognitive Index (%) ^f	.30 (.04)	.40 (.08)	1.17

^a Mean number of independent clauses in narratives 1-7.

^b Mean score from 0-6 based on level of social attribution in narratives 1-7.

^c Mean score from 0-9 based on psychological attributes given to shapes in narratives 8-10.

^d Proportion of social features identified out of a possible 20 in narratives 1-7 (*n*/20*100).

^e Proportion of independent clauses containing emotional mental state words in narratives 1-7 (*n*/T-Units*100).

^f Proportion of independent clauses containing cognitive mental state words in narratives 1-7 (*n*/T-Units*100).

ToM = Theory of Mind.

*, *p* < .05, **, *p* < .01, ***, *p* < .001

Relationship between SAT Performance and Socioemotional Difficulties

Table 5 displays the output from the hierarchical regression used to analyse the influence of SAT performance on socioemotional difficulties. Demographic variables of group status, age, sex and IDACI Rank were entered in the first model. The second model included scores from the SAT indices (number of words, number of T-Units, Animation Index, Person Index, Saliency Index, ToM – Affective Index and ToM – Cognitive Index). Finally, the third model added scores from the cognitive tests (AQ, Recalling Sentences subtest, Word Classes subtest and Block Design subtest). The first model was statistically significant ($F(4,46) = 3.44, p = .02$), explaining 16% of the variance in Peer Problems (adjusted R^2). DLD group status was the only significant predictor. The second model was also statistically significant, explaining 20% of the variance ($F(11,39) = 2.16, p = .04$). However, the inclusion of SAT indices did not explain any additional variance (R^2 Change = .15, $F(7,39) = 1.32, p = .26$) as DLD group status was again the only significant predictor. In the third model, performance on the ToM – Affective Index and scores on the AQ were significant predictors of Peer Problems and the overall model accounted for 45% of the variance ($F(15,22) = 3.01, p = .01$); however, the model did not significantly

explain additional variance compared to the earlier models (R^2 Change = .29, $F(4,22) = .01$, $p = 1.00$). Table 5 also shows hierarchical regression with emotional problems as the outcome. The first model significantly predicted 19% of the variance ($F(4,46) = 3.96$, $p = .01$), with both DLD group status and sex identified as significant predictors. The inclusion of SAT indices accounted for 20% of the variance in the second model ($F(11,39) = 2.16$, $p = .04$), but did not explain any additional variance (R^2 Change = .12, $F(7,39) = 1.09$, $p = .38$) as only DLD status remained a significant predictor of emotional problems. The third model was not a significant fit of the data ($F(15,22) = 1.96$, $p = .07$), although AQ score was a significant predictor of emotional problems.

Relationship between Language Ability and SAT Performance

In order to demonstrate that the SAT is appropriate for adolescents with DLD, the influence of expressive and receptive language ability on SAT performance was examined. Performance on the Person Index was significantly predicted by performance on the Recalling Sentences subtest in the DLD group ($b = .35$, [95% CI = .05, .66], $p = .026$), indicating that those with better expressive language ability were better at describing the shapes as people. Expressive language ability also predicted performance on the Animation Index in the DLD group ($b = .22$, [95% CI = .01, .44], $p = .049$). Additionally, performance on the Salience Index was predicted by performance on the Receptive subtest in the DLD group ($b = 2.74$, [95% CI = .40, 5.08], $p = .024$), indicating that better receptive language abilities were associated with a higher proportion of social features mentioned in the narrative. Receptive or expressive language abilities did not predict SAT performance in the TLD group.

Table 5.

Predictors of socioemotional difficulties. B coefficients and 95% confidence intervals reported.

Predictors	Peer Problems			Emotional Problems		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
<i>Demographics</i>						
DLD	1.91(.61,3.21)**	1.82(.23,3.42)*	.99(-.91,2.89)	2.05(.55,3.54)**	2.07(.20,3.93)*	1.93(-.86,4.72)
Age	0.01(-.03,.05)	.01(-.04,.05)	-.02(-.07,.04)	-.03(-.08,.01)	-.04(-.09,.01)	-.06(-.14,.02)
Sex	-.29(-1.54,.97)	0.20(-1.32,1.71)	-.35(-1.94,1.23)	1.51(.07,2.95)*	1.37(-.39,3.14)	1.94(-.39,4.26)
IDACI Rank	-.01(-.01,.01)	-.01(-.01,.01)	-3.98(-.00,.00)	.01(-.01,.01)	1.67(-.01,.01)	.01(-.01,.01)
<i>SAT Indices</i>						
Number of Words		.01(-.01,.01)	-.01(-.01,.01)		.01(-.01,.02)	.01(-.01,.02)
T-Units		-.10(-.25,.05)	-.04(-.17,.09)		-.12(-.29,.06)	-.08(-.27,.11)
Animation		0.24(-.47,.94)	.51(-.22,1.24)		.60(-.23,1.42)	.62(-.46,1.69)
Person		0.4(-.01,.81)	.24(-.14,.62)		.33(-.15,.80)	.27(-.28,.83)
Saliency		0.01(-.04,.06)	.02(-.03,.07)		-.02(-.08,.04)	.01(-.07,.08)
ToM - Affective		-3.80(-9.52,1.93)	-6.19(-12.22,-.16)*		4.60(-11.28,2.08)	-6.11(-14.98,2.76)
ToM - Cognitive		0.06(-2.75,2.86)	.76(-1.90,3.42)		-.67(-3.94,2.61)	.70(-3.21,4.60)
<i>Cognitive measures</i>						
AQ			.18(-.48,.09)***			.16(.03,.29)*
Expressive Language			-.19(-.48,.09)			-.26(-.68,.17)
Receptive Language			.25(-.12,.62)			.50(-.04,1.05)
Block Design			.24(-.04,.51)			-.06(-.45,.34)
R ²	0.23*	0.38*	0.67**	0.26**	0.38*	0.57
Adjusted R ²	0.16*	0.20*	0.45**	0.19**	0.20*	0.28
R ² Change	--	0.15	0.29	--	0.12	0.19

*. $p < .05$, **. $p < .01$, ***. $p < .001$.

Discussion

The current study aimed to provide a better understanding of the role of social cognition in the socioemotional difficulties of adolescents with Developmental Language Disorder (DLD). Previous studies of social cognition in the DLD population have focused on children (e.g. Andres-Roqueta et al., 2016) despite evidence suggesting that social cognition abilities are still developing in adolescence (Blakemore & Choudhury, 2006). Studies have also used typical ToM tasks, such as the ‘Sally-Anne task’ or ‘Strange Stories’ task (e.g. Botting & Conti-Ramsden, 2008), with instructions that place a higher demand on receptive vocabulary and may be at risk of confounding language abilities. By examining performance on the Social Attribution Task (SAT) the current study measured social cognition abilities on a novel, engaging visual task that did not require strong receptive language skills to understand complex instructions. This is the first time the SAT has been explored in the DLD population, having previously been used with adolescents and adults with autism (e.g. Abell et al., 2000; Klin, 2000; Klin & Jones, 2006).

Previous investigations of the SAT have found that when presented with the simple, silent animation of basic shapes, typically developing children and adults are likely to construct a story of the small circle protecting the little triangle from being victimised by the large triangle. TD participants attribute social meaning to the story and human personalities to the shapes, demonstrating social cognition abilities. In the current study, the hypothesis that the DLD group would perform worse on the SAT compared to the TLD group was met to a certain extent. The DLD group scored significantly lower than their TLD peers on the Person, Salience and ToM – Affective indices. These findings demonstrate that the adolescents with DLD were poorer at describing the shapes as people, despite being explicitly asked “What kind of person is the big/small triangle/circle?” Adolescents in the DLD group were more likely to view the shapes in terms of physical or relative properties instead of describing personality characteristics. Additionally, the DLD group identified fewer key social aspects in their narrative of the story and used fewer emotional terms to describe the shapes compared to their TLD peers. Social interactions are full of nuanced cues that help us understand our conversational partners’ mental states and can aid in predicting their behaviour as well as how to respond appropriately. A difficulty recognising social aspects of the story may indicate that adolescents with DLD have difficulty picking up cues in social interactions. These results are consistent with the literature that shows a deficit in social cognition abilities in children and young people with

DLD (Nilsson & Jensen de Lopez, 2016; Vissers & Koolen, 2016). There were no other significant group differences in SAT performance, but the pattern of results was expected, with adolescents in the DLD group scoring lower than the TLD group. Both groups scored similarly on the Animation Index, demonstrating their ability to describe the video in terms of social meaning. They also used a similar number of cognitive mental state terms to describe the actions of the shapes. It is of interest that adolescents with DLD struggled with the affective but not the cognitive elements of theory of mind. These findings are consistent with the literature that suggests children and adolescents with DLD are poorer at identifying emotions in faces and voices than their TD peers (Botting & Conti-Ramsden, 2008; Fujiki, Spackman, Brinton, & Illig, 2008; Taylor, Maybery, Grayndler, & Whitehouse, 2015).

We next examined whether performance on these specific SAT indices predicted socioemotional difficulties. In the current sample, higher ratings of peer and emotional problems were reported by the parents of the DLD group compared to the TLD group, consistent with the large body of evidence that indicates increased socioemotional difficulties in children and young people with DLD (Yew & O'Kearney, 2013). However, when SAT indices were added to the model there was no significant change. This is in contrast to the previous literature demonstrating the link between poor social cognition abilities and social problems in the DLD population (Andres-Roqueta et al., 2016; Bakopoulou & Dockrell, 2016; Botting & Conti-Ramsden, 2008).

The SAT is a social cognition task with simple instructions that place much lower demand on verbal skills than other ToM tasks that have previously been used within a DLD sample, such as false belief tasks, emotion identification and conflict resolution (Andres-Roqueta et al., 2016; Bakopoulou & Dockrell, 2016; Marton et al., 2005). The SAT is also much more representative of the interpretive skills that are essential during a real-life social interaction than other tasks that have been used in this area. For example, the Animation Index demonstrates how adolescents apply social meaning to the animation, representing their understanding of social cues. Rather than relying on frequency data this index measures the complexity of social interpretation through the levels of social attribution in different categories, providing more detail about varying degrees of understanding than a 'pass/fail' measure. Furthermore, the ToM - Cognitive and ToM - Affective Indices in the current study provide a measure of how well the adolescents understand others' thoughts as well as feelings, whereas some false belief tasks such as the 'unexpected contents' task and 'Sally-

Anne' task are predominantly concerned with the thoughts of the other person but do not focus on their emotions. Studies that do involve emotion recognition use photographs which again do not reflect the dynamic nature of social interactions.

Nevertheless, the current study is not without its limitations. The small sample size may account for low power, hindering generalisability. Therefore, a larger follow up study may be of benefit. It is also not clear whether the group differences in SAT performance were due to social cognition or language abilities. Specifically, the SAT is a verbal task and expressive language ability predicted performance on the Person and Animation indices, while receptive language ability predicted scores on the Saliency Index. Therefore, it could be that group differences in performance on the SAT are due to language limitations and not social cognition abilities. However, the finding that language ability only predicted performance in the DLD group and not the TLD group suggests that the presence of a language impairment may be driving social cognition impairment. Including a language-age-matched control group may help to clarify whether poor social cognition abilities are a deficit or a delay in individuals with DLD, if they are still performing worse compared to their language-age-matched peers. Perhaps inclusion of pragmatic language assessments, such as the Making Inferences or Conversational Skills subtests in the CELF 5 (Wiig & Secord, 2014) may provide more information about the association with different language skills more suited to social interpretation. Comparison to a ToM task that adolescents with DLD are known to struggle with, such as the Eyes Task or Strange Stories task, may also have proved useful in helping to determine the appropriateness of the SAT for this population.

Despite the strengths of the SAT compared to other social cognition tasks, it can only provide a measure of an individual's ability to interpret others' actions, not a measure of how the adolescent themselves would interact in a social situation. To address this, observational studies of social interactions among adolescents with DLD could be explored using an adolescent equivalent of the Manchester Inventory for Playground Observation (MIPO) (Gibson, Hussain, Holsgrove, Adams, & Green, 2011). Another, more feasible, study could employ measures such as eye-tracking or virtual reality to examine how participants interpret social cues directed towards themselves. For example, a recent study employing eye-tracking techniques found that children with DLD were more similar to their TD peers than an autistic comparison group who avoided looking at speakers' faces during a social interaction (Hosozawa, Tanaka, Shimizu, Nakano, & Kitazawa, 2012).

Alternatively, measuring physiological responses to social interactions, using a tool such as salivary samples of cortisol levels to measure stress, could provide more nuanced findings of how adolescents with DLD interpret social situations.

Conclusion

Social cognition is an extremely useful skill to have. Being able to ascribe intent and identify others' emotions allows one to interpret others' motivations and predict future actions, leading to more successful social interactions. A deficit in social cognition could explain the increased peer problems seen in adolescents with DLD and could aid in understanding how to improve these social difficulties. The current paper found that adolescents with DLD perform significantly worse than their TLD peers on selected indices of an animated social cognition task. However, social cognition abilities did not account for the variance in peer or emotional problems. While the preliminary results from this novel task are interesting, further research with a larger sample size and additional language measures is advised to determine the effect of language ability on social cognition abilities.

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Appendix A.

Scoring template for the Social Attribution Task (SAT).

Scoring T-Units

A T-Unit is an independent clause, plus all clauses dependent on it. Every independent clause (plus its dependents) equals 1 T-Unit and should be recorded on its own line.

T-Units are supposed to be the smallest grammatically meaningful units of an utterance, so a good test of whether to include something as a part of a T-Unit, or to start a new one, is to ask yourself “does it make sense by itself?”

Clauses joined by co-ordinating conjunctions (such as *and*, *but*, *so*) are usually considered as separate T-units, as long as each element can stand alone. E.g. *They're playing and the big triangle opens the door and now they're running behind* = 3 T-Units

They're playing (T1) *and the big triangle opens the door* (T2) *and now they're running behind* (T3)

You'll often see in the narratives that children start with “and” at the beginning of a new T-unit. However, sometimes a clause containing “and” will be counted as a single T-Unit. E.g.

He tried and tried = 1 T-Unit

He goes straight through the house and breaks it apart = 1 T-Unit

In the above examples, the subject of the second element of the clause is omitted but can be linked to the subject of the first element – in both cases here the pronoun “he.”

Therefore, a single T-Unit is counted. Note that the second elements (*and tried*; *breaks it apart*) do not pass the “does it make sense by itself?” test, so this gives another clue.

Dependent clauses or elements may tell you something about the timing (while, after) or characteristics.

That one's hiding while the triangle's going for the other kid = 1 T-Unit

because “*while the triangle's going for the other kid*” is a dependent of “*That one's hiding*”

Salience Index (SI) (Narratives 1-7)

This index examines the information content of the child's narrative. Clearly, there is no need for explicit use of the words describing the elements of the social story; **the element is scored as present or absent in terms of whether or not the idea is represented, explicitly or implied**, in the participant's narratives. Work through the narrative to determine which of the story elements are present. Provide evidence (in quotation marks) from the child's narrative in the space below and the number of points (0 or 1) awarded for that item. For example, for item 1, if the child refers to the rectangle as a 'house', then their narrative should be reproduced below (e.g., "they went into the house") and a score of 1 awarded.

1.Rectangle is human enclosure
2.Recognition of three actors (rectangle not an actor, 3 agents throughout)
3.Little triangle and circle are together (may be implicit)
4.The big triangle and the small triangle fight
5.Indication of the direction of hostility: The big triangle is the aggressor, the little triangle is resistant
6.The little triangle is overwhelmed by the big triangle (e.g. the big triangle wins, the big triangle scares off the little triangle)
7.The little circle tries to avoid conflict (e.g. hides, cowers, seeks protection)
8.The big triangle searches for the little circle (e.g. entraps, tries to catch)
9.The little circle panics (e.g. is afraid, scared, terrified)
10.Indication that the little triangle came to the little circle's aid (e.g. save, rescue, help)
11.The little circle escapes the big triangle (e.g. evades, flees, gets away from)
12.The big triangle is trapped inside the enclosure
13.The little circle and the little triangle celebrate (e.g. are happy, dance, rejoice)
14.Proposition explaining the reason for celebration (e.g. escaped from the big triangle, are free)
15.Indication that the big triangle chases the little triangle and the little circle (e.g. goes after, pursues them)
16.Indication that the big triangle momentarily does not know where the little triangle and circle are (as a result of the big triangle's momentary search of the other two shapes inside the rectangle)
17.The little triangle and the little circle are successful at evading the big triangle (e.g. they escape, run away)
18.The big triangle is frustrated (e.g. mad, angry)
19.Proposition of explanation for the big triangle's anger (e.g. because he failed to catch them)
20.The big triangle breaks the enclosure

Scoring.

(Number of elements of the story included in the participant's narration / 20) *100

Animation Index (AI) (Narratives 1-7)

This index captures the level of sophistication of social attributions made in the narratives. It includes allusions to behaviours, perceptions, emotions, cognition, relationships, and words denoting (explicitly) a symbolic representation. The categories are not scored; the levels of attribution in each category are (A through M).

1. Behaviours (doing something):
A. Behaviours which necessitate actors or agents, but which are not uniquely or necessarily human behaviours, nor do they necessarily require any attribution of mental or feeling states (e.g., chasing, fighting, destroying, but NOT 'go' verbs) [code = 1a]
B. Verbs or behaviours which do not involve an explicit mental state but are uniquely human (e.g., talking, says, or a quotation) [code = 1b]
C. Behaviours which are uniquely human by virtue of implied indication of a shared mental state without which the behaviour cannot occur (e.g., cheering, celebrating, trapping, hiding, dancing around, playing) [code = 1c]
D. Behaviours which are uniquely human by virtue of direct indication of an awareness by one character of another's mental state, accompanied by an attempt to alter the second character's mental state (e.g., intimidation, deception, trickery, bullying, arguing, joking, rebuffing, taunting, helping) [code = 1d]
2. Perceptions:
E. Sensory experiences or attention which are not uniquely human (e.g., look, watch, see, notice) [code = 2e]
3. Emotions (feeling something):
F. Emotional terms that usually result from a behaviour or an action, but which do not necessarily result from a social action, or which are not uniquely human (e.g., happy, sad, scared, mad, alarmed, panicked) [code = 3f]
G. Emotional terms which result only from a social situation (e.g., envious, jealous, sulking, bitter, mended his ways, expressing sour grapes, annoyed, admiration) [code = 3g]
4. Cognition, intention, motivation (usually thinking something):
H. Lower developmental level, mental state terms expressing desire or knowledge (e.g., want to, know, mistake) [code = 4h]
I. Higher developmental level, mental state terms expressing belief, thoughts, imagination, plans (e.g., pretending, remembering, decision, trying to) [code = 4i]
5. Relationships or personality traits:
J. Allusion to a person as constrained by his or her features (e.g., big guy, little guy, kid) [code = 5j]
K. Allusion to a person as constrained by his or her relationship to another (e.g., is a daddy, mummy, or baby) [code = 5k]
L. Allusion to a person as constrained by his or her actions or attribution of personality traits (e.g., to be a bully, friends, companions, curious, timid, shy) [code = 5l]
6. Symbolic nature:
M. An acknowledgement of the symbolic nature of an object or shape (e.g., represents, stands for, symbolizes, a home, domain) [code = 6m]

Scoring procedure.

Score	Criteria
0	No human agency; mechanistic; geometric reasoning only
1	A or E or J
2	B or C or F or H or K or M
3	D or G or I or L
4	At least two of D or G or I or L, but not two of the same category
5	At least three of D or G or I or L, but not two of the same category
6	Four of D or G or I or L, but at least one of each

Theory of Mind Index (Narratives 1-7)

Cognitive mental states (CogA, CogB, CogC, CogD).

This index examines the use of cognitive mental state terms in narratives. Cognitive mental states are defined as:

- A. Terms expressing one characters' desire or knowledge (**e.g. he wants, she knows**)
- B. Behaviours which not only implicitly indicate a shared cognition, thought, or plan between two characters but which cannot exist without it (**e.g., trapping, rescuing, sneaking, hiding, spying**)
- C. Terms expressing one character's belief, thought, imagination, intention, plan, motivation (**she thinks, she is planning, he's pretending that**)
- D. Behaviours which explicitly indicate a shared cognition, thought, or plan between two characters in which one character intentionally impacts on the other's cognitive state (**e.g., intimidation, deception, trickery, bullying, arguing, joking, rebuffing**)

Affective mental states (AffA, AffB, AffC).

This index examines the use of affective mental state terms in narratives. Affective mental states are defined as:

- A. Emotional terms that may not be the result of social interaction or may not be uniquely human
- B. Behaviours which not only implicitly indicate a shared emotional state between two characters but which cannot exist without it (**e.g., cheering, celebrating, hugging, high-fiving**)
- C. Emotional terms which result only from a social situation (**e.g., envious, jealous, sulking, bitter, mended his ways, expressing sour grapes, admiration**)

Scoring procedure.

Sum Cognitive Mental States (SumCog) = CogA + CogB + CogC; SumCog/No. T Units

Sum Affective Mental States (SumAff) = AffA + AffB + AffC; SumAff/No. T Units

Person Index (PI) (Narratives 8-10)

Here, children are instructed explicitly to perceive the shapes as people. This index measures the participant's ability to derive personality features from the shapes' actions in the animation. Children's responses are coded according to their level of sophistication. These involve, in increasing level of sophistication:

0 = nothing (no response, triangle, circle, behaviour)

1 = purely physical properties: descriptions based on the shapes' form, e.g., big, small, skinny

2 = relative properties: descriptions of the interrelated social (e.g., family) roles of the characters although still related to their relative shape, e.g., adult, dad, mother, grown-up, kid, boy, baby

3 = psychologically-derived features: these attributions reflect characterological statements, e.g., curious, timid, bully, mean, shy, naughty, i.e., features that the characters would carry with them beyond the specific events portrayed in the video.

Scoring procedure.

The description of each figure (big triangle, small triangle, and circle) should be scored according to the level of sophistication. Scores should then be summed to yield a total Person Index ranging from 0 to 9.

Note: If there is a misattribution (i.e. psychologically-derived feature for the wrong shape) the maximum score is 2 for that shape.

Appendix B.

Examples of SAT narratives from participants randomly selected from each group.

Example from Participant in DLD Group

Narrative 1 “What happened in the video clip?”

Well I thought, well it was just a normal triangle, being just walking around you know. Then a smaller triangle trying to chase a circle was like going round the screen and like. Then the big triangle was opening the door to like stay away. And then like the circle went in. The big triangle and the smaller triangle were having a fight. Whilst the smaller triangle got himself stuck in the...like box...thing. The big triangle had him cornered. But the circle moved around everywhere. And then um the circle got out and they were both being chased by the big triangle and they ran off and the big triangle just destroyed everything.

Narratives 2-7 “What happened here?”

1st clip. Well the big triangle just obviously seemed to have redone his built his box so he was inside just close the door up, then the small triangle and the circle came along they're friends. He noticed and he opened the door then.... the small triangle and the circle just stood there.

2nd clip. He um...well the big triangle was like talking to them I think. Then he ??? prepared to attack the small one the small triangle. Then he attacked then the circle ran off. Got himself stuck in the doorway again I think. And then he closed the door and the big triangle and the small triangle kept on fighting each other.

3rd clip. Circle got trapped again, triangle was going to attack him but then the small triangle was going to attempt to open the door.

4th clip. The circle escaped by jiggling around the big triangle gets trapped in there the triangle circle circle around each other.

5th clip. Uhhmm...well they're happy and the big triangle gets out starts chasing them around the building around around around ??? and eventually they fly off again into the distance.

6th clip. The big triangle twists around smashes through the door and breaks the entire thing.

Narratives 8-10 “What kind of person is the big triangle/little triangle/circle?”

Big triangle. Bully.

Little triangle. A person who's trying to help the circle.

Little circle. The smallest one, the one that's more afraid and the one that's being bullied.

Example from Participant in TLD Group

Narrative 1 “What happened in the video clip?”

So there’s a big triangle in the rectangle and it tries to get out. And then it gets out. And then a little triangle and a small circle comes... in. and then it bounces around the little circle. And then the big triangle comes and like bounces into the little triangle and then the little circle goes up to the rectangle and like, the side opens and then it goes inside and then gets trapped in there. But then the big triangle... barges into the side and it opens and then the little circle comes out and the big triangle goes in. and then the side closes. And then it opens again and the ball goes in, but then it closes again. And then the little triangle barges into the side and it opens. And then the... little circle comes out and then...barges into the small triangle and bounces into it. And then the big triangle comes out of the rectangle and chases the little triangle and the little circle around the rectangle. And then the big triangle goes back into the rectangle and then the little triangle and the little circle goes off the screen.

Narratives 2-7 “What happened here?”

1st clip. The big triangle barged into the side of the rectangle – the inside of the rectangle. And it opened and then it closed again. And it was in there. Then the little circle came in... onto the screen. And then the little triangle bounced around the little circle.

2nd clip. The big triangle came out of the rectangle and saw the little triangle and then barged into the little triangle like bounced, into it. While the little circle went up to the rectangle which was open and it ...there was a little gap in between the kind of the door bit of the rectangle, trying to close but the ball, the circle got stuck. And then it moved a bit and then it got pushed inside by the door bit of the rectangle.

3rd clip. The little circle was bouncing around in the rectangle and then the big triangle opened up the rectangle and like, pushed it down really far. And then it went into the rectangle and then it closed and then the little circle bounced really, really quickly around the bottom of the rectangle and the little triangle went into the side of the rectangle but didn’t get in.

4th clip. The little triangle - wait, the little circle and the big triangle were still in the rectangle and then little triangle opened up the rectangle and the ball came out, and then it shut again trapping the big triangle inside and then the little circle and the little triangle bounced into each other and around each other.

5th clip. The big triangle came out and the rectangle stayed open and then the big triangle chased the little triangle and the little circle around and around the rectangle and then the little triangle and the little circle went off the screen and the triangle went inside the rectangle and came back out again.


6th clip. The big triangle... shut the rectangle and then it went back towards the side of the screen and then charged into the side of the rectangle and split it into 4 pieces and then it went inside but wasn’t inside, it was just, blown apart.

Narratives 8-10 “What kind of person is the big triangle/little triangle/ circle?”

Big Triangle. Bit of a bully.

Little Triangle. Um...quite an innocent little person.

Little Circle. Maybe the little triangle’s friend? Like ... stayed with him.

This declaration concerns the article entitled:									
Do you like me? Differences in learning social cues in adolescents with Developmental Language Disorder (DLD).									
Publication status (tick one)									
draft manuscript	<input checked="" type="checkbox"/>	Submitted	<input type="checkbox"/>	In review	<input type="checkbox"/>	Accepted	<input type="checkbox"/>	Published	<input type="checkbox"/>
Publication details (reference)	Forrest, C. L., Button, K., Halligan, S. L., & St Clair, M. C. (in preparation). Do you like me? Differences in learning social cues in adolescents with Developmental Language Disorder (DLD).								
Candidate's contribution to the paper (detailed, and also given as a percentage).	The candidate contributed to the formulation of ideas (50%) and to the design of methodology (50%). The candidate executed the experimental work, including the analysis and the majority of the interpretation of the results (70%) and predominantly executed the presentation of the data in journal format (90%).								
Statement from Candidate	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature.								
Signed						Date	17/01/2019		

Chapter 5: Cross-sectional Experimental Study

Do you like me? Differences in learning social cues in adolescents with Developmental Language Disorder (DLD).

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Chapter rationale: In order to expand on the previous findings that showed a group difference in social cognition skills, Chapter 5 examines performance on the Social Evaluation Learning Task (SELT; Button et al., 2015) as a mediator of socioemotional problems in adolescents with and without DLD. This task mimics the online updating of social cues that needs to be performed during a social interaction in order to make a judgement about whether the other person has a favourable view or not. Outcomes of social and emotional problems are also investigated to assess whether poor social cognition, as measured by SELT performance, mediates the relationship between DLD and associated socioemotional difficulties.

Abstract

Background: Individuals with Developmental Language Disorder (DLD) have been found to experience higher rates of socioemotional difficulties compared to their typically developing (TD) peers. However, the mechanisms underlying this relationship are unclear. Social cognition has been proposed as a mediator but research has focused on children, using theory of mind (ToM) tasks that are not always representative of real-life social functioning. Here we examine the mediating effect of a novel, computerised social evaluation task on the relationship between DLD and socioemotional outcomes in adolescents. **Method:** Twenty-four adolescents with DLD and twenty-six adolescents with typical language development (TLD) completed the Social Evaluation Learning Task (SELT; Button et al., 2015). Parent- and self-reports of social and emotional outcomes were also measured. **Results:** Compared to their TLD peers, adolescents with DLD received significantly higher ratings of peer and emotional problems from their parents but did not report significantly more problems themselves. Adolescents with DLD had more difficulty learning whether the computer characters “liked” or “disliked” them in the SELT compared to the TLD group. They were particularly poor in learning that they were disliked as they chose more positive responses when asked to evaluate what the computer character thought of them and gave higher ratings of “likeability”. There was no association between performance on the SELT and socioemotional outcomes in the DLD group, but a poorer understanding of social cues predicted higher reports of social anxiety in the TLD group. **Conclusion:** Interpreting social cues in a computerised task, specifically learning that they are disliked, is more difficult for adolescents with DLD than their TLD peers. However, this poor social cognition ability has no bearing on socioemotional difficulties in the DLD group. Due to the exploratory nature of this study, further examination of online interpretation of social cues in this population is recommended.

Approximately 7% of the population have Developmental Language Disorder (DLD)¹, a difficulty with expressive or receptive language without a known cause (Bishop, Snowling, Thompson, Greenhalgh, & consortium, 2016). As well as difficulties with language, individuals with DLD are at risk for increased feelings of anxiety (Beitchman et al., 2001), depression (Conti-Ramsden & Botting, 2008) and social difficulties (Durkin & Conti-Ramsden, 2007) compared to their typically developing (TD) peers. These negative outcomes can persist throughout the lifespan (Beitchman et al., 2014), yet the developmental pathways to these elevated socioemotional difficulties are still unknown (Yew & O'Kearney, 2013). Contrasting findings have emerged from longitudinal studies which have examined the predictors involved in the relationship between DLD and increased risk for social and emotional difficulties. For example, St Clair, Pickles, Durkin, and Conti-Ramsden (2011) found pragmatic language skills to be the strongest predictor for emotional and peer problems in adolescents with DLD, suggesting that language ability is directly associated with socioemotional problems. Wadman, Botting, Durkin, and Conti-Ramsden (2011) on the other hand, found peer problems predicted depressive symptoms in adolescents with DLD, suggesting that the relationship between language and emotional problems may be mediated by social difficulties. Communicating with others is key to functioning in society. Given the social nature of language and communication, exemplified by the difficulties with pragmatic skills and peer relations, recent studies have examined the mediating effect of social cognition to explain the increased risk for social and emotional difficulties in young people with DLD.

Social cognition is an umbrella term that refers to an individual's understanding of social interactions. Social cognition draws on skills such as Theory of Mind (ToM) or 'mentalizing', which are the ability to understand others' thoughts, feelings and motives (Frith & Frith, 2003). These skills are necessary when communicating with others in order to react appropriately in different situations. Indeed, the Social Information Processing Theory (Crick & Dodge, 1994) describes the crucial steps that are involved in processing and understanding social interactions, ranging from encoding social cues to making

¹ As recommended by a recent panel of experts, we have opted to use the term Developmental Language Disorder (DLD) instead of Specific Language Impairment (SLI) (Bishop et al., 2017). The definition remains the same as many recent definitions (in that diagnosis is no longer based on a discrepancy between verbal and nonverbal intelligence) and follows long-term studies' adoption of this term (e.g. Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018). Therefore, we refer to DLD throughout the paper when referencing older studies that discuss children with expressive or receptive language difficulties with no known cause.

judgements about how to best respond. Having an insight into how another person is feeling and thinking, as well as examples of successful interactions in long-term memory from which to draw upon, can support effective communication. According to the usage-based theory of language (Tomasello, 2009), children strengthen their social cognition abilities through conversational interactions with their caregiver. Indeed, language ability has been found to predict social cognition in the general population (Astington & Jenkins, 1999; Jenkins & Astington, 1996). Consequently, children with language difficulties such as DLD may have impaired social cognition skills, as demonstrated by a recent meta-analysis (Nilsson & Jensen de Lopez, 2016).

Impairments in social cognition in association with DLD could have significant consequences for individuals' social and emotional functioning. Deficits in ToM abilities may make it harder to pick up on a speaker's intentions, which could lead to misinterpreting social situations and making faux pas. For example, children with DLD displayed inappropriate behaviour, such as aggression or withdrawal, during a conflict resolution task and found it difficult to navigate social situations using speech (Bakopoulou & Dockrell, 2016; Marton, Abramoff, & Rosenzweig, 2005). As a result, these children may be more likely to experience peer rejection. For instance, Botting and Conti-Ramsden (2008) showed that poor performance on social cognition tasks predicted lower levels of friendship and social activities in adolescents with DLD. In addition, Andres-Roqueta, Adrian, Clemente, and Villanueva (2016) found that children with DLD received more "least liked" ratings from their classmates and these ratings were predicted by their poor performance on social cognition tasks. Furthermore, these social cognition abilities explained 11% of the variance in least liked ratings when the effect of age and language was controlled. This indicates that poor language skills alone do not account for the lower social functioning seen in children with DLD, but that social cognition difficulties may be implicated in the increased level of peer problems seen in children and adolescents with DLD. Furthermore, these social difficulties could contribute to poorer emotional adjustment as the participants with DLD in Marton et al.'s (2005) study reported lower social self-esteem compared to their TD peers, and Bakopoulou and Dockrell (2016) found social cognition and prosocial behaviour predicted higher teacher-ratings of socioemotional difficulties in the DLD group, accounting for 44% of the variance.

As well as the different outcomes used to measure socioemotional functioning in young people with DLD, the nature of the tasks used to measure social cognition may

explain the inconsistency in variance. As social cognition is an umbrella term, the false-belief tasks that are typically used do not cover all the different aspects involved in social understanding, such as assessing someone's emotions during a social interaction and responding appropriately to difficult situations, such as conflicts. For example, the Eyes Task (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001a) measures emotion decoding and the Strange Stories task (Happé, 1994) uses vignettes to examine how participants interpret others' social understanding. Additionally, previous research on social cognition in DLD has focused on children, with only Botting and Conti-Ramsden (2008) focusing on adolescents and Clegg, Hollis, Mawhood, and Rutter (2005) studying adults. Adolescence in general is a risk period for the development of psychiatric disorders (Jones, 2013) and young people with DLD are at increased risk of social and emotional problems compared to their typically developing peers (Lindsay & Dockrell, 2012). Social problems in the DLD population have been found to increase during adolescence (St Clair et al., 2011); therefore, there is a clear need for more studies examining the mechanisms involved in this age-group.

The current study will use the Social Evaluation Learning Task (SELT; Button et al., 2015) to provide an online measurement of adolescents' responses to judgements in a social situation. Evaluating social cues is a key skill for successful social interactions and the SELT will provide a novel account of how adolescents with DLD process information in computerised social situations. Based on previous findings of social cognition deficits in the DLD population we expect that adolescents with DLD will perform worse on the SELT compared to the TLD group. Given the findings that adolescents with DLD are more socially anxious than their peers (Voci, Beitchman, Brownlie, & Wilson, 2006; Wadman, Durkin, & Conti-Ramsden, 2011a) it may be logical to expect our sample to perform in a similar way to a previous study examining the SELT in adults with social anxiety (Button et al., 2015). Thus, adolescents with DLD may find it easier than their TLD peers to learn the rule that they are "disliked" and may not display a positive self-bias. Alternatively, due to the research discussed regarding social cognition as a potential comorbid difficulty in children and young people with DLD, it may be that the DLD group will perform poorly on the SELT and will have a significant difficulty learning whether they are "liked" or "disliked", which may also be reflected in their ratings given after each condition. Either way, it is predicted that there will be a significant difference in SELT performance based on group status.

We aimed to explore the mediating effect of social evaluation learning on psychosocial outcomes in adolescents with DLD. We compared adolescents with DLD to age- and sex-matched peers with typically developed language (TLD) on measures of socioemotional functioning and performances on the SELT, used as a measure of social cognition. Based on previous research, we expected that the participants with DLD would receive higher ratings of social and emotional difficulties through self- and parent-report. Additionally, we predicted that there would be a significant group difference in performance on the SELT when adolescents with DLD are compared to their age- and sex-matched peers, due to either a difficulty following social cues or higher rates of social anxiety. Furthermore, we predicted that these social cognition abilities would partially mediate the relationship between language and socioemotional outcomes.

Method

Participants

There were two recruitment streams for the study. Participants with a diagnosis of DLD were recruited through referrals from professionals and online support groups. In addition, a screening procedure was used to recruit the TLD comparison group and also identified further participants with a history of language difficulties for inclusion in the DLD group. Participants were all aged 11-18 years old and were native English speakers. All participants attended mainstream schools, although three participants were recruited from a specialised language unit within a mainstream school. Exclusion criteria consisted of parent-report of hearing impairments, intellectual disabilities and diagnoses of autism spectrum disorder (ASD). Additionally, the Autism Quotient (AQ; Baron-Cohen, Hoekstra, Knickmeyer, & Wheelwright, 2006; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001b) was administered to parents or participants to provide a standardised screening measure of ASD symptoms, and poor performance on the nonverbal IQ measure in the testing phase provided further exclusionary criteria.

Participants in the DLD group were recruited based on a history of DLD through referrals from a local speech and language therapy service employed by the local authority to provide services to schools, referrals from Special Educational Needs Coordinators (SENCOs) within schools, or via flyers posted in online support groups for DLD. In addition, a screening procedure was used to recruit typical language developed (TLD)

participants matched on age (within six months) and sex, as well as additional DLD participants. Participants were recruited via flyers displayed in local schools, at the University of Bath or on social media. Screening packs consisting of background questionnaires for parents and self-report measures of language and communication skills for participants were sent to 258 participants, of which 109 were completed by both parent and participant.

Forty participants with a diagnosis of DLD were initially identified for the study. Five participants with parent report of language difficulties or with a low score on the self-report measure (CC-SR) identified through the screening procedure were included in the DLD group. Four participants did not respond to invitation emails. One participant was excluded due to a hearing impairment, twelve participants were excluded due to a diagnosis of autism or exceeding the cut-off on the AQ and one participant withdrew from the study.

Twenty-seven participants were invited to the testing stage as part of the DLD group, with twenty-seven matched controls identified via the screening process forming a TLD group matched on age and sex. One further participant was excluded from the DLD group after scoring more than 2 SDs below the mean on the nonverbal IQ measure. SELT data is missing from one participant in the DLD group and one participant in the TLD group due to technical problems during administration. Another participant in the DLD group reported suicidal ideation on the socioemotional measures and therefore the testing phase was terminated in order to follow safety protocol. This resulted in a total sample of 24 adolescents with DLD and 26 TLD participants matched on age and sex.

Measures

Parent-reported questionnaires.

Background questionnaire. This consisted of twenty-four questions to ascertain demographics of the sample, such as child age, parent/guardian marital status, occupation and educational level, and information about the child's early development and family history of mental health and learning difficulties. Questions regarding language referred to what languages were spoken in the home; whether the child had a history of speech and language problems (suspected or diagnosed); whether the child had ever received speech and language therapy; whether they were currently receiving speech and language therapy; and whether there was a history of speech and language problems in the family (suspected

or diagnosed). Other questions included the speed at which developmental milestones in language, motor skills and self-help were met and whether the child or any family members had any learning difficulties or a history of mental health difficulties (suspected or diagnosed). Postcodes were also gathered to generate an Income Deprivation Affecting Children Index (IDACI) Rank, a measure of socioeconomic status. The IDACI Rank is based on the percentage of children living in families that are income deprived in Lower-layer Super Output Areas across England, where 1 = most deprived neighbourhood and 32,844 = least deprived neighbourhood. School postcodes were used when home postcodes were missing (n = 5). Two participants in the DLD group did not have either postcode available.

The Strengths and Difficulties Questionnaire (SDQ). The SDQ (Goodman, 1997) was completed by the participant's parent/guardian. This questionnaire consists of 25 items which form five scales (Peer Problems; Emotional Problems; Hyperactivity; Conduct Problems and Prosocial scale), the first four of which are totalled to produce the Total Difficulties score. The SDQ is a well-established measure and has a test-retest reliability of .85 (Goodman, 1999). The scales of interest were the Emotional Problems and Peer Problems subscales, each consisting of five items rated on a scale of *Not True* (0), *Somewhat True* (1) and *Certainly True* (2). Total scores for each subscale range from 0-10.

The Autism Spectrum Quotient (AQ). The adolescent version of the AQ was administered to parents of children aged 12-15 years old (Baron-Cohen et al., 2006). Scores of 30 or more on the parent-report are well-established thresholds for ASD symptoms and were applied in the current study.

Adolescent-reported measures.

The Communication Checklist Self-Report (CC-SR). The CC-SR (Bishop, Whitehouse, & Sharp, 2009) was completed by the participant. This questionnaire consists of 70 questions about communication abilities. The participant rates the items on a scale of 0 – *Less than once a week (or never)*; 1 – *About once a week*; 2 – *Once or twice a day* or 3 – *Several times a day (or all the time)*. These items form three composite scales. The Structural Language composite describes aspects of language such as grammar and meaning (e.g. “I mix up ‘he’, ‘she’, ‘it’ and ‘they’”). The Pragmatic Skills composite contains items relating to language use in social contexts (e.g. “I give detailed information

when a more general comment would be fine”). Finally, the Social Engagement composite is comprised of items regarding nonverbal communication and social functioning (e.g. “I find it hard to know when people are upset or annoyed”). Positive items are reverse scored and the mean scaled score is 10 ($SD = 3$). A scaled score lower than 5 on the Structural Language composite and greater than 7 on the Pragmatic Skills composite is indicative of DLD (Bishop et al., 2009). Internal consistency for each of the composites is greater than .85 (Bishop et al., 2009). The CC-SR was used in the screening sample only, in order to identify or rule out DLD.

The Autism Spectrum Quotient (AQ). The adult version of the AQ was completed by participants aged 16 years or over (Baron-Cohen et al., 2001b). Scores of 32 or more on the self-report are well-established thresholds for ASD symptoms and were applied in the current study.

Cognitive measures.

Clinical Evaluation Language Functioning – 4 (CELF-4). In order to measure language ability, two subtests from the CELF-4 (Semel, Wiig, & Secord, 2006) were administered. The Recalling Sentences subtest requires participants to listen to sentences of increasing length and complexity and repeat verbatim, providing a measure of expressive language. The Word Classes subtest requires participants to pick two words out of a list of four that are best matched and provide a definition for how the two words are similar, providing a measure of receptive language ability. Both subtests have an excellent rating of reliability (internal consistency coefficient of .92 and .91 respectively; Semel, Wiig & Secord, 2006).

Wechsler Intelligence Scale for Children – 4th edition (WISC-IV). The Block Design subtest was administered to provide a measure of nonverbal ability (Wechsler, 2004). This task requires participants to use 3D blocks to recreate 2D patterns of increasing complexity. Block Design is a measure of spatial awareness and contributes to fluid reasoning.

Social and emotional outcomes.

Warwick Edinburgh Mental Well-being Scale (WEMWBS). The WEMWBS (Tennant et al., 2007) consists of 14 items focusing on positive mental wellbeing. Participants rate statements on a scale of 1 *None of the time* – 5 *All of the time*, according

to how they felt in the past two weeks. Scores range from 14-70 with a higher score reflecting a better state of mental wellbeing.

Perceived Social Support – Friendship (PSS-Fr). The PSS-Fr (Procidano & Heller, 1983) consists of 20 statements about friendship quality and measures how well participants believe their support needs are met by their relationships with friends. Participants answer *Yes*, *No* or *Don't Know* depending on how true they feel each statement is. The number of *Yes* answers is summed to create a total score (0-20) with a higher score indicating better social support. Norms from a study of undergraduate students reveal a mean score of 15.15 (Procidano & Heller, 1983).

Revised Children's Manifest Anxiety Scale (RCMAS). The RCMAS (Reynolds & Richmond, 1978) consists of 28 statements regarding feelings of anxiety. Participants rate each item according to how often they have felt or acted that way in the past two weeks (*Never*, *Sometimes*, *Mostly*, or *Always*). Ratings are assigned scores of 0-3 respectively and summed. A total score ranges from 0-84 with a higher score denoting more symptoms of anxiety.

Moods and Feelings Questionnaire (MFQ). The MFQ (Angold & Costello, 1987) consists of 33 statements that measure depressive thoughts and feelings. Participants rate each item according to how often they have felt or acted that way in the past two weeks (*Never*, *Sometimes*, *Mostly*, or *Always*). Ratings are assigned scores of 0-3 respectively and summed. A total score ranges from 0-99 with a higher score denoting more depressive symptoms.

Social Anxiety Scales for Adolescents (SAS-A). The SAS-A (La Greca, 1998) consists of 18 statements measuring how the participant feels in social situations and four filler statements (e.g. "I like to read"). Items are rated on a scale of 1 *Not at all* to 5 *All the time*. Three subscales (Fear of Negative Evaluation (FNE), Social Avoidance and Stress Specific to New Situations (SAD-New) and Social Avoidance and Stress in General (SAD-General) are generated along with a total score. Scores can range from 8-40 for FNE, 6-30 for SAD-New, 4-20 for SAD-General and 18-90 for the total score. The total score was used in the current study. A total score of 50 or above reflects High Social Anxiety, while Low-Socially Anxious participants report a score of 36 or below. Internal consistencies for the subscales are .91 (FNE), .83 (SAD-New) and .76 (SAD-General) (La Greca & Lopez, 1998).

Social Cognition

Social Evaluation Learning Task (SELT). The SELT (Button et al., 2015) is a computerised probability learning task, designed to measure how well participants can learn whether a computer character likes them or not. Participants are presented with positive and negative word pairs and are asked to pick which of the words best describes what the computer character (“Charley”, “Sam”, “Chris” or “Bobby”) thinks of the participant (self-referential condition), or another character called “George” (other-referential condition). For example, “I think [you are] / [George is] witty – dull”. The list of word pairs was modified to take into account the age and language ability of participants. Two TLD adolescents piloted the data and any words that were questioned were replaced with new words, while still remaining within similar “likeableness” ratings given by Anderson (1968). For example, “inquisitive” was replaced with “curious” and “candid” was replaced with “direct”. Participants receive feedback after each trial (“Correct” or “Incorrect”) in order to learn the “rule” of each condition. The two rules that the participant learnt were “Like” or “Dislike” and the two conditions are “Self” or “Other”, resulting in four conditions: “Self-Liked”; “Self-Disliked”; “Other-Liked”; “Other-Disliked”. There are 32 trials for each computer character with an 80-20 split on feedback. For example, in the Like rule, participants receive Correct feedback for selecting positive words 80% of the time, and Incorrect feedback for positive words 20% of the time. In the Dislike rule, participants receive Correct feedback for selecting positive words 20% of the time and Incorrect feedback for positive words 80% of the time. Participants’ understanding of the rule (Like or Dislike) is measured by the Errors to Criterion outcome, which is the number of errors made before reaching the criterion of 8 consecutive responses consistent with the prevailing Like or Dislike rule, regardless of occasionally misleading feedback. This score therefore indexes the number of trials taken to acquire the correct rule, demonstrating the learning process. At the end of each of the four conditions the participant must rate how much they think the computer character liked them or George on a scale of 0 *Not at all* – 9 *Very Much*. This forms the Global Rating outcome (mean “likeability”), demonstrating how the participant has interpreted the feedback following each trial.

Procedure

Ethical approval was granted by the University of Bath Psychology Ethics Committee (Ref: 15-245). SLTs and SENCOs passed on recruitment letters to students and their parents with a contact email for the study. Informed consent and assent was obtained from parents/guardians and participants. Parents in the DLD group completed the consent form, background questionnaire, AQ and SDQ online or returned the forms in a freepost envelope. Participants who did not exceed the threshold on the AQ were then invited to complete the assessment stage in a quiet room either at the University, their school or their home. Participants who were recruited through schools gave assent and were screened with the CC-SR while their parents gave consent and completed the AQ, SDQ and background questionnaire, either online or via paper copies. Those that had no language difficulties were matched on age (within six months) and sex to participants in the DLD group to form the control group. Again, the assessment stage was completed wherever was convenient for the participant. Parents/guardians screened through schools completed online consent forms for the assessment stage and the remaining background questionnaire, and participants completed online assent forms at the beginning of the assessment. Participants were administered the two language tasks, the WEMWBS, the PSS-Fr, the RCMAS, the MFQ, the Block Design task, the SAS-A and the SELT. The assent form and all socioemotional questionnaires were read aloud to all participants. The on-screen instructions and word choices for the SELT were also read aloud to all participants and definitions of any words were given when requested using a glossary to ensure standardised explanations. These tasks formed part of a larger study lasting approximately 90 minutes in total. In the event of a participant reporting suicidal ideation on the MFQ a safety protocol was followed which involved a structured interview to ascertain how often they experienced those feelings and whether or not they were likely to act upon them, and the participant's parent was notified of the findings. This happened once and the testing was terminated in order to follow the safety protocol. Participants received £15 on completion of the assessment stage and any travel expenses were reimbursed. Entry into a prize draw to win a £50 shopping voucher was offered as incentive to complete the screening questionnaires. Additionally, brief reports of individuals' results were sent to parents/guardians and findings from the overall study were shared with parents/guardians in the form of a newsletter.

Statistical Analysis

Data were analysed using Stata 14 (StataCorp., 2015). Instead of analysing language as a construct, participants were categorised into groups of DLD and TLD status for two reasons. Firstly, children with DLD have disordered language development, not simply a delay, with the majority of the literature investigating DLD and associated socioemotional difficulties examining DLD as an entity based on a clinical cut-off and parental report of poor language functioning (Bishop et al., 2016). Secondly, previous research has suggested an absence of a linear relationship between language ability and severity of socioemotional problems (Fujiki, Brinton, & Clarke, 2002; Hart et al., 2004), therefore analysing language ability as a continuous scale was not deemed useful. First, group differences in socioemotional outcomes were analysed. Following tests for assumptions, regression was used to test for group differences in the WEMBS and PSS scales. Due to the skewed data, the RCMAS, MFQ and SAS-A scales were transformed using the square root function before analysing group differences with regression. Negative binomial regressions were used to test group differences in the SDQ Peer Problems and Emotional Problems subscales due to the most frequent response in each scale being zero. There were two outcomes of interest in the SELT: errors to criterion (mean number of errors made before 8 consecutive condition consistent responses) and global rating (mean likeability). Predictor variables were group (DLD vs TLD); referential condition (Self vs. Other) and rule (Like vs. Dislike). A mixed ANOVA, controlling for sex, age and IDACI Rank, was modelled with Group as a between-subjects factor and Referential Condition and Rule as within-subjects factors for each of the outcomes. Interaction effects of Group x Referential Condition; Group x Rule; and Group x Referential Condition x Rule were measured. Pairwise comparisons with Bonferroni corrections were used to examine interactions further. In order to test whether the SELT performance mediated the relationship between DLD and social and emotional problems, the *sgmediation* command was used with DLD group status as the independent variable, errors to criterion as the mediator and socioemotional scales as the outcomes. Case resampling bootstrapping was used to test the indirect effect, as recommended by (Zhao, Lynch, & Chen, 2010). Finally, to test the effect of language ability on SELT performance, a regression analysis was conducted for each group with the Word Classes – Receptive subtest and Recalling Sentences subtest as predictors and overall errors to criterion as the outcome. Sex, age and IDACI Rank were controlled in all analyses.

Results

Demographics

Participants were matched on age and sex, with an average age of 13 years and 6 months ($SE = 2.38$ months, range = 12 years and 1 month to 17 years and 9 months) in the total sample, of whom approximately 36% were female. English was the only language spoken at home in the majority of cases, although one participant in the DLD group spoke a second language, and two participants in the TLD group spoke a second language. See Table 1 for sample characteristics. As expected, the DLD group were significantly more delayed in reaching early speech and language developmental milestones compared to the TLD group and were more likely to have received speech and language therapy. The DLD group were also significantly more delayed in self-help development compared to their TLD peers. There was a significantly lower level of parental education in the DLD group compared to the TLD group, and a significantly lower socioeconomic status, as measured by the Income Deprivation Affecting Children Index (IDACI) Rank). The IDACI Rank ranged from 303 to 32662 in the DLD group and from 13021 to 32489 in the TLD group, demonstrating higher deprivation in the DLD group.

Table 1.
Demographics of sample.

	DLD (n = 24)	TLD (n = 26)	Total (n = 50)	DLD vs TLD
Mean age (SE)	13;6 (3.39)	13;6 (3.41)	13;6 (2.38)	-
Female %	33.3	38.5	36.0	-
<i>Language spoken</i>				n.s.
English only %	95.8	92.3	94.0	
English plus other %	4.2	7.7	6.0	
<i>Motor development</i>				n.s.
Delayed %	29.2	3.8	16.0	
Typical %	54.2	80.8	68.0	
Fast %	16.7	15.4	16.0	
<i>Speech & language development</i>				.03(.00, .14)^****
Delayed %	75.0	7.7	40.0	
Typical %	25.0	69.2	48.0	
Fast %	-	23.1	12.0	
<i>Self-help development</i>				.13(.03, .55)^***
Delayed %	45.8	3.8	24.0	
Typical %	45.8	84.6	66.0	
Fast %	8.3	11.5	10.0	
<i>Speech & Language Therapy</i>				χ^2 32.37***
Yes	83.3	3.8	42.0	
No	16.7	96.2	58.0	
<i>Biological parents</i>				n.s.
Yes %	91.3	100.0	95.9	
No – adopted %	8.7	-	4.1	
<i>Parental marital status</i>				n.s.
Married/Cohabiting/Civil Partnership %	65.2	88.5	77.6	
Separated %	17.4	7.7	12.2	
Divorced %	17.4	3.8	10.2	
<i>Parental psychological distress^a</i>				n.s.
Yes %	17.4	15.4	16.3	
No %	82.6	84.6	83.7	
<i>Parental education</i>				.21(.06, .68)**
Secondary school %	39.1	19.2	28.6	
Diploma %	13.0	-	6.1	
Undergraduate %	39.1	42.3	40.8	
Postgraduate %	8.7	38.5	24.5	
Mean IDACI Rank ^b (SE)	19713.95 (1711.32)	24583.85 (1119.98)	22351.81 (1042.32)	-4431.48(-8502.84, -360.11)*

Statistics are *b* coefficients or odds ratio where stated ^ (95% confidence interval).

^a As measured by parent-report of mental health difficulties in the background questionnaire.

^b n = 24 in DLD group.

*. $p < .05$, **. $p < .01$, ***. $p < .001$

Cognitive and Language Measures

Table 2 illustrates that there was a significant group difference on all cognitive and language measures. As expected, the expressive and receptive language abilities of the DLD group were below population norms of $M = 10$, $SD = 3$, and they performed significantly worse than the TLD group on the Recalling Sentences and Word Classes subtests.

Table 2.

Mean scaled scores from cognitive and language tasks for the Developmental Language Disorder (DLD) group and Typically Developing (TLD) group.

	DLD	TLD	DLD vs TLD
Block Design subtest	8.04(2.84)	11.81(2.48)	-3.62(-5.33, -1.92)***
Recalling Sentences subtest	4.75(2.98)	9.73(2.84)	-4.77(-6.60, -2.93)***
Word Classes – Receptive subtest	5.79(2.89)	12.88(2.36)	-6.47(-8.04, -4.90)***

Statistics are *b* coefficients (95% confidence interval), controlling for age, sex and IDACI Rank.

*, $p < .05$, **, $p < .01$, ***, $p < .001$

Social and Emotional Outcomes

Table 3 shows that, despite following an expected pattern, the self-reported experience of social and emotional functioning in the DLD group was not significantly poorer than the TLD group. Additionally, both groups reported very similar levels of perceived social support on the PSS-Fr. Conversely, the DLD group received significantly higher ratings than the TLD group on the parent-rated SDQ subscales of Emotional Problems and Peer Problems.

Table 3.

Mean (and standard error) ratings of social and emotional scales from self-report and parent-report.

	DLD	TLD	DLD vs TLD	Cohen's <i>d</i> (95% CI)
<i>Self-report</i>				
Warwick Edinburgh Mental Wellbeing Scale (WEMWBS)	51.50 (1.94)	54.27 (1.30)	-2.51(-7.62, 2.61)	.34 (-.22,.90)
Perceived Social Support – Friendship (PSS-Fr)	11.25 (.79)	11.27 (.53)	.00(-1.98, 1.98)	.01(-.55,.56)
Revised Children's Manifest Anxiety Scale (RCMAS)	22.04 (3.14)	14.23 (2.29)	1.02(-.03, 2.07)	-.58(-1.14,-.01)
Moods and Feelings Questionnaire (MFQ)	16.25 (2.80)	10.0 (2.11)	.77(-.29, 1.84)	-.51(-1.07,.06)
Social Anxiety Scale – Adolescents (SAS-A) ^a	44.55 (3.26)	39.31 (2.72)	.39(-.31, 1.09)	-.36(-.93,.21)
<i>Parent-report</i>				
SDQ Emotional Problems	3.63 (.63)	1.69 (.41)	.95(.31, 1.60)**	-.74(-1.31,-.16)
SDQ Peer Problems	3.21 (.49)	1.08 (.31)	1.06(.35, 1.77)**	-1.06(-1.65,-.46)

Statistics are *b* coefficients (95% confidence interval), controlling for age, sex and IDACI Rank.

^a. *n* = 22 in DLD group.

*. *p* < .05, **. *p* < .01, ***. *p* < .001

Social Evaluation Learning Task

Table 4 shows the mean outcome scores of Errors to Criterion and Global Rating from the SELT. Errors to Criterion is the mean number of errors made before reaching the criterion of eight consecutive condition-consistent responses, illustrating learning of the rule. For example, eight Like responses in a row within the Like block demonstrates understanding that the character likes the participant or George. Global Rating is the score from 0-9 given by the participant at the end of each block illustrating how much they thought the computer character liked them or George. Table 4 shows the DLD group made more errors on average than the TLD group when trying to learn the rule. A mixed ANOVA with Errors to Criterion as the outcome supported this finding, showing a significant main effect of group ($F(1, 181) = 16.01, p < .001, \text{partial } \eta^2 = .08$), illustrating that the DLD group took longer to learn the rule in general. Additionally, there was a main effect of rule (Like vs Dislike) ($F(1, 181) = 19.77, p < .001, \text{partial } \eta^2 = .10$), with both groups taking longer to understand the social judgement of the computer character when the rule was Dislike. There was no significant effect of condition (Self vs Other) ($p = .084$). There was a significant interaction between group and rule ($F(1, 181) = 10.87, p = .001, \text{partial } \eta^2 = .06$), with pairwise comparisons revealing that the DLD group took significantly longer to reach understanding of the rule than the TLD group in the Dislike rule ($t = 5.17, 95\% \text{ CI } [3.25, 10.18], p < .001$) but there was no significant group difference in the Like rule ($t = .67, 95\% \text{ CI } [-2.59, 4.33], p = 1.00$). Additionally, there was a significant interaction between condition and rule ($F(1, 181) = 5.18, p = .024, \text{partial } \eta^2 = .03$), with pairwise comparisons indicating that significantly more errors were made in the Self-Disliked condition than the Other-Disliked condition ($t = 2.84, 95\% \text{ CI } [.21, 6.90], p = .030$) suggesting that participants in both groups found it easier to learn that George was disliked compared to learning that they were disliked.

Figure 1 shows the learning process for each group in more detail. The cumulative mean accuracy for the different conditions was plotted across each of the 32 trials. In the Self condition, both groups were better at learning they were liked than disliked, reflecting a positive self-bias. The DLD group was more accurate to begin with, reflecting their tendency to choose positive words overall. Both groups were poorer at learning they were disliked to begin with, but the TLD group achieved higher accuracy over time, demonstrating that they were better at learning from the feedback provided. In the Other

condition, the TLD group was better at understanding social cues in both the Like and Dislike rules. Again, they made more errors learning the Dislike rule to begin with but were very quick to learn that George was disliked and this slope was steeper than in the Self condition. The TLD group did not appear to display a bias between the rules in the Other condition, displaying very similar levels of accuracy and in fact they were slightly better at learning the Dislike rule. The DLD group, however, struggled most with learning the Dislike rule, but not to the same extent as in the Self condition.

Further evidence that the DLD group were worse at learning social evaluation comes from the global ratings outcome. This rating was given by participants to demonstrate how much, on a scale of 0-9 (Complete Dislike-Complete Like), they thought the computer character liked them or the other person. Table 4 shows, on average, the DLD group gave higher ratings than the TLD group in both the Self and Other condition. With global rating as the outcome, a mixed ANOVA showed a significant main effect of group ($F(1, 181) = 4.02, p = .046, \text{partial } \eta^2 = .02$), with the DLD group giving higher ratings of 'likeability' overall. Additionally, there was a significant main effect of rule (Like vs Dislike) ($F(1, 181) = 242.21, p < .001, \text{partial } \eta^2 = .57$), indicating that higher ratings were given in the Like rule overall. There was no effect of condition (Self vs Other) ($p = .440$) suggesting participants' ratings were not influenced by whether the computer was judging themselves, or the Other character (George). Furthermore, there was a significant interaction between group and rule ($F(1, 181) = 9.05, p = .003, \text{partial } \eta^2 = .05$), with pairwise comparisons indicating that participants in the DLD group reported higher likeability ratings on a scale of 0-9 when the rule was Dislike ($t = 3.52, 95\% \text{ CI } [.32, 2.35], p = .003$) but no difference for the Like rule ($t = -.59, 95\% \text{ CI } [-1.23, .79], p = 1.00$).

Table 4.

Mean global rating scores and errors to criterion for referential condition and rule by group.

Outcome	Condition	Rule	DLD	TLD
Errors to Criterion ^a	Self	Like (80%)	4.71	4.08
		Dislike (20%)	13.21	6.54
		Average	8.96	5.31
		Positive Bias	8.50	2.46
	Other	Like (80%)	5.83	3.85
		Dislike (20%)	9.42	3.42
		Average	7.63	3.64
		Positive Bias	3.59	-43
Global Rating ^b	Self	Like (80%)	7.13	7.15
		Dislike (20%)	3.58	2.15
		Average	5.36	4.65
		Other	Like (80%)	6.46
	Dislike (20%)	3.29	2.42	
	Average	4.88	4.73	

^a Mean number of errors made before 8 consecutive accurate responses (range = 0-24, lower score reflects better learning)

^b Mean rating of "How much did I like you/George?" at the end of each of the 4 conditions (ranging from 0 = Completely Dislike to 9 = Completely Like)

Rule: Like = 80% "correct" feedback for selecting positive word; Dislike = 20% "correct" feedback for selecting positive word

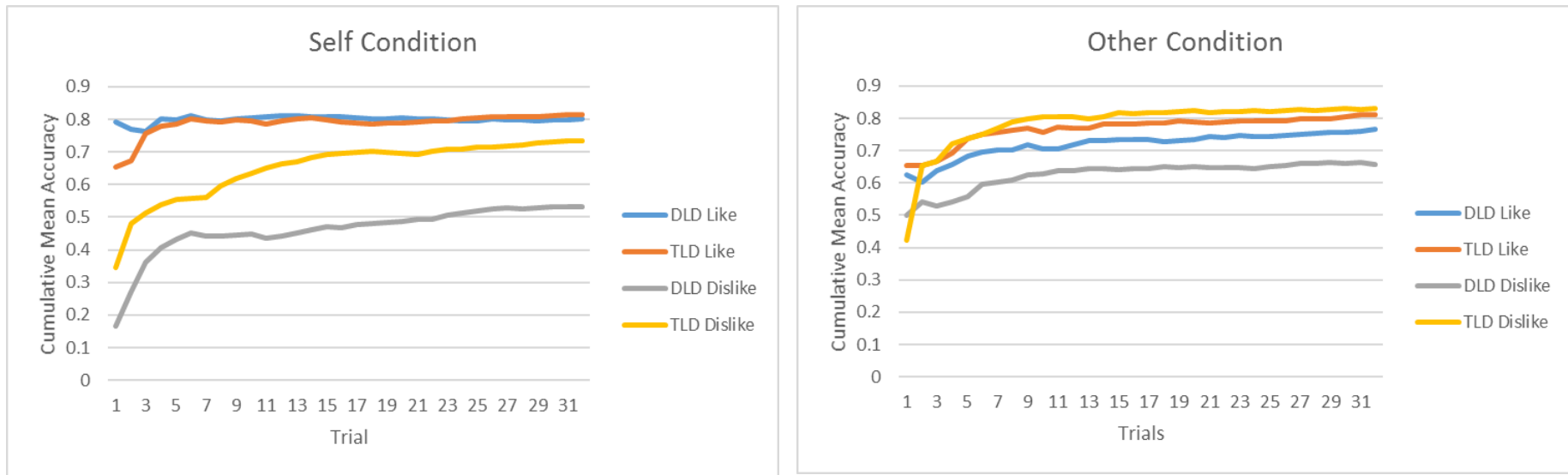


Figure 1. Cumulative mean accuracy over 32 trials.

Social Cognition as a Predictor for Socioemotional Problems

In order to assess whether poor performance on the SELT predicted socioemotional problems we ran a mediation analysis with DLD status as the independent variable, overall errors to criterion as the mediator and socioemotional scales as the dependent variable. In line with Baron and Kenny (1986), mediation models were run only for variables demonstrating a direct effect. Therefore, parent-reported peer problems ($b = 1.91$, $SE = .64$, 95% CI [.62, 3.20], $p = .005$) and emotional problems ($b = 2.16$, $SE = .77$, 95% CI [.60, 3.72], $p = .008$) were modelled because there was a direct effect of DLD status on each of these outcomes. However, the Sobel-Goodman test with case resampling bootstrapping revealed the indirect effect was non-significant, indicating that there was no effect of mediation on peer problems ($b = .39$, $SE = .33$, $z = 1.17$, 95% CI [-.26, 1.03], $p = .242$) or emotional problems ($b = .26$, $SE = .41$, $z = .64$, 95% CI [-.54, 1.07], $p = .523$). When separated by group significant effects were found only for the TLD group, with overall errors to criterion across all conditions predicting higher levels of social anxiety as measured by the SAS-A ($b = .18$, 95% CI [.01, .34], $p = .034$).

Language Ability as a Predictor of Social Cognition

In order to test whether performance on the SELT was confounded by language ability, the Recalling Sentences subtest (expressive language) and the Word Classes – Receptive subtest (receptive language) were regressed against overall errors to criterion for each group. In the DLD group, there was no significant effect of expressive language ($b = -.60$, 95% CI [-1.46, .25], $p = .155$) or receptive language ($b = -.26$, 95% CI [-1.18, .66], $p = .557$) on SELT performance. Similarly, SELT performance in the TLD group was not significantly predicted by expressive language ability ($b = .27$, 95% CI [-.26, .81], $p = .299$) or receptive language ability ($b = -.64$, 95% CI [-1.31, .04], $p = .064$).

Discussion

The current study aimed to examine the mediating effect of social cognition abilities on the relationship between Developmental Language Disorder (DLD) and social and emotional difficulties in adolescents, using a novel task. The Social Evaluation Learning Task (SELT) measures online interpretation of social cues, based on the judgements of four computer characters. Participants updated their social perceptions using feedback from the

computer before rating how much they thought the computer character liked them, or someone else. This provided a measure of how well adolescents with DLD are able to understand social inferences about themselves and others, a core skill for social interactions.

As expected, the DLD group received higher parent-ratings of peer and emotional problems than their TLD peers. This is consistent with the literature (Conti-Ramsden & Botting, 2008). Conversely, self-report of anxiety, depression, wellbeing and social support was not significantly different between groups, suggesting that the adolescents with DLD do not perceive any significant problems in these areas. The lack of significant emotional problems from self-report could be due to the smaller sample size in the current study, compared to previous papers that found a significant difference in self-reported emotional problems using the much larger Manchester Language Study (MLS; e.g. Conti-Ramsden, Mok, Pickles, & Durkin, 2013). Interestingly, Durkin and Conti-Ramsden (2007) also examined the MLS and found that while the TD group reported a significantly better quality of friendships, the majority of participants with DLD in their sample reported successful friendships. Similarly, Wadman, Durkin, and Conti-Ramsden (2011b) found that adolescents with DLD perceived themselves to have adequate social functioning, although they still reported experiencing greater levels of social stress. In the current study, adolescents in both groups reported similar levels of social support from their friendships, although the score was slightly lower than the norm of 15.15 (Procidano & Heller, 1983). The lower than average score may account for why there was no significant difference if the TLD group were also reporting poor social support. Although, it should be noted that the norms generated from Procidano and Heller (1983) were based on undergraduate students and therefore they may have different methods of social support than the younger sample in this study.

Despite there being no group difference in self-report measures of socioemotional problems there was a significant difference between groups in their ability to understand social cues on the SELT. Compared to their TLD peers, adolescents with DLD were poorer at learning the rule that they were Disliked. This finding is consistent with previous studies that demonstrate poor social cognition abilities in children and adolescents with DLD (Bakopoulou & Dockrell, 2016). Moreover, the DLD group tended to be more favourable in their ratings of how much they thought the computer character liked them or the other person, and they chose more positive responses, particularly in the Dislike rule. This

positive outlook could be protective and may account for the lack of group difference in self-reports of wellbeing and social support if adolescents with DLD are poorer at recognising social problems. Additionally, the discrepancy between parent- and self-report of social and emotional problems in the current study may reflect the adolescents' difficulty with being attuned to their social difficulties. However, there was no association between SELT performance and socioemotional difficulties in both groups combined, ruling out the possibility of a mediation, nor in the DLD group independently, unlike previous studies in this population which have demonstrated a relationship between social cognition deficits and poor social functioning (Andres-Roqueta et al., 2016; Bakopoulou & Dockrell, 2016; Botting & Conti-Ramsden, 2008). Conversely, a difficulty learning social rules on the SELT was related to higher reports of social anxiety in the TLD group. This is in direct contrast to Botting et al. (2015) who found that adults with high social anxiety were more sensitive to learning social evaluations. The difference in findings compared to previous studies is likely due to the small sample size of the current study.

Due to the wide range of concepts covered by the term “social cognition” there are varying measures used in the literature and therefore different areas that tasks are tapping into. For example, Botting and Conti-Ramsden (2008) used the Eyes Task (Baron-Cohen et al., 2001) and the Strange Stories task (Happé, 1994) to measure emotion recognition and responses to hypothetical social scenarios in adolescents with DLD. The current study examined the ability to understand social cues by recording adolescents' “real-time” responses to social evaluations about themselves and another. Being able to pick up on social cues and update one's understanding of how they are viewed by others is an important skill necessary for successful social interactions, and one that adolescents with DLD appear to struggle with. Therefore, this study provides a novel finding about how adolescents with DLD are learning social cues and warrants further investigation.

Limitations

It is important to consider these findings in the context of the limitations of the study. The sample size is small, which limits the power to detect significant differences. Therefore, the findings should be interpreted with caution. Recruitment of the sample was limited by time and three participants had to be dropped from the analysis due to missing SELT data. Despite this, significant group differences in parent-report of socioemotional

problems and performance on the SELT were found and it is recommended to replicate this study with a larger sample to see whether the effects still hold.

Additionally, the SELT involves language and has previously only been used with adults with social anxiety (Button, Browning, Munafo, & Lewis, 2012; Button et al., 2015). To compensate for this, the list of word pairs was adapted for a younger sample and was piloted among typically developing adolescents before use. All on-screen instructions and word pairs were read aloud, participants' understanding was checked and definitions of the words were given when requested. In fact, when expressive and receptive language scores were modelled as predictors for errors to criterion, language ability did not have a significant effect on SELT performance in either group. Inclusion of a social cognition task that young people with DLD are known to have difficulty with, such as the Eyes Task or Strange Stories task, may help to evaluate the appropriateness of the SELT for this population. Furthermore, future examinations of this task may also wish to include chronologically age-matched peers from the same school class as the adolescents with DLD, and from a similar socioeconomic background. This would allow for more control over exposure to social situations and therefore any difference in social cognitive abilities is more likely to be related to the language disorder and not missed opportunities for social interactions. Although, it should be noted that socioeconomic background was controlled in the current analyses.

As this was an exploratory study using a novel experimental paradigm there is a large scope for future studies to further examine the SELT in adolescents with DLD. The current study used two subscales from the CELF-4 to assess receptive and expressive language ability. However, pragmatic language abilities could have had an effect on participants' understanding of the SELT, given the social nature of the task. Future studies may also do well to investigate evaluation of non-verbal social cues to reduce the linguistic load of the task. This would allow for more confidence in whether the group difference in SELT performance is due to social cognition difficulties or the language demands of the task. There could also be an effect of speech and language therapy (SLT) in that adolescents still receiving SLT are being taught social cognition skills. Additionally, a longitudinal study of social cognition in adolescents with DLD may be beneficial to understand the mechanisms involved. For example, participants could be tested on the SELT at the beginning and end of the school year to examine whether real-life social interactions have had any effect on their social cognition skills.

Conclusion

More understanding of the mechanisms that are responsible for increased socioemotional problems in adolescents with DLD is crucial to provide parents and teachers with a better understanding of how to help the young people they are supporting. This paper used a novel computerised social evaluation learning task (SELT) as a measure of social cognition to explore the social understanding abilities of adolescents with and without DLD.


Adolescents with DLD displayed a deficit in understanding social cues compared to their TLD peers, making more errors when learning that they were disliked than learning they were liked. While the DLD group received higher parent-ratings of peer and emotional problems than their TLD peers, the adolescents did not report higher levels of emotional or social difficulties themselves. Additionally, difficulties in learning social cues on the SELT did not predict socioemotional problems in the DLD group but participants in the TLD group who made more errors were also found to report higher social anxiety. These findings contradict previous literature that demonstrates a link between social cognition and socioemotional difficulties in children and adolescents with DLD. Due to the small sample size and exploratory nature of the study, further research is recommended, particularly given the lack of research into the adolescent population of individuals with DLD.

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This declaration concerns the article entitled:									
A cross-lagged investigation of peer problems, emotional dysregulation and emotional problems in children with and without early language difficulties: Evidence from the Millennium Cohort Study.									
Publication status (tick one)									
draft manuscript	<input checked="" type="checkbox"/>	Submitted	<input type="checkbox"/>	In review	<input type="checkbox"/>	Accepted	<input type="checkbox"/>	Published	<input type="checkbox"/>
Publication details (reference)	Forrest, C. L., Gibson, J. L., Halligan, S. L., & St Clair, M. C. (in preparation). A cross-lagged investigation of peer problems, emotional dysregulation and emotional problems in children with and without early language difficulties: Evidence from the Millennium Cohort Study.								
Candidate's contribution to the paper (detailed, and also given as a percentage).	The candidate contributed to the formulation of ideas (50%) and considerably contributed to the design of methodology (70%). The candidate predominantly executed the experimental work, including the analysis and interpretation of the results (90%) and predominantly executed the presentation of the data in journal format (90%).								
Statement from Candidate	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature.								
Signed							Date	17/01/2019	

Chapter 6: Secondary Data Analysis

A cross-lagged investigation of emotion regulation, peer problems and emotional problems in children with and without early language difficulties: Evidence from the Millennium Cohort Study.

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Word count: 6123

Declaration of Interest: All authors state no conflicts of interest.

Chapter rationale: As social cognition was not found to mediate the emotional outcomes in adolescents with DLD the final study aims to investigate whether another factor, namely emotional dysregulation, is having an effect on the relationship between DLD and socioemotional outcomes. Emotional dysregulation has been found to predict social and emotional problems and is also intrinsically linked to language as individuals need to be able to define emotions and understand how to manage them. However, the research on emotional regulation in DLD is lacking. Therefore, the MCS is analysed again using cross-lag analysis to determine whether the pathways between emotional dysregulation, peer problems and emotional problems differ between children at risk of DLD and their typically developing peers throughout childhood and early adolescence.

Abstract

Background: Adolescents with a history of language difficulties are at risk for increased social and emotional difficulties; however, the pathways involved are unclear. Here we examine the contribution of poor emotion regulation by comparing longitudinal data from children at risk of Developmental Language Disorder (rDLD) and the general population (GP). **Method:** Data from the Millennium Cohort Study (MCS) were analysed at age 3, 5, 7, 11 and 14 years. The rDLD group (children with parent-reported difficulties and/or a score $-1.5SD$ on Naming Vocabulary subtest at age 5) was compared to a GP group on parent-reports of emotion regulation, peer problems and emotional problems. **Results:** Significantly higher ratings of poor emotion regulation, peer problems and emotional problems were found in the rDLD group across all time-points. Poor emotion regulation consistently predicted subsequent peer and emotional problems throughout development in both groups. Stronger cross-lag effects were found in the rDLD group for poor emotion regulation at age 3 predicting age 5 emotional problems, and age 5 emotional problems predicting age 7 emotion regulation difficulties. Stronger reciprocal cross-lag effects were also observed in the rDLD group between peer and emotional problems at age 3 and 5. No significant group differences were found in adolescence. **Conclusions:** Previous findings of increased socioemotional problems in individuals with language difficulties are supported. Poor emotion regulation predicts peer and emotional difficulties throughout development but the early-years relationship between emotion regulation and emotional problems is stronger in children at risk of DLD. Early reciprocal peer and emotional difficulties are also stronger in the rDLD group but these effects dissipate in mid-childhood. Nevertheless, the consistent relationship between early emotion regulation difficulties and socioemotional problems throughout development warrants further investigation in individuals with lower language skills. **Keywords:** Developmental Language Disorder; Specific Language Impairment; Adolescents; Emotion regulation; Emotional problems; Peer problems.

Key points:

- Children and young people with Developmental Language Disorder (DLD) are at risk for higher levels of social and emotional difficulties but the mechanisms are unknown
- Previous longitudinal research has focused on clinical cohorts or population cohorts in early childhood
- The current study examines the development of emotion regulation, peer problems and emotional problems in a population cohort spanning early childhood to early adolescence
- Poor emotion regulation predicts peer and emotional problems at all time-points, but stronger effects are seen in the rDLD group between poor emotion regulation at age 3 and age 5 emotional problems
- Emotion regulation may be an underlying problem in children at risk of DLD

Developmental Language Disorder (DLD)¹ affects approximately 7% of the population and manifests as a difficulty with expressive and/or receptive language that cannot be accounted for by any hearing impairment, neurodevelopmental conditions or global intellectual disability (Norbury et al., 2016). As well as impaired communication, individuals with language difficulties experience increased levels of anxiety (Beitchman et al., 2001), depression (Conti-Ramsden & Botting, 2008) and social difficulties (Durkin & Conti-Ramsden, 2007) compared to typically developing (TD) peers. These negative social and emotional outcomes can persist throughout the lifespan (Clegg, Hollis, Mawhood, & Rutter, 2005). However, there is conflicting evidence over whether these difficulties are predicted by language ability alone or whether there are other factors involved (Yew & O'Kearney, 2013). Therefore, there is a clear need to examine the developmental pathways involved in the relationship between DLD and associated negative outcomes in order to provide more targeted interventions. The current study presents a cross-lagged examination of a population cohort throughout childhood and adolescence to evaluate more completely the causal mechanisms involved in language difficulties and negative social and emotional outcomes.

Due to the close association between language and emotion regulation (Vallotton & Ayoub, 2011), and between emotion regulation and socioemotional outcomes (Aldao, Nolen-Hoeksema, & Schweizer, 2010), emotion regulation may be a key factor to consider in relation to the social and emotional difficulties associated with DLD. Emotion regulation is the ability to monitor, evaluate and modify emotions that arise in different situations (Thompson, 1994). Pre-verbal children rely on parent support to regulate their emotions, a stage known as 'interpersonal regulation', gradually becoming more self-sufficient and entering the 'intrapersonal regulation' stage as they develop verbal skills to label and express their emotions independently (Holodynski & Friedlmeier, 2010). Previous research in typically developing children has shown vocabulary at 24 months predicts emotional self-regulation at 36 months (Vallotton & Ayoub, 2011). Given the centrality of language development to increasing competence in regulating emotions, early language difficulties could fundamentally alter developmental trajectories in this regard. Children with impaired language may have difficulty labelling emotions (Fujiki, Brinton, & Clarke, 2002), and may struggle to understand and implement regulation strategies as modelled by their parents. For example, reappraisal is an effective form of emotion

¹ See supplementary materials for details on DLD terminology.

regulation that involves the use of 'self-talk' to reframe negative experiences into something more positive, and therefore relies heavily on language (e.g. Gross, 2002; Gross & John, 2003). Private speech is reportedly delayed in children with DLD (Lidstone, Meins, & Fernyhough, 2012) and they receive significantly worse ratings than their TD peers on measures of emotion regulation (e.g., Fujiki, Spackman, Brinton, & Hall, 2004). Recent findings from the Millennium Cohort Study (MCS) demonstrate that emotion regulation difficulties at age 3 are significantly higher in a group with early language difficulties compared to the TD group (St Clair, Forrest, Yew, & Gibson, under review). Given the strong relationship between maladaptive emotion regulation strategies (or emotion dysregulation) and internalising disorders in the general population (Aldao et al., 2010), and the increased rates of negative emotional outcomes such as anxiety and depression in DLD (Conti-Ramsden, Mok, Pickles, & Durkin, 2013), the relationship between emotion regulation difficulties and negative emotional outcomes in children with DLD warrants further evaluation. In addition to psychopathological outcomes, longitudinal studies demonstrate the positive relationship between emotion regulation and social competence in TD children (Spinrad et al., 2006). Therefore, poor emotion regulation could also account for the increasing social problems in children and young people with DLD (St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). Indeed, Fujiki et al. (2004) found that poor emotion regulation and language ability accounted for 43% of the variance in social reticence scores in children with DLD. Impairments in emotion understanding and regulation may affect how children process and interpret emotional information from themselves and others, and therefore affect how they perceive social situations (Lemerise & Arsenio, 2000).

Social problems, in turn, may lead to feelings of loneliness, anxiety and depression (Geoffroy et al., 2018), providing an additional indirect pathway through which emotion regulation leads to negative emotional outcomes. Indeed, recent findings from the same sample in the MCS show a mediating effect of peer problems in mid-childhood on emotional problems in early adolescence (Forrest, Gibson, Halligan, & St Clair, 2018). Reciprocal effects are also possible, as low mood may encourage withdrawal from social interactions, leading to fewer opportunities to practice social skills and regulate emotions. Overall, there is evidence to suggest that emotion regulation, social problems and emotional problems are interrelated.

Current study

The current study aims to examine the moderating effect of language difficulties on the pathways between emotion regulation difficulties, peer problems and emotional problems in children and adolescents from the MCS. Although previous research indicates that emotion regulation difficulties predict both social problems and emotional problems in the general population, less is known about the effect on the DLD population. Fujiki et al. (2004) found that poor emotion regulation and lower language ability predicted social problems in children with DLD but there has been less focus on emotional outcomes. Given the particular importance of social relationships during adolescence, and the general increase in emotional problems during this developmental period (McLaughlin, Hatzenbuehler, Mennin, & Nolen-Hoeksema, 2011), research that spans childhood and adolescence is particularly desirable. Previous findings from the MCS cohort demonstrate that emotion regulation difficulties and peer problems at age 3 are significantly higher in a group at risk of DLD and that each of these predicts both concurrent emotional problems and longitudinal emotional problems at age 11 (St Clair et al., under review). The current study will examine the effect of parent-reported emotion regulation difficulties at age 3, 5 and 7 on parent-reported peer problems and emotional problems at age 3, 5, 7, 11 and 14. Those at risk of DLD are expected to receive higher ratings of emotion regulation difficulties, peer problems and emotional problems than the GP group. Secondly, it is hypothesised that poor emotion regulation will predict later peer and emotional problems. Finally, given the link between language and emotion regulation, as well as the established link between social and emotional difficulties (Forrest et al., 2018), we expect the inter-relationship between emotion regulation, peer and emotional difficulties to be stronger in the rDLD group than the GP group. In line with the literature showing sex differences in emotional outcomes (Rescorla et al., 2007) and the influence of poverty on language development (Hart & Risley, 1995), these covariates will be controlled for in the analyses.

Method

Ethics

The original study received full ethical approval from the NHS Multi-Centre Research and Ethics Committee (MREC) at each wave (Connelly & Platt, 2014).

Participants

Participants were obtained from six waves of the Millennium Cohort Study (MCS) (Connelly & Platt, 2014). All children were born between September 2000 and January 2002 and were assessed at nine months, and three, five, seven, eleven and fourteen years of age. The full sample size was 19,518 children. In total, 5256 individuals were excluded from this analysis (537 due to multiple births and 4,719 due to missing risk of DLD status data). The current sample is 14,262 singletons. All measures were informant report (referred to as the ‘main respondent’ in the MCS documentation).

Measures

Risk of Developmental Language Disorder (rDLD). There was only one standardised measure of language available; therefore, no formal diagnosis of DLD can be made. Instead, an rDLD variable was created denoting children at risk of developing DLD, based on parent-reported language difficulties and/or low vocabulary ability at age 5. Parent-reported language difficulties were defined by endorsement of “Language developing slowly” or “Doesn’t understand others” at age 5 ($n = 440$). Low vocabulary was defined as scoring 1.5 *SD* below the mean (T score of 35 or below) on the British Ability Scales (BAS) naming vocabulary subtest ($n = 529$) (Elliott, Smith, & McCulloch, 1997). This test provides a measure of expressive language ability, requiring participants to name as many pictures of objects as possible from the 36 options and has a reliability coefficient of .65 at age 5 (Elliott et al., 1997). There were 78 children who met both criteria of parent report of language difficulties and low score on the naming vocabulary subtest.

In total, 6.3% of the sample ($N = 891$) were included in the rDLD group at age 5, which is a conservative rate given the recent UK prevalence rate of 7.6% for DLD (Norbury et al., 2016). Further details of the numbers in the rDLD group by only the parent report or only the naming vocabulary subtest, as well as additional comparisons across variables of interest, are provided in the supporting information.

As we were interested in those with a primary language difficulty, children who met criteria for the rDLD group but whose language difficulties could be explained by additional factors were not included in the rDLD group. This consisted of children who were in a family environment where English was not spoken in the home ($n = 320$), as well as diagnoses and parent reports of Autism Spectrum Disorder (ASD) ($n = 487$); hearing

difficulties ($n = 1,229$); or Down Syndrome ($n = 12$). No other reports of additional support or special educational needs related to global intellectual disability were reported in the rDLD group. All participants who did not meet criteria for rDLD, but may have had additional developmental difficulties (e.g., hearing difficulties or ASD) were included in the general population (GP) comparison group. This is in line with recent recommendations for control groups with developmental disorders as outlined by Fombonne (2016). Of the total sample eligible for the study, 93.7% were included in the GP group at age 5 ($N = 13,371$).

Emotion regulation difficulties. This variable was measured at age 3, 5 and 7 and was derived from the mean of five items taken from the Child Social Behaviour Questionnaire (CSBQ; for more information about this derived variable see Johnson, Atkinson, & Rosenberg, 2015). Items were rated on a scale of 1-3 by the main respondent (predominantly mother) and included ‘shows mood swings’; ‘gets over excited’; ‘easily frustrated’; ‘gets over being upset quickly’ (reverse-scored) and ‘acts impulsively’. A higher score indicates more difficulty regulating emotions. Given the small number of items in this scale, inter-item correlations instead of Cronbach’s alpha were used to measure reliability (Pallant, 2010). The inter-item correlations for the emotion regulation variable were .22 at age 3, .26 at age 5 and .29 at age 7. Inter-item correlations ranging between .2 and .4 are said to be sufficient (Briggs & Cheek, 1986).

Emotional and Peer problems. The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) was completed by the main respondent (predominantly mother) at ages three, five, seven, eleven and fourteen years. This 25-item scale is comprised of five subscales (Emotional Problems, Conduct Problems, Hyperactivity, Peer Problems and Prosocial). Each item is rated on a scale of Not True (0), Somewhat True (1) and Certainly True (2) with a higher score indicating more problems. The scales of interest were the Emotional Problems and Peer Problems subscales, each consisting of five items measuring worries or low mood and difficulties with friendships (see supporting information for details). Internal consistency is .67 for the Emotional Problems subscale and .57 for the Peer Problems subscale (Goodman, 2001).

Additional Measurements. The BAS-II Pattern Construction subtest (Elliott et al., 1997) was administered at age 5. This subtest provides a measure of spatial ability by requiring children to copy designs using coloured blocks.

Statistical analysis

Data were analysed using Stata 14 (StataCorp., 2015) with the prefix *svy* to adjust for survey data (Ketende & Jones, 2011). The *svy* prefix allows for sampling weights, which account for cluster sampling and stratification within the survey design to provide an accurate estimate of the underlying UK population (using a finite population correction factor (*fpc*)). Additionally, the sampling weights account for attrition in each wave. The *mi impute* function in Stata 14 (StataCorp., 2015) was used to account for missing data on the emotional problems, peer problems and emotion regulation variables at all ages. Twenty imputed datasets were created. A total run length of 200 chained iterations were imputed using the method of predictive mean matching (see supporting information for details). The variables of Emotional Problems and Peer Problems were highly skewed, therefore negative binomial regression was used to analyse the rDLD and GP group differences for these outcomes. Instead of analysing language as a construct, participants were categorised into groups of rDLD and GP status for two reasons. Firstly, children with DLD have disordered language development, not simply a delay, with the majority of the literature investigating DLD and associated socioemotional difficulties examining DLD as an entity based on a clinical cut-off and parental report of poor language functioning (Bishop et al., 2016). Secondly, previous research has suggested an absence of a linear relationship between language ability and severity of socioemotional problems (Fujiki, Brinton, & Clarke, 2002; Hart et al., 2004), therefore analysing language ability as a continuous scale was not deemed useful. Confounding variables of sex and poverty (as measured by the OECD definition: income 60% below median income) were controlled for in all regression analyses. Nonverbal IQ was not included as a covariate in accordance with suggestions for neurodevelopmental studies (Dennis et al., 2009). Cross-lagged path analysis was conducted using Mplus (Muthén & Muthén, 1998-2012) using the imputation function. This allowed for analysis of associations between the variables of emotion regulation, peer problems and emotional problems at each of the five time-points (age 3, 5, 7, 11 and 14). The model used the robust maximum likelihood estimation (Estimator = MLR), which

assumes that remaining missing data are missing at random. Standardised path coefficients are presented and correlations between variables were computed at each time-point, although not shown in the figures for ease of readability. Group by predictor interaction terms compared the strengths of the pathways between the groups.

Results

Demographics

The rDLD group consisted of 891 individuals at age 5, or 6.3% of the sample, and approximately 29% females. This was significantly fewer than the 49% females in the GP group and is in line with previous findings of sex differences in DLD (St Clair et al., 2011). Significantly more children were below the OECD poverty line at age 5 in the rDLD group compared to the GP group. The rDLD group performed significantly worse on the BAS Pattern Construction measure of spatial ability. More children in the rDLD group were born prematurely but there was no group difference in age at age 5 (see Table 1).

Group Difference in Emotion Regulation, Peer and Emotional Problems

Table 1 demonstrates the group differences in emotion regulation, peer problems and emotional problems. The rDLD group received significantly higher ratings of emotion regulation difficulties than the GP group at each of the three time-points. Parent-reports of peer problems were significantly higher for the rDLD group compared to the GP group at all five time-points. Similarly, significantly higher ratings of emotional problems were reported for the rDLD group compared to the GP group at all five time-points.

Table 1.

Social and emotional problems in risk of Developmental Language Disorder (rDLD) group and General Population (GP) group.

	rDLD (n=891)	GP (n=13,371)	All (n=14,262)	rDLD vs. GP
<i>Demographic variables at age 5</i>				
Female (%)	29.4	48.5	46.8	.44(.37,.52) ^{^***}
Premature (%)	9.8	7.3	7.5	n.s.
Poverty Indicator (%)	55.8	28.4	31.0	3.21(2.69,3.83) ^{^***}
BAS Naming Vocabulary	38.64 (.53)	56.21 (.18)	54.67	-15.92(-16.88, -14.96) ^{***}
BAS Pattern Construction	42.72(.51)	51.27(.18)	50.58(.18)	-9.42(-10.69, -8.14) ^{***}
Age at Wave 3 (in years; months)	5;2.5	5;2.5	5;2.5	n.s.
<i>Emotion regulation difficulties^a</i>				
Age 3	2.01 (.02)	1.87 (.01)	1.87 (.01)	.08(.04, .12) ^{***}
Age 5	1.91 (.02)	1.70 (.01)	1.71 (.01)	.14(.10, .18) ^{***}
Age 7	1.91 (.03)	1.72(.01)	1.75(.01)	.11(.06, .16) ^{***}
<i>SDQ Peer Problems</i>				
Age 3	2.11(.08)	1.44(.02)	1.53(.02)	.27(.19,.35) ^{***}
Age 5	1.68(.07)	1.05(.02)	1.13(.02)	.33(.24,.42) ^{***}
Age 7	1.83(.09)	1.16(.02)	1.27(.02)	.33(.23,.43) ^{***}
Age 11	1.96(.09)	1.33(.02)	1.45(.02)	.25(.16,.34) ^{***}
Age 14	2.24(.11)	1.78(.03)	1.88(.03)	.12(.02,.23) [*]
<i>SDQ Emotional problems</i>				
Age 3	1.77(.08)	1.29(.02)	1.35(.02)	.23(.14,.31) ^{***}
Age 5	2.10(.09)	1.29(.02)	1.37(.02)	.42(.33,.51) ^{***}
Age 7	2.19(.11)	1.48(.02)	1.56(.02)	.32(.21,.43) ^{***}
Age 11	2.48(.10)	1.84(.03)	1.93(.03)	.25(.19,.33) ^{***}
Age 14	2.58(.13)	2.06(.04)	2.14(.03)	.23(.11,.34) ^{***}

Statistics are *b* coefficients or odds ratio when [^] is reported (95% confidence interval). All analyses control for sex and poverty (OECD).

^a. A higher score indicates more difficulties in this area.

* $p < .05$ ** $p < .01$ *** $p < .001$

Cross-lag Analysis

For the GP group (Figure 1) all paths were significant at the $p < .001$ level.

Autoregressions show a similar pattern of stability between age 3 and age 14 for peer and emotional problems, ranging from .34 and .37 to .48 and .49 respectively. Emotion regulation was slightly more stable with standardised coefficients of .51 between ages 3 and 5 and .62 between ages 5 and 7. The largest cross-lag effect was between emotion regulation difficulties at age 5 and emotional problems at age 7 ($\beta = .14$, $SE = .01$). Similar effects were found for peer problems at age 7, and for peer and emotional problems at age 11 predicted by poor emotion regulation at age 7 (all pathways were $\beta = .13$, $SE = .01$). This pattern was replicated for poor emotion regulation at age 7 predicting peer and emotional problems at age 14 ($\beta = .10$, $SE = .01$).

Different pathways emerged when the rDLD group was modelled (Figure 2). Emotion regulation difficulties at age 3, 5 and 7 predicted peer and emotional problems at all later time-points (age 5, 7, 11 and 14) but these significant paths were not always reciprocal. Specifically, emotional problems at age 3 did not significantly predict emotion regulation difficulties at age 5 and peer problems at age 5 did not predict poor emotion regulation at age 7. Additionally, there were no significant reciprocal cross-lag effects of peer and emotional problems between age 5 and 7 or age 7 and 11. The strongest cross-lag effects were between peer problems at age 3 and emotional problems at age 5 ($\beta = .21$, $SE = .04$, $p < .001$) and between emotional problems at age 11 and peer problems at age 14 ($\beta = .21$, $SE = .04$, $p < .001$).

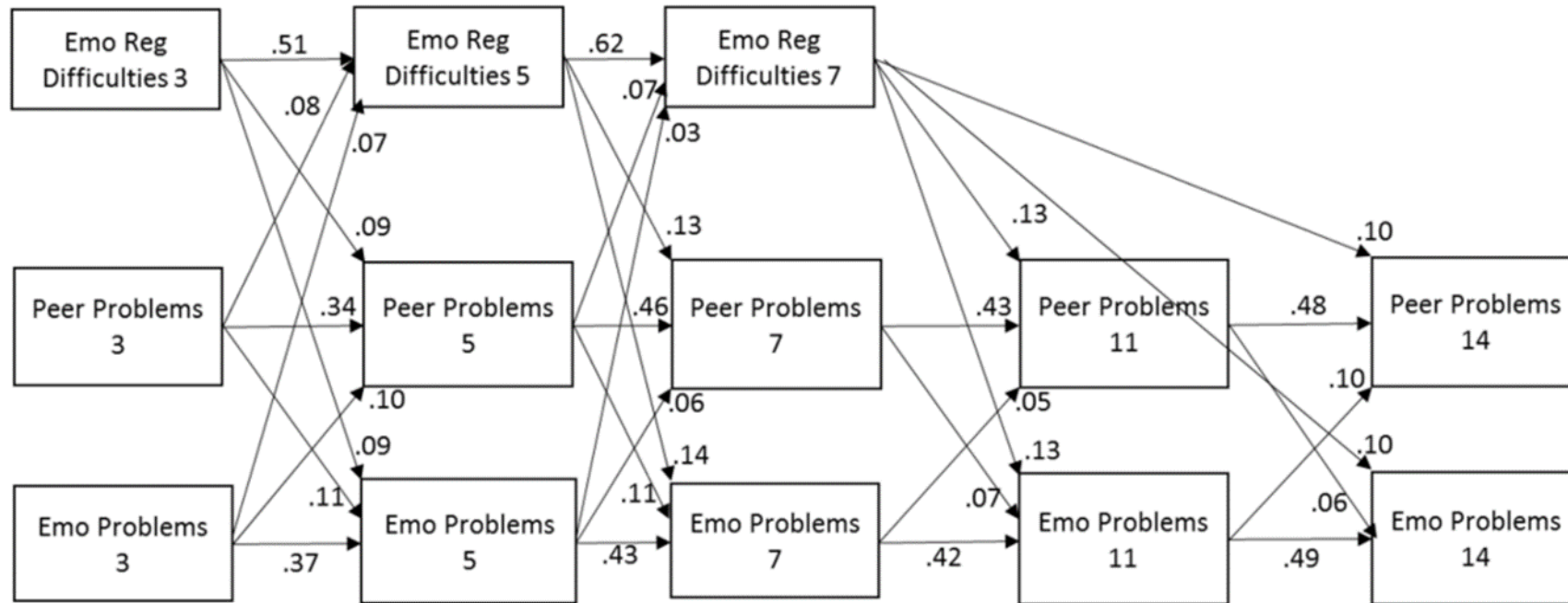


Figure 1. Path analysis of emotion regulation difficulties (Emo Reg Difficulties), SDQ emotional problems (Emo Problems) and SDQ peer problems (Peer Problems) at age 3, 5, 7, 11 and 14 in the General Population (GP) group.

Note. A higher score in emotion regulation difficulties indicates more difficulties in this area. All paths are significant at the $p < .001$ level.

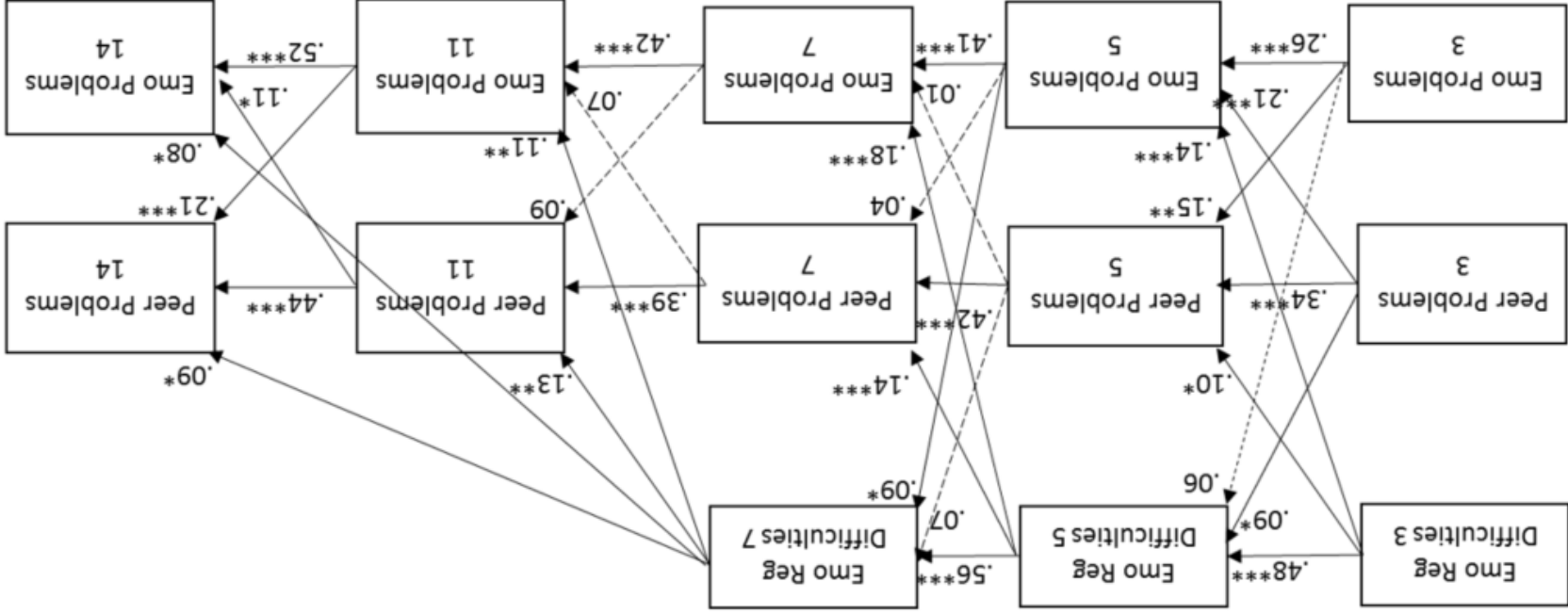


Figure 2. Path analysis of emotion regulation difficulties (Emo Reg Difficulties), SDQ emotional problems (Emo Problems) and SDQ peer problems (Peer Problems) at age 3, 5, 7, 11 and 14 in the risk of Developmental Language Disorder (rDLD) group.
Note. A higher score in emotion regulation difficulties indicates more difficulties in this area. Dashed lines indicate non-significant paths.
 *** $p < .001$; ** $p < .01$; * $p < .05$.

We next tested whether the paths were equivalent across both groups with group by predictor interaction terms. Paths with a coefficient difference of .05 or more between the two groups were deemed as having the potential to differ significantly. Only these paths were tested, in order to reduce the number of comparisons made. Two autoregression pathways measuring the stability of variables across time were tested. The path between emotion regulation difficulties at age 5 and age 7 showed stronger stability in the GP group than the rDLD group ($\beta = .02$, $SE = .01$, $p < .05$), but there was no significant group difference between autoregressions within the emotional problems variable at ages 3 and 5 ($\beta = .02$, $SE = .01$, $p = .12$).

Seven cross-lag pathways were tested for interaction effects: Three between ages 3 and 5, two between ages 5 and 7 and two between ages 11 and 14. In the early years, the rDLD group showed a stronger link between poor emotion regulation at age 3 and emotional problems at age 5 compared to the GP group ($\beta = .04$, $SE = .01$, $p < .01$). Significantly stronger effects in the rDLD group were also found for peer problems at age 3 predicting emotional problems at age 5 ($\beta = .05$, $SE = .01$, $p < .001$) and for emotional problems at age 3 predicting peer problems at age 5 ($\beta = .04$, $SE = .01$, $p < .01$). In mid-childhood, a stronger effect in the rDLD group was found for emotional problems at age 5 predicting emotion regulation difficulties at age 7 ($\beta = .02$, $SE = .01$, $p < .05$); however, this relationship was not reciprocal as there was no significant group difference in emotion regulation difficulties at age 5 predicting emotional problems at age 7 ($\beta = .01$, $SE = .01$, $p = .45$). Finally, in adolescence, there was no significant interaction effect for peer problems at age 11 predicting emotional problems at age 14 ($\beta = .01$, $SE = .01$, $p = .21$), or for emotional problems at age 11 predicting peer problems at age 14 ($\beta = .01$, $SE = .01$, $p = .26$).

Discussion

The current study used a population cohort to investigate the pathways between early emotion regulation difficulties, peer problems and emotional problems in young people with and without a risk of DLD. As well as replicating previous findings, this study has provided further insight into the role of early emotion regulation difficulties on later peer and emotional problems, which has previously been examined in relation to social outcomes in children with DLD (Fujiki et al., 2004).

Supporting the first hypothesis, the results show that emotion regulation difficulties, peer problems and emotional problems are significantly higher in the rDLD group than the GP group, at each of the three time-points. These results are in line with previous studies which found increased social and emotional problems in both clinical samples (St Clair et al. 2011) and community samples (St Clair et al., under review). These findings also suggest that children who are at risk of DLD have more difficulty managing their emotions appropriately than their peers, which is consistent with previous conclusions from a clinical sample (Fujiki et al., 2002).

Secondly, the cross-lag analysis supports the hypothesis that poor emotion regulation predicts later peer and emotional problems, but there were distinct pathways for each group. For instance, the GP group demonstrated significant reciprocal relationships between emotion regulation difficulties, peer problems and emotional problems longitudinally, such that each domain influenced the other two domains at the next time-point. This is in contrast to McLaughlin et al. (2011) who found that emotion regulation difficulties in TD adolescents predicted anxiety, but not vice versa. However, it is worth noting that the McLaughlin study used self-report for all measures and examined a latent variable of emotion dysregulation, which consists of more disruptive regulation strategies. Conversely, not all paths were reciprocal when the rDLD group was modelled. For example, peer and emotional difficulties appeared to be less influential on emotion regulation difficulties in the rDLD group, with no effect of emotional problems at age 3 or peer problems at age 5 on later emotion regulation difficulties. Similarly, there were no significant reciprocal cross-lagged paths between peer and emotional problems at age 5 and 7 or age 7 and 11 in the rDLD group. This may indicate that these children's poor emotion regulation abilities are more integral to their social and emotional development during mid-childhood in the rDLD group, rather than as a by-product of any problems in

peer situations or due to elevated emotional problems. However, these paths became significant in the rDLD group in adolescence: In particular, emotional problems at age 11 had more of an effect on peer problems at age 14 than poor emotion regulation did.

Finally, the third hypothesis that the inter-relationship between emotion regulation difficulties, peer problems and emotional problems would be stronger in the rDLD group than the GP group was supported to an extent. The stronger link between poor emotion regulation at age 3 and emotional problems at age 5 in the rDLD group is perhaps reflective of the longer ‘interpersonal regulation’ stage (Holodynski & Friedlmeier, 2010) that these children may experience due to a difficulty expressing their emotions. The opposite direction of this relationship is also stronger in the rDLD group, with emotional problems at age 5 predicting poor emotion regulation at age 7. The strongest group difference was found for reciprocal cross-lag effects between peer problems and emotional problems in early childhood in the rDLD group, again highlighting the influence of emerging language difficulties on additional socioemotional problems in early childhood. These findings also reinforce the established link between social and emotional difficulties in general (Geoffroy et al., 2018).

By analysing a population cohort such as the Millennium Cohort Study (MCS) we have extended research from previous community studies focusing on young children (e.g., Clegg, Law, Rush, Peters, & Roulstone, 2015) into the adolescent population, a key time for the onset of later psychiatric disorders (Jones, 2013). The current paper has used cross-lag analysis which allows for prediction over time, accounting for subtle developmental links which cross-sectional studies may miss. Additionally, we have used a general population group for comparison, based on recent recommendations that argue a typically developed control group may overestimate any group differences in negative social and emotional outcomes (Fombonne, 2016).

However, it is important to consider the limitations of the current study. A cohort as large as the MCS is subject to attrition at later time points. However, this was controlled for by using the *svy* command in Stata 14, which adds weights to adjust for attrition in each wave of data collection. Multiple imputation was used to account for missing data in the main variables of interest – emotion regulation difficulties, peer problems and emotional problems. While this was necessary, the constraints of using imputed data restricted our ability to explore indirect effects in the cross-lag model. For instance, we were unable to

investigate how poor emotion regulation at age 3 indirectly affects outcomes in peer and emotional difficulties after age 5. Furthermore, the rDLD group is much smaller than the GP group, which may limit the conclusions which can be drawn from these findings. This is a consequence of secondary data analysis and future studies with more control over the sample are encouraged.

Conclusion

To the authors' knowledge, this is the first paper to use a population cohort to examine the effect of early emotion regulation difficulties on later social and emotional problems in individuals with a language difficulty. The rDLD group were perceived to have poorer emotion regulation skills, more peer problems and more emotional problems than the GP group at age 3, 5, 7, 11 and 14. Cross-lagged analysis revealed different developmental pathways between variables for each group; in the rDLD group, peer and emotional problems at age 7 and 11 were predicted only by poor emotion regulation at age 5 and 7, suggesting that early emotion regulation difficulties are having a significant effect on later social and emotional problems in children with language difficulties. Interaction effects showed the influence of age 3 emotion regulation difficulties on age 5 emotional problems was stronger in the rDLD group, as were relationships between early peer and emotional problems at age 3 and 5. This paper extends the literature surrounding emotion regulation in individuals with language difficulties and provides further evidence for the different developmental pathways to socioemotional difficulties experienced by children with and without language difficulties.

Acknowledgements: We thank all MCS participants and their families. We also acknowledge the time and effort of the MCS team at the Centre for Longitudinal Studies at the UCL Institute of Education, as well as the UK Data Service, in collating and making the data available for researchers. However, they bear no responsibility for the analysis or interpretation of these data.

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Supplementary materials for Chapter 6

Developmental Language Disorder (DLD) Terminology

As recommended by a recent panel of experts, we have opted to use the term Developmental Language Disorder (DLD) instead of Specific Language Impairment (SLI) (Bishop et al., 2017). The definition remains the same as many recent definitions (in that diagnosis is no longer based on a discrepancy between verbal and nonverbal intelligence) and follows long-term studies' adoption of this term (Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018). Therefore, we refer to DLD throughout the paper when referencing older studies that discuss children with expressive or receptive language difficulties with no known cause. In the current study, rDLD refers to children who met criteria for low language based on parent report and/or an expressive language subtest and are considered at risk of DLD (see below for more details).

Further Details on the Risk of DLD (rDLD) Variable

Risk of DLD was evaluated at age 5 as children with a language delay have been found to catch up with their peers by around this age (Bishop & Edmundson, 1987). We used a combination of parent reported difficulties alongside a standardised language test as Bishop and McDonald (2009) note that the combination of measures from different sources provides a more comprehensive picture of language abilities. Furthermore, use of parent report of language difficulties within a large scale cohort has precedence. See Hughes, Sciberras, and Goldfeld (2016) for a similar measure of parental report of language difficulties relating to social and emotional problems. St Clair et al. (under review) has documented that this categorisation of risk of DLD is associated with reduced naming vocabulary at age 3 and reduced verbal reasoning skills at age 11 in comparison to the GP.

Items in Strengths and Difficulties Questionnaire (SDQ) scales

Emotional Problems scale	Peer Problems scale
Often complains of headaches	Rather solitary, tends to play alone
Many worries	Has at least one good friend (reverse scored)
Often unhappy, downhearted	Generally liked by other children (reverse scored)
Nervous or clingy in new situations	Picked on or bullied by other children
Many fears, easily scared	Gets on better with adults than with other children

Group differences with rDLD Parent Report and rDLD Vocabulary report

Table 1.

Comparison between Risk of Developmental Language Disorder group (rDLD) and subgroups of rDLD Naming Vocabulary (rDLD NV) and rDLD Parent Report (rDLD PR) and General Population group (GP).

	rDLD (n = 891)	rDLD NV (n = 529)	rDLD PR (n = 440)	GP (n = 13,371)	rDLD NV vs GP	rDLD PR vs. GP
<i>Demographic variables at age 5</i>						
Female (%)	29.4	34.1	24.0	48.5	.57(.46, .71)***	.33(.25, .42)***
Premature (%)	9.8	10.0	8.8	7.3	n.s.	n.s.
Poverty Indicator (%)	55.8	66.5	45.9	28.4	5.04(3.91, 6.50)***	2.06(1.64, 2.60)***
BAS Naming Vocabulary	38.64 (.53)	30.92 (.20)	45.09 (.72)	54.67 (.23)	-22.73(-23.35, -22.12)***	-8.82(-10.25, -7.39)***
BAS Pattern Construction	42.72 (.51)	10.97 (.58)	43.89 (.78)	51.27 (.18)	-9.56(-11.06, -8.06)***	-8.08(-10.04, -6.12)***
Age at Wave 3 (in years)	5.21	5.26	5.15	5.21	18.87(9.23, 28.50)***	-22.52(-32.98, -12.07)***
<i>Emotion regulation</i>						
Age 3	2.01 (.02)	1.98 (.03)	2.03 (.03)	1.87 (.01)	n.s.	.11(.06, .17)***
Age 5	1.91 (.02)	1.89 (.02)	1.93 (.03)	1.70 (.01)	.08(.03, .13)**	.16(.10, .21)***
Age 7	1.91 (.03)	1.87 (.03)	1.94 (.03)	1.72 (.01)	n.s.	.15(.08, .21)***
<i>SDQ Peer Problems</i>						
Age 3	2.11 (.08)	2.05 (.11)	2.17 (.10)	1.44 (.02)	.17(.06, .28)**	.30(.21, .39)***
Age 5	1.68 (.07)	1.70 (.09)	1.74 (.09)	1.05 (.02)	.25(.13, .37)***	.33(.21, .45)***
Age 7	1.83 (.09)	1.84 (.11)	1.84 (.11)	1.16 (.02)	.24(.10, .38)**	.31(.18, .44)***
Age 11	1.96 (.09)	1.99 (.11)	2.06 (.13)	1.33 (.02)	.21(.10, .32)***	.25(.13, .38)***
Age 14	2.24 (.11)	2.17 (.14)	2.33 (.15)	1.78 (.03)	n.s.	.14(.02, .27)*
<i>SDQ Emotional problems</i>						
Age 3	1.77 (.08)	1.83 (.11)	1.76 (.10)	1.29 (.02)	.20(.07, .32)**	.23(.12, .33)***
Age 5	2.10 (.09)	2.16 (.13)	2.10 (.11)	1.29 (.02)	.38(.24, .51)***	.40(.29, .51)***
Age 7	2.19 (.11)	2.10 (.15)	2.22 (.13)	1.48 (.02)	.19(.03, .35)*	.34(.22, .47)***
Age 11	2.48 (.10)	2.45 (.12)	2.59 (.15)	1.84 (.03)	.18(.07, .28)**	.26(.14, .38)***
Age 14	2.58 (.13)	2.59 (.18)	2.65 (.18)	2.06 (.04)	.17(.03, .32)*	.27(.12, .43)**

Statistics are beta coefficients or odds ratio where marked ^ (95% confidence interval), controlling for poverty indicator (below 60% median income) and gender. ***. $p < .001$, **. $p < .01$, *. $p < .05$

Sampling Framework

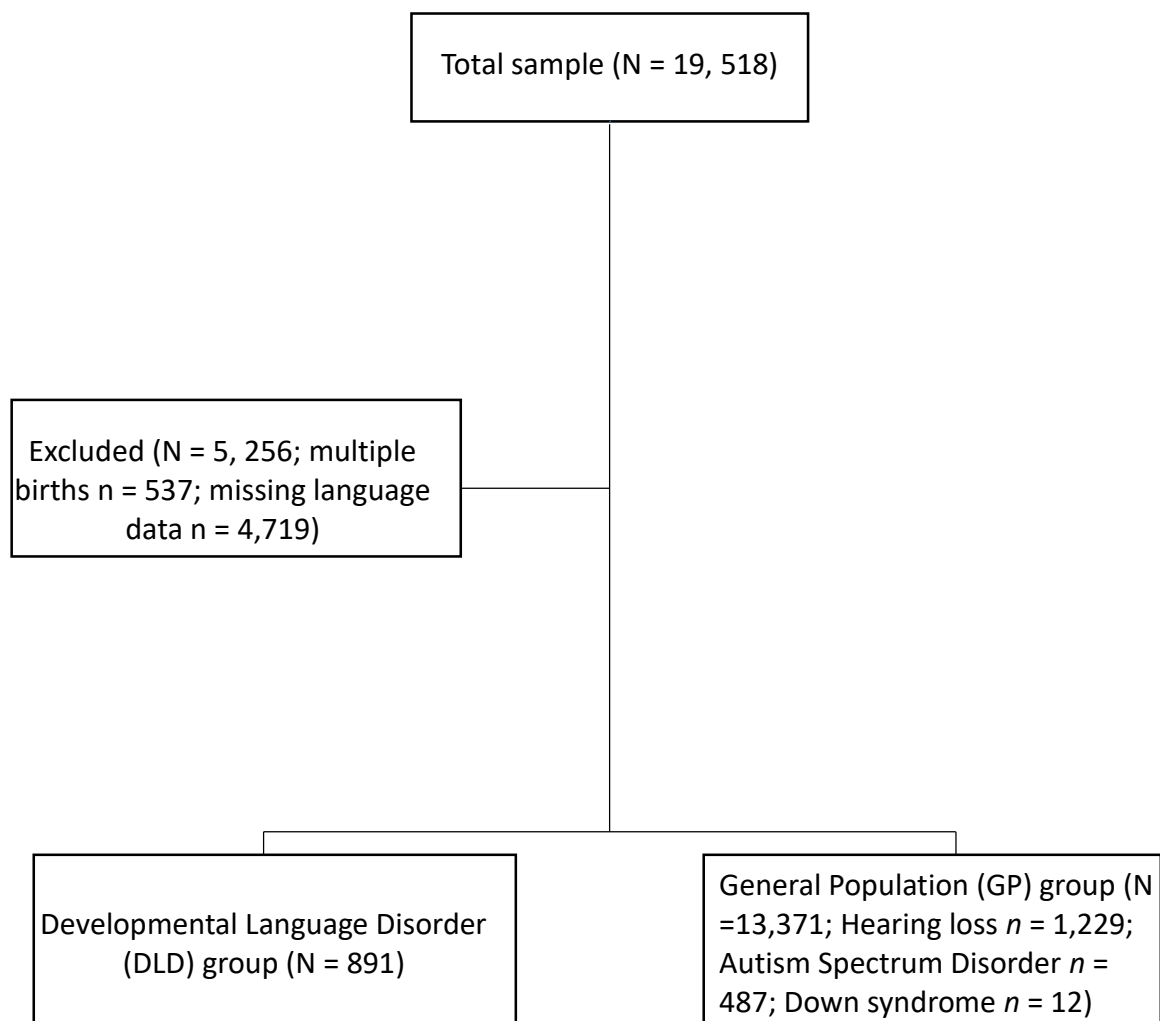


Figure 1. Flow diagram of group allocation.

Imputation Predictors for each Outcome Variable

Table 2.

Imputation for Emotion Regulation variable at age 3

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity	1		Yes		89.58
Naming Vocabulary (Age 3)	2			Yes	80.03
Self-regulation (Age 3)	2		Yes	Yes	77.08
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Emotion regulation (Age 7)	4	Yes	Yes	Yes	70.15
Child gender	1&2	Yes			91.09
OECD Poverty Indicator	1&2	Yes		Yes	99.39
SDQ Emotional Subscale Age 3	2	Yes		Yes	76.61
Respondent Age	2		Yes		81.01
SDQ Peer Subscale age 3	2	Yes			76.14
SDQ Conduct Subscale age 3	2		Yes		76.76
SDQ Hyperactivity Subscale age 3	2		Yes		76.03
SDQ Prosocial Subscale age 3	2		Yes		76.22
Parental Self Esteem	1		Yes		80.84
Respondent Ethnicity	1		Yes	Yes	96.14
Respondent in work	2		Yes	Yes	80.30
Respondent Marital Status	1		Yes	Yes	96.29
Illness/Problem during Pregnancy	1			Yes	96.10
Current Treatment for Depression	2			Yes	81.03
Lived apart from baby (until 9 months)	1		Yes		96.22

Table 3.

Imputation for Emotion regulation variable at age 5

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity	1		Yes		89.58
Naming Vocabulary (Age 3)	2		Yes		80.03
Naming Vocabulary (Age 5)	3		Yes	Yes	77.78
Self-regulation (Age 5)	3		Yes	Yes	76.78
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 7)	4	Yes	Yes		70.15
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes		99.39
OECD Poverty Indicator	3		Yes	Yes	78.67
SDQ Emotional Subscale Age 3	2	Yes	Yes	Yes	76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes		76.54
OECD Equivalised income	3		Yes		78.43
Respondent Gender	3		Yes		79.24
Respondent Age	3		Yes		79.23
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes		Yes	76.49
SDQ Conduct Subscale age 5	3		Yes		76.64
SDQ Prosocial Subscale age 5	3		Yes		76.63
Parental Self Esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes	Yes	92.51
Languages spoken at home	1			Yes	96.39
Respondent in work	3		Yes	Yes	79.24
Respondent Marital Status	3		Yes	Yes	78.91
Current Treatment for Depression	3		Yes		79.24
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	3		Yes		78.82
Kessler K6 Distress Scale	3		Yes		74.49

Table 4.

Imputation for Emotion regulation variable at age 7

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes	Yes	89.58
Naming Vocabulary (Age 3)	2		Yes	Yes	80.03
Naming Vocabulary (Age 5)	3		Yes	Yes	77.78
Self-regulation (Age 7)	4		Yes		70.14
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes		99.39
OECD Poverty Indicator	4		Yes		71.97
SDQ Emotional Subscale Age 3	2	Yes	Yes		76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes		76.54
SDQ Emotional Subscale Age 7	4	Yes	Yes		69.91
OECD Equivalised income	4		Yes	Yes	71.08
Respondent Age	4		Yes		72.08
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes	Yes	Yes	76.49
SDQ Peer Subscale age 7	4	Yes	Yes		69.95
SDQ Conduct Subscale age 7	4		Yes		70.06
SDQ Hyperactivity Subscale age 7	4		Yes		69.80
SDQ Prosocial Subscale age 7	4		Yes		70.08
Parental Self esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1			Yes	96.39
Respondent in work	4		Yes		72.08
Respondent Marital Status	4		Yes		71.73
Illness/Problem during Pregnancy	1		Yes	Yes	96.10
Current Treatment for Depression	4			Yes	72.04
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	4		Yes		71.63
Kessler K6 Distress Scale	4		Yes		68.44

Table 5.

Imputation for Peer Problems variable at age 3

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes		89.58
Naming Vocabulary (Age 3)	2		Yes		80.03
Self-regulation (Age 3)	2		Yes	Yes	77.78
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes		99.39
SDQ Emotional Subscale Age 3	2	Yes	Yes	Yes	76.61
Respondent Gender	2		Yes		81.02
Respondent Age	2		Yes		81.01
SDQ Peer Subscale age 5	3	Yes	Yes		76.49
SDQ Peer Subscale age 7	4	Yes	Yes		69.95
SDQ Peer Subscale age 11	5	Yes	Yes		66.57
SDQ Peer Subscale age 14	6	Yes	Yes		58.95
SDQ Conduct Subscale age 3	2		Yes	Yes	76.76
SDQ Hyperactivity Subscale age 3	2		Yes		76.03
SDQ Prosocial Subscale age 3	2		Yes		76.22
Parental Self Esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	2		Yes		96.39
Respondent Ethnicity	2		Yes		96.14
Respondent in work	2		Yes		80.30
Respondent Marital Status	2		Yes		76.81
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	2		Yes		81.03
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	2		Yes		80.30
Kessler K6 Distress Scale	2		Yes		71.59

Table 6.

Imputation for Peer Problems variable at age 5

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes	Yes	85.23
Irritability (temperament)	1		Yes	Yes	90.96
Regularity (temperament)	1		Yes	Yes	89.58
Naming Vocabulary (Age 3)	2		Yes	Yes	80.03
Naming Vocabulary (Age 5)	3		Yes		77.78
Self-regulation (Age 3)	2		Yes		77.08
Self-regulation (Age 5)	3		Yes		76.78
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes	Yes	99.39
OECD Poverty Indicator	3		Yes	Yes	78.67
SDQ Emotional Subscale Age 3	2	Yes	Yes	Yes	76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes		76.54
OECD Equivalised income	3		Yes		78.43
Respondent Gender	3		Yes	Yes	79.24
Respondent Age	3		Yes	Yes	96.39
SDQ Peer Subscale age 3	2	Yes	Yes	Yes	79.23
SDQ Peer Subscale age 7	4	Yes	Yes		69.95
SDQ Peer Subscale age 11	5	Yes	Yes		66.57
SDQ Peer Subscale age 14	6	Yes	Yes		58.95
SDQ Conduct Subscale age 5	3		Yes	Yes	76.64
SDQ Hyperactivity Subscale age 5	3		Yes		76.19
SDQ Prosocial Subscale age 5	3		Yes		76.63
Parental Self Esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1		Yes		96.39
Respondent Ethnicity	1		Yes	Yes	96.14
Respondent in work	3		Yes	Yes	79.24
Respondent Marital Status	3		Yes	Yes	78.91
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	3		Yes		79.24
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	3		Yes		78.82
Kessler K6 Distress Scale	3		Yes	Yes	74.49

Table 7.

Imputation for Peer Problems variable at age 7

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes		89.58
Naming Vocabulary (Age 3)	2		Yes		80.03
Naming Vocabulary (Age 5)	3		Yes	Yes	77.78
Self-regulation (Age 3)	2		Yes		77.08
Self-regulation (Age 5)	3		Yes	Yes	76.78
Self-regulation (Age 7)	4		Yes	Yes	70.14
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 5)	3	Yes	Yes	Yes	71.75
Emotion regulation (Age 7)	4	Yes	Yes	Yes	70.15
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes	Yes	99.39
OECD Poverty Indicator	4		Yes	Yes	71.97
SDQ Emotional Subscale Age 3	2	Yes	Yes		76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes	Yes	76.54
SDQ Emotional Subscale Age 7	4	Yes	Yes		69.91
OECD Equivalised income	4		Yes	Yes	71.08
Respondent Gender	4			Yes	72.08
Respondent Age	4		Yes	Yes	72.08
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes	Yes	Yes	76.49
SDQ Peer Subscale age 11	5	Yes	Yes		66.57
SDQ Peer Subscale age 14	6	Yes	Yes		58.95
SDQ Conduct Subscale age 7	4		Yes		70.06
SDQ Hyperactivity Subscale age 7	4		Yes		69.80
SDQ Prosocial Subscale age 7	4		Yes	Yes	70.08
Parental Self esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1		Yes	Yes	96.39
Respondent Ethnicity	1		Yes		96.14
Respondent in work	4		Yes	Yes	72.08
Respondent Marital Status	4		Yes		71.73
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	4		Yes	Yes	72.04
Longstanding Illness	4		Yes		71.63
Kessler K6 Distress Scale	4		Yes		68.44

Table 8.

Imputation for Peer Problems variable at age 11

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes		89.58
Naming Vocabulary (Age 3)	2		Yes	Yes	80.03
Naming Vocabulary (Age 5)	3		Yes	Yes	77.78
Emotion regulation (Age 3)	2	Yes	Yes	Yes	69.43
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Emotion regulation (Age 7)	4	Yes	Yes		70.15
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes	Yes	99.39
OECD Poverty Indicator	5		Yes	Yes	69.08
SDQ Emotional Subscale Age 3	2	Yes	Yes		76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes	Yes	76.54
SDQ Emotional Subscale Age 7	4	Yes	Yes		69.91
SDQ Emotional Subscale Age 11	5	Yes	Yes		66.53
OECD Equivalised income	5		Yes	Yes	69.08
Respondent Gender	5		Yes		66.58
Respondent Age	5		Yes		66.58
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes	Yes	Yes	76.49
SDQ Peer Subscale age 7	4	Yes	Yes		69.95
SDQ Peer Subscale age 14	6	Yes	Yes		58.95
SDQ Conduct Subscale age 11	5		Yes		66.54
SDQ Hyperactivity Subscale age 11	5		Yes		66.40
SDQ Prosocial Subscale age 11	5		Yes		66.58
Parental Self esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1			Yes	96.39
Respondent Ethnicity	1		Yes		96.14
Respondent in work	5		Yes	Yes	66.58
Respondent Marital Status	5		Yes	Yes	64.98
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	5		Yes	Yes	66.58
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	5		Yes		66.04
Kessler K6 Distress Scale	5		Yes	Yes	60.86

Table 9.

Imputation for Peer Problems variable at age 14

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes		89.58
Naming Vocabulary (Age 3)	2		Yes	Yes	80.03
Naming Vocabulary (Age 5)	3		Yes		77.78
Self-regulation (Age 3)	3		Yes		77.08
Self-regulation (Age 5)	4		Yes		76.78
Self-regulation (Age 7)	5		Yes		70.14
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Emotion regulation (Age 7)	4	Yes	Yes		70.15
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes		99.39
OECD Poverty Indicator	6		Yes		60.92
SDQ Emotional Subscale Age 3	2	Yes	Yes		76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes		76.54
SDQ Emotional Subscale Age 7	4	Yes	Yes		69.91
SDQ Emotional Subscale Age 11	5	Yes	Yes		66.53
SDQ Emotional Subscale Age 14	6	Yes	Yes		58.92
OECD Equivalised income	6		Yes		60.92
Respondent Age	6		Yes		58.28
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes	Yes		76.49
SDQ Peer Subscale age 7	4	Yes	Yes		69.95
SDQ Peer Subscale age 11	5	Yes	Yes		66.57
SDQ Conduct Subscale age 14	6		Yes		58.93
SDQ Hyperactivity Subscale age 14	6		Yes		58.90
SDQ Prosocial Subscale age 14	6		Yes		58.94
Parental Self esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Respondent Ethnicity	1			Yes	96.14
Respondent in work	6		Yes		58.29
Respondent Marital Status	6		Yes		56.86
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	6		Yes		57.20
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	6		Yes		57.19
Kessler K6 Distress Scale	6		Yes		53.92

Table 10.

Imputation for Emotional Problems variable age 3

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes	Yes	89.58
Naming Vocabulary (Age 3)	2	Yes	Yes		80.03
Self-regulation (Age 3)	2		Yes		77.08
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Child gender	1&2	Yes			91.09
OECD Poverty Indicator	1&2	Yes	Yes		99.39
SDQ Emotional Subscale Age 5	3	Yes	Yes		76.54
SDQ Emotional Subscale Age 7	4	Yes	Yes		69.91
SDQ Emotional Subscale Age 11	5	Yes	Yes		66.53
SDQ Emotional Subscale Age 14	6	Yes	Yes		58.92
Respondent Gender	2			Yes	81.02
Respondent Age	2		Yes		81.01
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Conduct Subscale age 3	2		Yes	Yes	76.76
SDQ Hyperactivity Subscale age 3	2		Yes	Yes	76.03
SDQ Prosocial Subscale age 3	2		Yes		76.22
Parental Self esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1		Yes	Yes	96.39
Respondent Ethnicity	1		Yes		96.14
Respondent in work	2		Yes	Yes	80.30
Respondent Marital Status	2			Yes	76.81
Illness/Problem during Pregnancy	1		Yes	Yes	96.10
Current Treatment for Depression	2		Yes		81.03
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	2		Yes		80.30
Kessler K6 Distress Scale	2		Yes		71.59

Table 11.

Imputation for Emotional Problems variable age 5

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes	Yes	85.23
Irritability (temperament)	1		Yes	Yes	90.96
Approach/withdrawal (temperament)	1		Yes		67.36
Regularity (temperament)	1		Yes	Yes	89.58
Adaptability (temperament)	1		Yes		78.52
Maternal Attachment	1		Yes		79.54
Naming Vocabulary (Age 3)	2	Yes	Yes	Yes	80.03
Naming Vocabulary (Age 5)	3		Yes	Yes	77.78
Self-regulation (Age 3)	2		Yes	Yes	77.08
Self-regulation (Age 5)	3		Yes	Yes	76.78
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes		99.39
OECD Poverty Indicator	3		Yes	Yes	78.67
SDQ Emotional Subscale Age 3	2	Yes	Yes	Yes	76.61
SDQ Emotional Subscale Age 7	4	Yes	Yes		69.91
SDQ Emotional Subscale Age 11	5	Yes	Yes		66.53
SDQ Emotional Subscale Age 14	6	Yes	Yes		58.92
OECD Equivalised income	3		Yes	Yes	78.43
Respondent Age	3		Yes		79.23
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes	Yes		76.49
SDQ Conduct Subscale age 5	3		Yes	Yes	76.64
SDQ Hyperactivity Subscale age 5	3		Yes		76.19
SDQ Prosocial Subscale age 5	3		Yes		76.63
Parental Self esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1		Yes		96.39
Respondent Ethnicity	1		Yes		96.14
Respondent in work	3		Yes		79.24
Respondent Marital Status	3		Yes	Yes	78.91
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	3		Yes		79.24
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	3		Yes		78.82
Kessler K6 Distress Scale	3		Yes		74.49

Table 12.

Imputation for Emotional Problems variable age 7

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes		89.58
Naming Vocabulary (Age 3)	2	Yes	Yes	Yes	80.03
Naming Vocabulary (Age 5)	3		Yes	Yes	77.78
Self-regulation (Age 3)	2		Yes	Yes	77.08
Self-regulation (Age 5)	3		Yes	Yes	76.78
Self-regulation (Age 7)	4		Yes		70.14
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Emotion regulation (Age 7)	4	Yes	Yes		70.15
Child gender	1&2	Yes			91.09
OECD Poverty Indicator	1&2	Yes	Yes		99.39
OECD Poverty Indicator	4		Yes	Yes	71.97
SDQ Emotional Subscale Age 3	2	Yes	Yes	Yes	76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes	Yes	76.54
SDQ Emotional Subscale Age 11	5	Yes	Yes		66.53
SDQ Emotional Subscale Age 14	6	Yes	Yes		58.92
OECD Equivalised income	4		Yes		71.08
Respondent Age	4		Yes		72.08
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes	Yes	Yes	76.49
SDQ Peer Subscale age 7	4	Yes	Yes		69.95
SDQ Conduct Subscale age 7	4		Yes		70.06
SDQ Hyperactivity Subscale age 7	4		Yes	Yes	69.80
SDQ Prosocial Subscale age 7	4		Yes		70.08
Parental Self esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1		Yes	Yes	96.39
Respondent in work	4		Yes		72.08
Respondent Marital Status	4		Yes		71.73
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	4		Yes	Yes	72.04
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	4		Yes		71.63
Kessler K6 Distress Scale	4		Yes		68.44

Table 13.

Imputation for Emotional Problems variable age 11

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes		89.58
Parenting beliefs	1				
Naming Vocabulary (Age 3)	2	Yes	Yes		80.03
Naming Vocabulary (Age 5)	3		Yes		77.78
Self-regulation (Age 3)	2		Yes		77.08
Self-regulation (Age 5)	3		Yes		76.78
Self-regulation (Age 7)	4		Yes		70.14
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Emotion regulation (Age 7)	4	Yes	Yes		70.15
Child gender	1&2	Yes	Yes	Yes	91.09
OECD Poverty Indicator	1&2	Yes	Yes	Yes	99.39
OECD Poverty Indicator	5		Yes	Yes	69.08
SDQ Emotional Subscale Age 3	2	Yes	Yes		76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes		76.54
SDQ Emotional Subscale Age 7	4	Yes	Yes	Yes	69.91
SDQ Emotional Subscale Age 14	6	Yes	Yes		58.92
OECD Equivalised income	5		Yes	Yes	69.08
Respondent Gender	5			Yes	66.58
Respondent Age	5		Yes		66.58
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes	Yes		76.49
SDQ Peer Subscale age 7	4	Yes	Yes		69.95
SDQ Peer Subscale age 11	5	Yes	Yes		66.57
SDQ Conduct Subscale age 11	5		Yes		66.54
SDQ Hyperactivity Subscale age 11	5		Yes		66.40
SDQ Prosocial Subscale age 11	5		Yes		66.58
Parental Self Esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1			Yes	96.39
Respondent Ethnicity	1		Yes		96.14
Respondent in work	5		Yes	Yes	66.58
Respondent Marital Status	5		Yes	Yes	
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	5		Yes	Yes	66.58
Lived apart from baby (until 9 months)	1		Yes		96.22
Longstanding Illness	5		Yes	Yes	66.04
Kessler K6 Distress Scale	5		Yes	Yes	60.86

Table 14.

Imputation for Emotional Problems variable age 14

Variables in Multiple Imputation Model	Wave	Analysis Model	Correlates of Analysis Variables	Correlates of Missingness	% Non-Missing
Mood (temperament)	1		Yes		85.23
Irritability (temperament)	1		Yes		90.96
Regularity (temperament)	1		Yes		89.58
Naming Vocabulary (Age 3)	2	Yes	Yes	Yes	80.03
Naming Vocabulary (Age 5)	3		Yes		77.78
Self-regulation (Age 3)	2		Yes		77.08
Self-regulation (Age 5)	3		Yes		76.78
Self-regulation (Age 7)	4		Yes		70.14
Emotion regulation (Age 3)	2	Yes	Yes		69.43
Emotion regulation (Age 5)	3	Yes	Yes		71.75
Emotion regulation (Age 7)	4	Yes	Yes		70.15
Child gender	1&2	Yes	Yes		91.09
OECD Poverty Indicator	1&2	Yes	Yes		99.39
OECD Poverty Indicator	6		Yes		60.92
SDQ Emotional Subscale Age 3	2	Yes	Yes		76.61
SDQ Emotional Subscale Age 5	3	Yes	Yes		76.54
SDQ Emotional Subscale Age 7	4	Yes	Yes		69.91
SDQ Emotional Subscale Age 11	5	Yes	Yes		66.53
OECD Equivalised income	6		Yes		60.92
Respondent Age	6		Yes		58.28
SDQ Peer Subscale age 3	2	Yes	Yes		76.14
SDQ Peer Subscale age 5	3	Yes	Yes		76.49
SDQ Peer Subscale age 7	4	Yes	Yes		69.95
SDQ Peer Subscale age 11	5	Yes	Yes		66.57
SDQ Peer Subscale age 14	6	Yes	Yes	Yes	58.95
SDQ Conduct Subscale age 14	6		Yes	Yes	58.93
SDQ Hyperactivity Subscale age 14	6		Yes		58.90
SDQ Prosocial Subscale age 14	6		Yes		58.94
Parental Self Esteem	1		Yes		80.84
Rutter Malaise Inventory	1		Yes		92.51
Languages spoken at home	1			Yes	96.39
Respondent Ethnicity	1			Yes	96.14
Respondent in work	6		Yes		58.29
Respondent Marital Status	6		Yes		56.86
Illness/Problem during Pregnancy	1		Yes		96.10
Current Treatment for Depression	6		Yes		57.20
Longstanding Illness	6		Yes		57.19
Kessler K6 Distress Scale	6		Yes		53.92

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Thesis Discussion

The purpose of this thesis was to investigate the pathways towards socioemotional difficulties in adolescents with DLD. The main objectives were:

- To investigate social and emotional outcomes in adolescents with DLD compared to their TLD peers in a clinical sample and a population cohort
- To explore whether adolescents with DLD perform poorly compared to their TLD peers on two novel social cognition tasks
- To explore whether emotion regulation abilities differ between children at risk of DLD (rDLD) and a general population (GP) group
- To assess whether peer problems or social cognition mediate the relationship between DLD and poor socioemotional outcomes
- To explore whether the relationship between poor emotion regulation and poor socioemotional outcomes is moderated by rDLD group status

In order to achieve these objectives three models were proposed, framed within the domain-general theory of DLD. Chapter 1 concluded that previous models postulating an underlying psychosocial deficit (i.e. Bishop, 1997; Redmond & Rice, 1998) were not an acceptable explanation of the relationship between DLD and socioemotional difficulties. This was due to the varying patterns of socioemotional difficulties seen throughout development and the fact that not every individual with DLD experiences such problems (e.g. Mok et al., 2014). Instead a more nuanced explanation was proposed, combining aspects of the Social Adaptation Model (SAM; Redmond & Rice, 1998) with a usage-based approach to language acquisition, suggesting that language difficulties lead to weaker social cognition and emotion regulation abilities, which contribute to poorer social experiences. In turn, these social difficulties reduce opportunities to socialise with others and develop social skills, which can result in negative emotional outcomes, such as increased anxiety and depression.

Addressing the first objective, the thesis found that parents and teachers perceived young people with language difficulties to experience higher rates of emotional problems and social difficulties compared to their TLD peers, which is consistent with the literature (Lindsay & Dockrell, 2012; St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). These increased rates were found in both a subsample of children at risk of DLD (rDLD) from the

MCS (Chapters 2 and 6) and a clinically-referred sample of adolescents with a history of DLD (Chapters 3-5). The findings from the MCS demonstrate that even those without a clinical diagnosis of DLD are at risk for increased social and emotional problems throughout childhood and into adolescence, replicating the findings from the MLS and other clinical samples in a population cohort. Previous findings from the MCS have shown expressive language predicts prosocial behaviour at age five, as well as a reciprocal relationship between poor expressive language and conduct disorder (Girard, Pingault, Doyle, Falissard, & Tremblay, 2017; Girard, Pingault, Doyle, Falissard, & Tremblay, 2016), while another longitudinal population study found an association between early language ability and early emotional and behavioural outcomes between two and six years of age (Clegg, Law, Rush, Peters, & Roulstone, 2015). Therefore, the findings from the current thesis extend the literature, showing that increased socioemotional problems are present in adolescence in individuals with language difficulties. The finding that adolescents with DLD are at greater risk of experiencing social and emotional problems compared to their TLD peers is important, given that, in the general population, approximately 75% of psychiatric problems experienced in adulthood first manifest in adolescence (Kim-Cohen et al., 2003). Indeed, within the DLD population, relationship problems and mental health difficulties have been found to continue into adulthood (Clegg, Hollis, Mawhood, & Rutter, 2005).

However, these increased rates of socioemotional problems were only found in parent- or teacher-report of difficulties. With the exception of Chapter 2, which found a higher proportion of best friends were reported in the GP group at age 14, and Chapter 3 which reported that significantly more TLD adolescents attended social clubs than their DLD peers, there were no significant group differences in self-report measures of social functioning. Additionally, in Chapters 3 and 5, adolescents with DLD did not perceive themselves to experience increased rates of anxiety or depression compared to their TLD peers, which contradicts previous findings (Botting & Conti-Ramsden, 2008; Conti-Ramsden, Mok, Pickles, & Durkin, 2013). There was no group difference in reports of mental wellbeing and both groups reported similar levels of social support from their friends, which is consistent with a previous finding that adolescents with DLD perceived themselves to be socially competent (Wadman, Durkin, & Conti-Ramsden, 2011). Furthermore, neither the rDLD group in Chapter 2 nor the DLD group in Chapters 3-5 reported significantly higher rates of victimisation compared to their typically developing

peers. While this is similar to findings from Lindsay, Dockrell, and Mackie (2008) it contradicts the majority of the literature (Conti-Ramsden & Botting, 2004; Knox & Conti-Ramsden, 2007; Redmond, 2011; van den Bedem, Dockrell, van Alphen, Kalicharan, & Rieffe, 2018b).

Taken together, these results suggest that parents and teachers observe problems with social and emotional functioning that individuals with DLD do not perceive themselves. The consistent findings of increased peer and emotional problems as rated by teachers and parents are in direct contrast to the Social Adaptation Model (SAM; Redmond & Rice, 1998) described in Chapter 1. Redmond and Rice's (1998) finding of conflicting reports among informants provided the rationale for rejecting the innate psychosocial deficit theory of the Social Deviation Model (SDM; Redmond & Rice, 1998) and supported their assertion that children with DLD adapted their behaviour in response to different social demands. Therefore, the consistent findings from this thesis could instead point to an underlying deficit. However, there are no significant group differences in self-report of social and emotional problems. Adolescents themselves may be better placed than parents and teachers to describe internalising problems and the discrepancy between these ratings suggests that parents and teachers may be biased in their observations. That is, having concerns about the child's language abilities may lead them to view other abilities as impaired. Another possible explanation is that parents may be more sensitive to the difficulties that their children are likely to experience, whereas adolescents may be under-reporting in order to "save face" or downplay their difficulties.

Alternatively, it could be argued that the lower ratings of difficulties reported by adolescents reflects a lack of self-awareness from the adolescents with DLD. Indeed, in Chapters 4 and 5 the DLD group demonstrated poorer social understanding than their TLD peers on experimental measures of social cognition. Evidence from the SELT in particular shows that adolescents with DLD are poorer at understanding when they are "disliked". It could be that the same social cognition deficits that prohibit adolescents with DLD from understanding negative social cues also prevent them from recognising difficulties with their peers or understanding their emotional problems. However, the performance on social cognition tasks in the current thesis did not predict parent-rated (Chapter 4) or self-reported (Chapter 5) social or emotional outcomes in the DLD group, which is not in line with the proposed model (Figure 4b in Chapter 1) and contrary to previous findings of social cognition predicting social outcomes in children and adolescents with DLD (Andres-

Roqueta, Adrian, Clemente, & Villanueva, 2016; Bakopoulou & Dockrell, 2016; Botting & Conti-Ramsden, 2008). Poorer social evaluation skills (Chapter 5) did predict higher levels of self-reported social anxiety in the TLD group. Nevertheless, there was still a significant group difference in social cognition abilities, providing further support for the domain-general theory of DLD and suggesting that this is an area that needs assistance in adolescents with DLD.

Equally, the conflicting findings could be due to different self-report measures, as Chapters 3-5 in the current thesis used the MFQ and RCMAS to assess self-reported emotional problems, unlike previous studies which used the SDQ self-report (Botting & Conti-Ramsden, 2008; Conti-Ramsden et al., 2013). However, the MFQ and RCMAS have been used in a clinical cohort study which found significantly higher rates of anxiety and depressive symptoms in adolescents with DLD (Conti-Ramsden & Botting, 2008). One explanation for this inconsistency could be the considerably smaller sample size of the studies in Chapters 3-5 of the current thesis ($n = 24$ or 26) compared to the large cohort originally recruited for the Manchester Language Study (MLS) ($n = 242$) (Conti-Ramsden & Botting, 1999). Consequently, the current thesis may lack the power to detect significant effects. However, it is important to note that no group differences in social problems were reported in Chapter 2, which had a sample size of 891 participants in the rDLD group. These conflicting findings highlight the need to investigate the relationship between DLD and socioemotional problems in large cohorts that are not the MLS, to see whether the effects still hold in children with significant language difficulties who were not recruited by clinical referral and may not have received the same level of support.

Despite the different outcome of informant ratings compared to the SAM, this thesis found support for the proposed model of a mediating effect of social functioning on emotional outcomes (Figure 4a in Chapter 1), albeit to different extents. The longitudinal cohort study in Chapter 2 found that teacher-report of peer problems at age 7 partially mediated parent-report of emotional problems at age 14 in young people in the rDLD group. Meanwhile, the cross-sectional study in Chapter 3 found that parent-report of peer problems fully mediated parent-report of emotional problems in adolescents aged 11-17, accounting for approximately 64% of concurrent emotional problems. The difference in strength of mediation is likely due to Chapter 3 using only one informant instead of two, and the mediation being concurrent, not longitudinal. Nevertheless, the effect of peer problems on emotional problems was found in two different samples and reflects findings

from the general population that poor social functioning predicts emotional problems (Arseneault, Bowes, & Shakoor, 2010; Geoffroy et al., 2018). Therefore, strategies to facilitate better social skills and peer relations should be considered when supporting the mental health outcomes of children and adolescents with DLD.

Finally, the influence of emotion regulation was examined between groups in order to evaluate whether an alternative factor to social cognition may be driving both social and emotional difficulties. Chapter 6 demonstrated that children considered at risk of DLD (rDLD) were poorer at emotion regulation compared to the GP group at age 3, 5 and 7, again adding support to the domain-general hypothesis of DLD. These findings are in line with a previous study that found teachers perceived children with DLD to have more difficulty with emotion regulation compared to their TD peers (Fujiki, Brinton, & Clarke, 2002). Cross-lag analysis revealed that poor emotion regulation predicted peer and emotional problems throughout development, consistent with previous findings in the DLD population (Fujiki, Spackman, Brinton, & Hall, 2004; van den Bedem et al., 2018a). Additionally, membership of the rDLD group moderated the developmental pathways between poor emotion regulation and emotional problems, with poor emotion regulation having a stronger effect in the rDLD group. This finding was in line with the proposed model in Chapter 1 (Figure 4c). However, this significant group difference was only found between two pathways in the early years (i.e. there was a stronger effect of poor emotion regulation at age 3 predicting emotional problems at age 5 in the rDLD group, and a stronger effect of emotional problems at age 5 predicting poor emotion regulation at age 7). Furthermore, the strongest pathways were found between early peer and emotional problems, suggesting that poor emotion regulation is making a limited contribution to socioemotional difficulties, particularly in adolescence. However, the different pathways found between groups, with reciprocal relations between emotion regulation, peer problems and emotional problems in the GP group and unidirectional pathways in the rDLD group, along with support from a recent longitudinal study (van den Bedem et al., 2018a) suggests that emotion regulation should be explored further.

Overall, the thesis found support for the models depicting social functioning as a mediator between DLD and poor emotional outcomes (Figure 4a in Chapter 1) and group status as a moderator between emotion regulation and poor socioemotional outcomes (Figure 4c in Chapter 1). Contrary to expectations, there was no mediating effect of social cognition (Figure 4b in Chapter 1). Language interventions for DLD may do well to

incorporate more aspects of socioemotional development, such as extra support for navigating social situations and strategies to regulate emotions, to provide a more comprehensive approach to tackle these additional difficulties that children and young people with DLD may face. Additionally, these socioemotional difficulties were found in adolescents with a history of DLD, so extra support after speech and language therapy (SLT) has been provided may be beneficial.

Of course, there may be other potential pathways to increased rates of socioemotional problems in adolescents with DLD. This thesis set out to test three specific models but a different direction could provide a better explanation of the relationship. For example, instead of examining the mediating effect of social cognition on peer and emotional problems it could be that peer problems are influencing social cognition problems due to limited exposure to social situations. That is, difficulties interacting with peers could prohibit opportunities to learn social skills and improve social understanding. Testing this alternative model may produce a mediation effect. Additionally, the configuration of the models tested in the thesis may be too narrow in their scope and instead of two separate models to test each social cognition task the variables could be interacting with each other. For instance, the social attribution skills as measured by the SAT may be required for successful social evaluation as demonstrated in the SELT, or vice versa. A further study examining whether the SELT and SAT influence each other would address this question and provide further information to help uncover the mechanisms involved in increased emotional problems in adolescents with DLD.

Strengths

This thesis expanded the literature by examining the underlying pathways between DLD and increased socioemotional problems in terms of environmental, cognitive and biological factors, providing a comprehensive overview of the possible mechanisms involved. The exploration of previously under-researched areas of social cognition and emotion regulation particularly strengthens the contribution that this thesis makes to the existing literature. The influence of peer problems was investigated in both an adolescent cross-sectional sample and in a population cohort spanning early childhood to early adolescence. The same pattern of peer problems mediating emotional problems was found across different informants, as well as longitudinally and concurrently. Additionally, multiple

informant reports of peer and emotional problems were used, with both teacher- and parent-reports in Chapter 2 and parent- and self-reports in Chapters 3-5, providing a broader indication of the difficulties that children and young people with DLD may face. The discrepancy between parent and self-report of social and emotional problems throughout this thesis has not been consistently demonstrated in the previous literature, highlighting the importance of allowing adolescents autonomy in research about their strengths and difficulties.

This thesis also extends the research on population cohorts in this area, which are important to investigate as previous research has often focused on clinical populations. Longitudinal studies are imperative to understanding the development of socioemotional difficulties over time; however, extensive research has been carried out on clinically diagnosed individuals with DLD from the Manchester Language Study (MLS). It is necessary to examine whether these same results are found in population cohorts among children and young people who have yet to be diagnosed with DLD. For instance, there may be differences in the severity of language difficulty and support received which may impact on the associated socioemotional difficulties. To the author's knowledge, Chapters 2 and 6 are among the first to use the Millennium Cohort Study (MCS) to investigate adolescent socioemotional outcomes in a subsample of those at risk of DLD (rDLD). Survey waves were used from three time points in Chapter 2 and five time points in Chapter 6, allowing for a more in-depth analysis than studies that have only one follow-up. The studies also spanned early childhood (at 3 or 5 years of age) until early adolescence (14 years of age), covering a broader range of development compared to previous population studies investigating socioemotional problems in those with a language difficulty (Reilly et al., 2006). The focus on adolescence across all the studies was also a strength as this is a significant period in development for peer relations and emotional difficulties in general (Jones, 2013; Kim-Cohen et al., 2003).

Furthermore, the investigation into emotion regulation and social cognition is somewhat lacking in this area of research but has been expanded upon in this thesis. To the author's knowledge, Chapter 6 provides the first in-depth investigation of emotion regulation as a contributing factor to socioemotional problems in childhood and adolescence within a population cohort considered to be at risk of DLD. Although a recent longitudinal study of clinically-referred adolescents with DLD reveals consistent findings, with emotion regulation making an independent contribution to emotional outcomes (van

den Bedem et al., 2018a), emotion regulation in the DLD population had previously only been investigated in terms of social functioning outcomes (Fujiki et al., 2004). Therefore, the findings from the current study, along with those from van den Bedem et al. (2018), suggest that emotion regulation is more important for emotional outcomes than peer outcomes and warrants further investigation as a contributing factor. Additionally, the use of novel tasks to measure social cognition demonstrates a significant contribution to the literature, providing new insight into the social understanding abilities of adolescents with DLD. This thesis provides the first examination of the SAT in the DLD population (Chapter 4) and the first examination of SELT in an adolescent and DLD population (Chapter 5). These tasks are more appropriate for the adolescent age-range than typical Theory of Mind (ToM) tasks which are usually passed at a much younger age, and are also more interactive and engaging, simulating real-life social scenarios more effectively than previous tasks. Despite the novelty of the tasks in the DLD population, group differences were still found in the SAT and SELT. Adolescents with DLD were poorer at attributing social aspects to animated shapes than their TLD peers, using fewer emotional mental state terms when describing the scene. The DLD group were also poorer at understanding social cues in a computerised task of evaluating social judgement.

Finally, the use of mediation and moderation to examine these developmental pathways is another strength of the thesis, providing a more in-depth analysis of the causal mechanisms involved in the relationship between DLD and associated difficulties, instead of cross-sectional comparison studies or within-group correlations. Using methods such as structural equation modelling (SEM) can help to examine models, such as the SAM and SDM, in more detail and help to provide a better understanding of the mechanisms involved in the relationship between DLD and socioemotional problems.

Limitations

It is necessary to consider the findings of the thesis in terms of the limitations as well as the strengths of the studies. One of the main limitations of this thesis is the secondary data analysis approach used in Chapters 2 and 6. Firstly, analysing the Millennium Cohort Study (MCS) limits the control over variables. For instance, the findings from these chapters should be interpreted with caution when considering the DLD literature, as the subsample from the MCS consisted of individuals with undiagnosed language difficulties. However, this variable was derived from a standardised expressive language test (British

Ability Scale Naming Vocabulary; Elliott, Smith, & McCulloch, 1997) and parent report of language difficulties to provide as robust a variable as possible given the measures available, and produced a comparable prevalence rate to a recent population screening study (Norbury et al., 2016). The combination of parental concerns and standardised tests is considered appropriate to provide a comprehensive overview of language functioning, covering knowledge of expressive vocabulary as well as daily use of language in a more social context (Bishop & McDonald, 2009; Bishop et al., 2017). Additionally, the results of higher ratings of peer and emotional problems from Chapter 2 reflect findings from the literature of individuals with clinical diagnoses of DLD, as well as the findings from the clinically-referred sample in Chapter 3.

Confidence in the rDLD variable is also supported by the fact that equivalent patterns of findings were reported when analyses were run separately on the group with only parent-report of language difficulties and on the group who met criteria for the low threshold on the Naming Vocabulary subtest (see supplementary materials for Chapter 2 and Chapter 6). Furthermore, another study using the rDLD variable found early psychosocial risk factors fully mediated emotional problems at age 3 and partially mediated emotional problems at age 11 in this group (St Clair, Forrest, Yew, & Gibson, in press). Similar to Chapters 2 and 6, the results in this paper were nearly identical when separating out into the distinct DLD criteria subgroups, again providing confidence in the validity of the combined rDLD variable.

Secondly, the studies from the MCS are limited by the lack of standardised self-report measures of socioemotional functioning that were included in the surveys. A longitudinal study that examines the same measures at different time points would provide more insight into the developmental pathways and a better understanding of how to address the associated socioemotional problems. This may be possible in future waves of the MCS as the Moods and Feelings Questionnaire (MFQ; Angold, Costello, Messer, & Pickles, 1995) has been included in the most recent wave (age 14), along with more questions assessing cohort members' socioemotional functioning. The MFQ was not included in Chapter 2 or 6 because there was no equivalent self-report measure of emotional problems at earlier waves to provide consistency.

The third limitation of analysing secondary data is the group differences observed in the cross-lagged evaluation of emotion regulation in Chapter 6 were relatively small,

perhaps as a function of the large sample size where small effects can be significant. However, standardised beta coefficients were used to provide a measure of effect size. More information could be gathered from a prospective longitudinal study of a clinical sample, as has recently been conducted in the Netherlands (van den Bedem et al., 2018a).

Conversely, the cross-sectional studies (Chapters 3, 4 and 5) were hindered by a small sample size. Therefore, the conclusions drawn from these findings are limited due to reduced power. Recruiting an adolescent sample of individuals with DLD proved difficult due to the reduced level of support that this age-group receives. A speech and language therapy (SLT) service employed by the local authority to provide services to schools was targeted to aid recruitment. Out of their 54 adolescent clients only eight agreed to participate in the study. Further recruitment waves were issued at later dates but no more potential participants were included in the sample. Social media was used to advertise the study to private SLT practitioners and parents of adolescents with DLD; however, the specific sample of 11-18 year olds without a diagnosis of autism spectrum disorder (ASD) limited the number of eligible participants. Additionally, many SENCOs did not know what DLD was and occasionally referred children with speech disorders such as dyspraxia. In order to achieve an adequate sample size, recruitment also involved screening of language difficulties using the Communication Checklist-Self Report (CC-SR; Bishop, Whitehouse, & Sharp, 2009) and parent-report of early language difficulties. Five participants with a history of language difficulties were recruited this way and included in the DLD group, the majority of whom demonstrated below average receptive and/or expressive language abilities. This was justified by the understanding that accounting for parental concerns is an important element of identifying individuals with DLD (Bishop & McDonald, 2009).

The exclusionary criteria of exceeding the cut-off on the self-report and parent-report versions of the Autism Quotient (AQ; Baron-Cohen, Hoekstra, Knickmeyer, & Wheelwright, 2006; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) may have been another contributory factor to the reduced sample size. While inclusion of this scale was deemed necessary to avoid confounding autistic traits on the social cognition measures of SAT and SELT, it may have resulted in an artificially 'cleaner' sample that does not reflect the DLD population. Indeed, evidence from the MLS demonstrates that a

much higher percentage of adolescents with DLD have ASD or autistic traits than in the general population (Conti-Ramsden, Simkin, & Botting, 2006), even though a diagnosis of ASD was an initial exclusion criterion in the sample. Twelve participants were excluded due to exceeding the cut-off on the AQ but did not have a diagnosis or suspected autism according to parental report. It may be that items on the AQ such as, “I am good at social chit-chat”, “In a social group, I can easily keep track of several different people’s conversations” and “I frequently don’t know how to keep conversations going” were tapping into language ability and therefore participants with DLD were being excluded unnecessarily. However, excluding participants with a high AQ score did allow for more confidence in the findings of reduced social cognition abilities in adolescents with DLD, providing a stronger argument that these deficits are the result of a significant difficulty understanding social cues and not due to comorbid autistic traits.

A further critique of the study design is that the socioemotional measures and experimental tasks all involved varying degrees of language ability to complete. In particular, the SAT required expressive vocabulary to provide descriptive narratives of the animations and the SELT relied heavily on receptive language abilities to judge the social cues. Therefore, the social cognitive performance being measured by these tasks may have been confounded by the linguistic demand involved. In an effort to minimise these potential confounding effects, all questionnaires and on-screen instructions from the SELT were read out loud to every participant. The word choices in the SELT were read out loud and definitions were given when required. The word list was also adapted to be more appropriate for children as it was originally designed for adults, although time constraints meant that piloting on a DLD sample was not feasible. Furthermore, regression analyses revealed that there was no significant effect of receptive or expressive language ability on SELT performance for either group. However, in the SAT, expressive language ability in the DLD group predicted scores on the Person and Animation Indices, while receptive language ability predicted scores on the Saliency Index. Conversely, emotion mental state words (Theory of Mind – Affective Index) were not predicted by language ability.

Implications

This thesis adds to the literature surrounding DLD, formerly known as specific language impairment (SLI), by highlighting that language, social and emotional abilities are all

interlinked. Specifically, the thesis shows that peer problems can account for emotional difficulties in adolescents with DLD. This is the strongest outcome from the thesis as it was found across two different samples (clinically referred or with a history of DLD and a group from a population cohort considered at risk of DLD) with two different informants (parent and teacher), both concurrently and longitudinally. These findings provide support for the mediation model proposed in Chapter 1, which extends the SAM by viewing the development of language and socioemotional problems within the usage-based framework and demonstrating that peer problems mediate emotional problems in adolescents with DLD. In doing so, the thesis has provided a potential structure for addressing increased emotional difficulties in this population by first addressing peer problems. This could be done either by teaching children and adolescents with DLD more social skills to increase their social functioning and in turn hopefully reduce emotional difficulties, or by equipping schools with more knowledge about the links between peer problems and emotional problems and providing them with more tools with which to support children and adolescents who are having difficulty in these areas. However, there is insufficient evidence to support the training of pragmatic language skills in children with DLD to improve their social functioning (Gerber, Brice, Capone, Fujiki & Timler, 2012). The limited effect of language interventions may indicate an underlying difficulty more in line with the SDM (Redmond & Rice, 1998). Perhaps the underlying difficulties with social cognition and emotion regulation, as found in Chapters 4, 5 and 6, should be targeted with regards to intervention. Focusing on these areas may have more impact because, as maintained by the domain-general theory of DLD, other areas of cognitive functioning are impaired, not just the linguistic domain.

The findings from the MCS subsample of children considered at risk of DLD demonstrates that even individuals without a clinical diagnosis of DLD may experience later social and emotional problems. The longevity of the negative outcomes found in Chapters 2 and 6 implies that children with language difficulties may be experiencing significant socioemotional problems that affect them throughout childhood and adolescent development. This is consistent with research from Cohen and colleagues who found undiagnosed language difficulties in 40% of adolescents who were referred to Child Adolescent Mental Health Services (CAMHS) (Cohen, Barwick, Horodezky, Vallance, & Im, 1998). Whether these adolescents would have been referred if they had received a diagnosis of DLD and support from speech and language therapy in their childhood

remains to be seen, but early language screening could help to direct children to the correct services to address their immediate needs. It could be that early language intervention reduces the number of children and adolescents later referred to CAMHS as the majority of socioemotional problems found in the DLD population do not reach clinical levels. This is an interesting idea for future studies to investigate.

There is still little understanding and even awareness of DLD. The need for increased awareness of DLD and the importance of language development in general is highlighted by the difficulty with recruitment during this thesis. Admittedly, the recruitment process may have been hindered by the requirement of a very specific sample of adolescents with language difficulties but without a diagnosis of ASD. However, when calling schools, many SENCOs had not heard of DLD or SLI and occasionally referred children with speech difficulties such as dyspraxia. Online support groups predominantly consisted of parents of young children with recent diagnoses. This raises the question of whether there is enough support for children with DLD and their parents once the child enters adolescence and experiences the additional stressors of complex peer relations and academic pressures. Perhaps this research, along with the previous literature, can help to raise awareness of DLD by demonstrating the severity and long-lasting impact of DLD and associated socioemotional problems. That is, by framing DLD in terms of socioemotional problems it may be taken more seriously. Indeed, we already know the impact of poor educational and employment outcomes in DLD in adulthood, and recent studies have demonstrated the link between social and emotional health in late adolescence and early adulthood. Additionally, the high rates of undiagnosed DLD in the Child and Adolescent Mental Health Service (CAMHS) referral population highlight further the intrinsic relationship between language and socioemotional difficulties, as well as the need for better understanding of the mechanisms involved in this relationship. Given the economic cost of mental health in the UK, it would be interesting and useful to examine whether these socioemotional difficulties in adolescence relate to increased use of NHS services in order to provide adequate support. However, the Bercow Report (Bercow, 2008) stated that provision for speech language and communication needs (SLCN) in the UK needs to be improved. A recent follow-up reported that more support was still needed but recent cuts to funding have hindered the progress (ICAN & RCSLT, 2018).

However, it is important to remember the constraints to which the findings from this thesis can be implemented. Given the wide interpretation of “social behaviour” and

“emotional problems” the implications of this thesis can only be discussed in terms of the explicit outcomes measured. The complex behaviours involved in socialising and the intricate relationship between language and socioemotional functioning means that there are areas which this thesis cannot explain fully. Ideas for potential areas of further study will be discussed in the next section. Additionally, including participants without a formal diagnosis in the DLD group may have influenced the findings. Specifically, the lack of group difference in self-report of socioemotional problems and the lack of mediation between social functioning and socioemotional problems may have been influenced by this factor. Focusing on parent-report of historic language difficulties as an inclusion criterion may have contributed to the significant group differences in parent-report of socioemotional problems because parents who were concerned about language development may have been inclined to view socioemotional functioning as impaired as well. Nevertheless, it should be noted that not all participants who were referred from SLTs and SENCOs met the clinical cut-off of 1.5 SD below the mean on the two language subtests that were administered during the testing phase. Therefore, even those participants who were clinically referred and still receiving speech and language therapy were not classed as meeting traditional diagnostic criteria for DLD, highlighting the arbitrary nature of a cut-off. Future studies could analyse the lowest scoring participants in the DLD group to see whether there are any differences between those with and without a clinical diagnosis.

Future Directions

While this thesis has provided some insight into the pathways between DLD and increased socioemotional problems in adolescents, there are still some questions that remain unanswered. The current studies using the SAT and SELT should be replicated using larger samples, and longitudinal studies may provide more information about the causal direction of social cognition ability that was not covered within this thesis. When considering the outcomes of the thesis in relation to the theory surrounding DLD it is important to note that performance on the SAT and, in particular, the SELT could have depended on domain-general skills such as processing speed, working memory or procedural learning. Future replications of these studies should also employ a non-social procedural learning task to determine whether the group difference observed is a social cognition deficit or a general

cognition deficit. Furthermore, the effect of social cognition could be expanded upon by using virtual reality to measure online social cognitions during a simulated, immersive social interaction. This method would allow experimenters to have full control over the social interaction and record real-time reactions to social cues, without the risk of responses being confounded by literacy demands. They could also measure physiological outcomes, such as cortisol levels, to confirm whether adolescents with DLD are experiencing more stress than their TLD peers during social interactions as previously reported (Wadman et al., 2011). Alternatively, the “cyber ball” task could be used to measure social exclusion (Williams, Cheung, & Choi, 2000). Being ‘left out’ of the ball throwing in this computerised task has been shown to predict negative affect in typically developing adolescents (Zadro, Williams, & Richardson, 2004); therefore, this paradigm could be investigated within the DLD population to provide more insight into how adolescents with a language difficulty evaluate an uncomfortable social situation that does not involve verbal skills. It may be that, similar to the findings from the SELT in this thesis, adolescents with DLD are less sensitive to negative evaluation than their typically developing peers.

Additionally, qualitative data from adolescents describing what it is like to have DLD, and how this affects their social functioning and wellbeing could provide a richer dataset and offer more support for the theoretical models proposed, or indeed an alternative explanation of the mechanisms involved in poor socioemotional functioning. For example, a recent narrative study from Lyons and Roulstone (2018) among 11 children with communication difficulties (speech-sound disorders and language disorder) offered more insight into the resiliency of these children and how they cope with daily functioning. In particular, it is important to conduct qualitative research with adolescents themselves, instead of with parents or teachers, as they are best placed to give insight into the social support they receive from their friends or emotion regulation strategies that they use. This emphasis on positive factors is also important, instead of a focus on psychopathology. These new directions of research may enable the evaluation of protective factors that can be implemented to reduce socioemotional difficulties in adolescents with DLD.

Furthermore, peer problems, social cognition and emotion regulation may not be the only factors involved, particularly given the partial mediation of peer problems in Chapter 2 and the lack of mediation of social cognition in Chapter 5. Moreover, the group difference in emotion regulation was only found in the early years at age 3 and only for the

emotional problems outcome at age 5. It could be that social cognition and emotion regulation are being driven by other factors, such as executive functioning or attachment style. Secure attachment symbolises a strong relationship between the child and their caregiver and may also influence other social interactions (Bowlby, 1977). Being secure and feeling safe allows the child to approach and interact with others with confidence, expanding their social knowledge and understanding. Individuals who are secure have a relationship built on trust and openness, which encourages them to be more open, thus building more trust. The opposite may be true for those with avoidant style attachment (Bowlby, 1977). Indeed, secure attachment has been linked to stronger language abilities (van IJzendoorn, Dijkstra, & Bus, 1995). Therefore, DLD may act as a barrier to secure attachment as a child who has difficulty expressing themselves and understanding others may develop a strained relationship with their parent who has difficulty responding to their needs. This strained relationship could in turn influence the child's social functioning as they miss out on the key social skills learned from joint attention. Attachment theory has not yet been thoroughly explored in children and adolescents with DLD but may provide an overarching framework to explain the increased socioemotional problems, within which social functioning, social cognition and emotion regulation reside.

Conclusion

The findings from this thesis suggest children and young people with language difficulties experience significantly higher rates of social and emotional problems than their TLD peers, and social difficulties may be mediating these emotional problems. For example, teacher-reported peer problems in mid-childhood were found to partially mediate parent-reported emotional problems in adolescence, demonstrating a longitudinal, cross-informant effect. When this mediation analysis was carried out in a single-informant cross-sectional study the effect was even stronger, with parent-reported peer problems fully mediating parent-reported emotional problems in an adolescent sample (M age = 13 years). These findings indicate that the social lives of adolescents with DLD are poorer than their TLD peers and they may need additional support to address these problems, which may in turn alleviate emotional problems. However, this is only true of informant reports as the young people themselves do not report significantly higher problems than their TLD peers. Whether this is due to a lack of social cognition remains to be seen – adolescents with DLD performed significantly worse than their TLD peers on experimental tasks of social cognition but these social cognitive differences did not explain their social and emotional

problems. Further experiments with larger samples and the use of virtual reality or qualitative measures could provide more information. Alternatively, poor emotion regulation abilities could be driving these differences as evidence from the MCS demonstrated poor emotion regulation was a stronger predictor of emotional problems in the rDLD group compared to the GP group in early childhood. Again, these factors need to be investigated in more detail but this thesis has made strides towards explaining the mechanisms involved in increased socioemotional problems by examining possible environmental, cognitive and biological factors. Ultimately, what is clear from this research is that DLD, social problems and emotional problems are inextricably linked and language should be one of the first points of assessment when evaluating how best to address the socioemotional needs of a young person.

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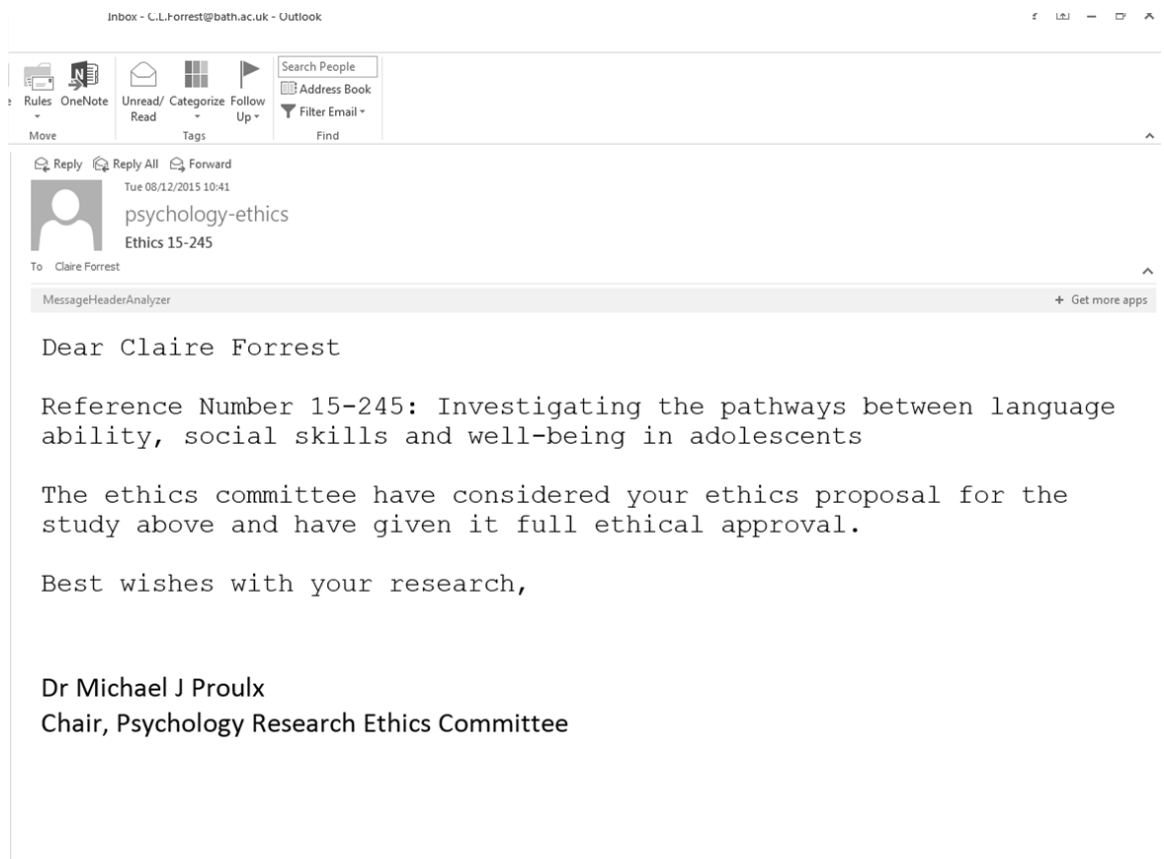
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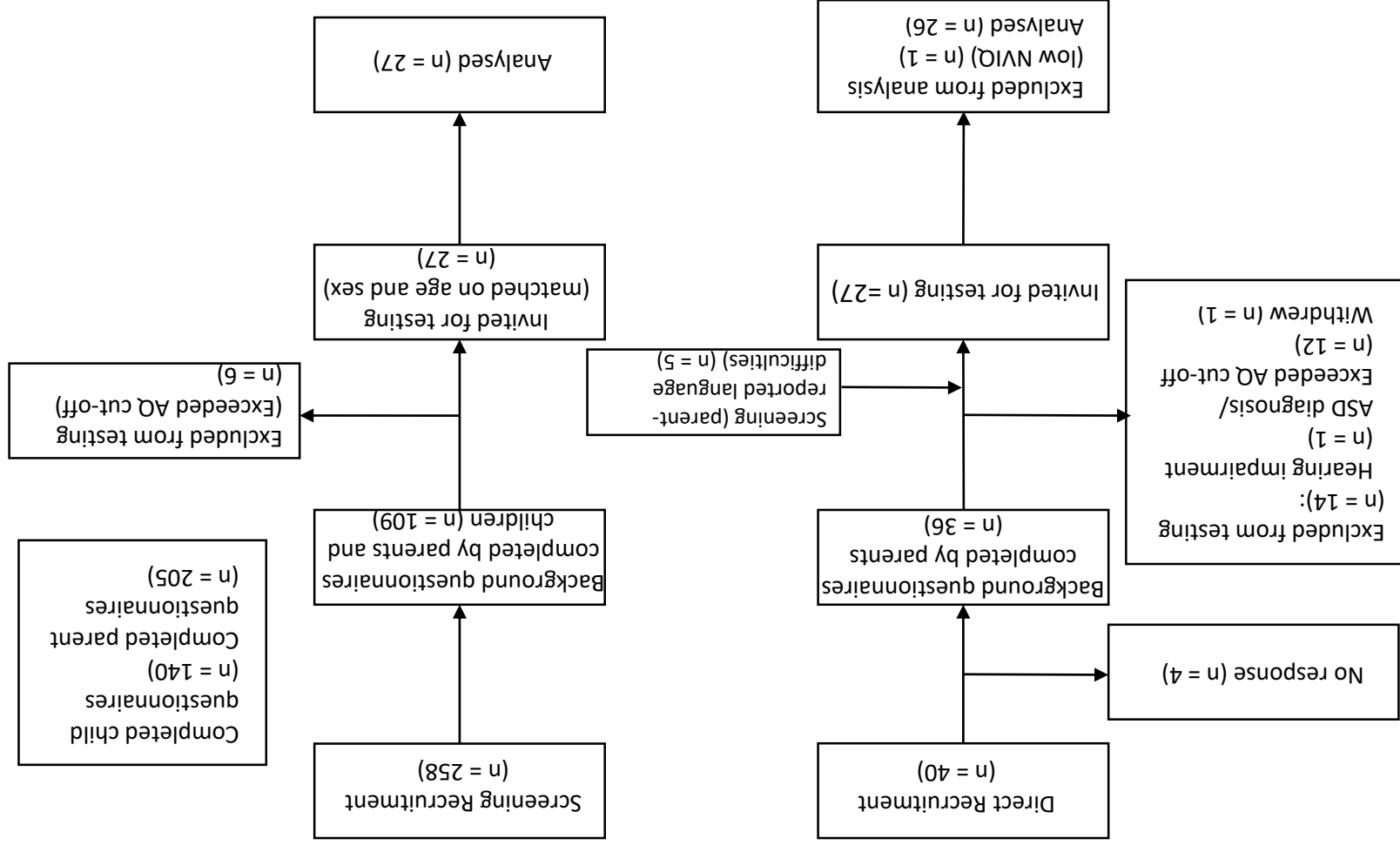
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Appendix A. Ethical Approval

The Department of Psychology Ethics Committee granted full ethical approval for the project on the 8th December, 2015 (reference number: 15-245). Three further minor amendment requests (to include different measures of social anxiety and new questionnaires to measure social functioning; to increase the maximum age of participants from 16 years to 18 years to aid recruitment of the sample and to edit the information letters for expansion of recruitment into Aberdeenshire) were approved by Chair's Action on the 2nd of February, 2016, the 4th of March, 2016 and the 22nd of August, 2016 respectively.



Appendix B.
Flowchart of recruitment.



Appendix C. Whole sample

Table 1.

Language profile for the Developmental Language Disorder (DLD) Group.

Participant	Age (Yrs;mths)	Sex	Standardised Tests						Parent Report	
			CC-SR Language Structure	CC-SR Pragmatic Skills	CC-SR Social Engagement	Recalling Sentences	Word Class Receptive	Block Design	History of speech/lang. problems?	SLT?
1	13:07	M	-	-	-	7	8	7		
2	12:09	F	-	-	-	5	5	6		
3	14:11	M	-	-	-	4	7	13		
4	13:08	M	-	-	-	6	5	9		
5	17:08	M	-	-	-	8	8	9		
6	13:09	M	-	-	-	1	5	6		
7	13:05	M	-	-	-	9	8	6		
8	14:03	F	-	-	-	7	10	12		
9	11:08	M	-	-	-	2	4	4		
10	11:07	M	-	-	-	7	5	12		
11	11:07	F	-	-	-	10	8	13		
12	13:05	M	9	10	9	7	6	13	Stuttering, Language developing slowly, DLD diagnosis	Yes, early years
13	14:03	M	9	10	10	7	11	11	"Poor sentence construction at times"	
14	14:00	F	12	13	12	7	7	9	Language developing slowly	Yes, early years
15	14:09	F	-	-	-	3	4	2		
16	13:00	F	13	12	10	9	11	11	Language developing slowly	
17	13:07	M	-	-	-	1	5	6		
18	14:10	M	-	-	-	1	2	5		
19	13:01	M	-	-	-	6	7	5		
20	14:05	M	-	-	-	4	2	8		
21	14:00	F	5	8	8	7	12	7	Doesn't understand others	
22*	13:10	F	-	-	-	1	3	7		
23*	13:01	M	-	-	-	9	12	10		
24	15:05	F	-	-	-	4	1	8		
25*	12:03	M	-	-	-	1	1	5		
26*	12:02	M	-	-	-	5	5	9		
27	12:06	M	-	-	-	2	3	7		
28	12:07	M	-	-	-	1	3	6		
29	12:00	F	-	-	-	1	4	4		
30	12:06	F	-	-	-	1	4	8		
31	12:08	M	-	-	-	4	6	7		

Note. Scaled scores are presented. Norms: $M = 10$, $SD = 3$. Participant 18 was excluded due to exceeding the 2 SD cut-off for the Block Design subtest. * indicates participants excluded due to exceeding the cut-off on the AQ.

Table 2. Language profile of Typical Language Developed (TLD) Group.

Parent Report		Standardised Tests									
History of speech/lang. problems? SLT?	Block Design	Word Class Receptive	Recalling Sentences	CC-SR Social Engagement	CC-SR Pragmatic Skills	CC-SR Language Structure	Sex	Age (Yrs: Mths)	Participant		
	14	11	16	16	14	15	M	13:06	1	13:06	1
	11	14	11	14	14	14	M	12:08	2	12:08	2
	14	16	14	14	11	14	F	14:08	3	14:08	3
	14	15	9	13	11	14	M	13:07	4	13:07	4
	16	14	11	15	14	17	M	17:09	5	17:09	5
	11	12	10	9	8	12	M	13:08	6	13:08	6
	12	14	10	10	10	9	M	13:04	7	13:04	7
	11	12	6	11	10	13	F	14:05	8	14:05	8
	12	13	10	10	11	11	M	11:04	9	11:04	9
	15	12	10	13	16	14	M	11:01	10	11:01	10
	11	17	11	14	16	12	F	11:01	11	11:01	11
	8	11	9	4	8	10	M	13:01	12	13:01	12
	12	12	15	7	10	9	F	13:03	13*	13:03	13
	12	14	8	10	12	10	M	14:02	14	14:02	14
	10	14	8	16	17	15	F	13:08	15	13:08	15
	10	14	5	14	10	9	F	14:02	16	14:02	16
	14	14	14	11	12	13	F	13:04	17	13:04	17
	8	12	6	14	17	17	M	14:03	18	14:03	18
	10	12	14	14	14	11	M	14:09	19	14:09	19
	14	16	15	14	12	17	M	12:09	20	12:09	20
	12	8	5	9	6	7	M	14:05	21	14:05	21
	13	14	12	13	15	12	F	14:10	22	14:10	22
	13	14	10	11	9	6	F	15:00	23	15:00	23
	12	14	11	14	15	14	M	12:11	24	12:11	24
	11	11	10	11	11	11	M	12:02	25	12:02	25
	14	15	14	5	17	13	F	11:09	26	11:09	26
	16	16	15	14	12	17	F	12:05	27	12:05	27
	13	8	5	14	12	11	M	12:09	28	12:09	28

Note. Scaled scores are presented. Norms: $M = 10, SD = 3$. * indicates participants excluded due to exceeding the cut-off on the AQ.

Appendix D.
Information sheets for teachers and speech and language therapists



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To whom it may concern,

Invitation to contribute to research

I am writing to request your help with the recruitment of participants for a project investigating the relationship between language ability, social skills and well-being in adolescents.

Aim of the project

Young people with a history of Developmental Language Disorder (DLD; previously known as Specific Language Impairment (SLI)) are at an increased risk for feelings of anxiety or depression, but it is unclear how this relationship develops. My PhD aims to investigate the mediating effect of social functioning on this relationship.

What will be involved?

The only commitment required of your school would be to pass along recruitment packs to any adolescents (11-18 years old) with a history of language difficulties (DLD/SLI). Unfortunately, children with a diagnosis of autism, hearing impairment or intellectual disability are excluded. Parents will complete a short questionnaire and students will complete a 1.5 hour assessment for which they are rewarded £15 upon completion.

Completely confidential

- Students will be under no obligation to take part in the study and I will only know their names if they contact me to participate.
- All information will be kept completely confidential and no names will be published.
- All researchers on this project have an Enhanced Disclosure and Barring Service (DBS) certificate which can be viewed on request.
- This project is being conducted under the supervision of Dr Michelle St Clair and has been approved by the University of Bath's Department of Psychology Research Ethics Committee (Reference: 15-245).

In return for your help I am happy to share my findings with you, and/or present on any topics you feel may be beneficial to your students (e.g. mental health, psychology, developmental disorders, university, etc.).

I will be in touch to follow up but if you have any questions, please do not hesitate to ask.

Yours faithfully,

Claire Forrest
PhD Researcher
University of Bath
Email: bathlangstudy@bath.ac.uk
Tel: 01225 38 6976

Appendix E. Recruitment flyer



UNIVERSITY OF
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How does language affect wellbeing in adolescents?



Why are we doing this research?

Language comes more easily to some people than others. Those who struggle with language may also have difficulty with socialising. We are interested in the relationship between language, social skills and wellbeing in adolescents with and without a language difficulty.

What is involved?

- ❖ 1st stage - Short, online questionnaires for adolescent and parent/caregiver (approx. 15 mins)
- ❖ 2nd stage - Language tasks, questionnaires and computer tasks for adolescent* (1.5hr)

*If invited to participate in the 2nd stage you will receive **£15 cash** on completion!

Who is eligible?

- ❖ Native English speakers
- ❖ Aged **11-18** years
- ❖ **No** hearing impairment, autism or intellectual disability
- ❖ **With or without** a language difficulty (e.g. Specific Language Impairment, Mixed Expressive/Receptive Language Disorder)



Please contact Claire Forrest at bathlangstudy@bath.ac.uk for a link to the questionnaire (Ethics Reference: 15-245).

bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk	bathlangstudy@bath.ac.uk
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Appendix F. Information sheets for parents and participants – direct recruitment



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psychology-enquiries@bath.ac.uk
www.bath.ac.uk/psychology

Dear parent/guardian,

Invitation to contribute to research

I am writing to invite you and your child to participate in a research project investigating the relationships between language ability, social skills and well-being. This research is being conducted from the Department of Psychology at the University of Bath and will form a part of my PhD.

The aim of the research

By conducting this study, we hope to shed light on how difficulties with language may influence how adolescents interpret social situations. This will help us gain a better understanding of why young people with language difficulties sometimes, but not always, also have difficulties in socialisation.

What will be involved?

You have been identified as being eligible for this study by your child's learning support teacher, but participation is entirely optional. You will be asked to fill in a short family history and a questionnaire about your child's strengths, difficulties and behaviours. Your child will be asked to complete some short questionnaires, a brief assessment of language and cognitive abilities as well as computer tasks to assess how they interpret social situations. They will have the opportunity to take breaks but all the tasks should take no longer than 90 minutes. Testing can be carried out at the University, at home or at your child's school (where possible).

Reward for participating

Your child will be paid £15 for completing the assessments and any travel expenses will be reimbursed. As well as this, we can provide some feedback which may help you better understand your child's unique profile of strengths and weaknesses. We will also be sending around brief updates on the studies' main findings.

Completely confidential

All information will be kept completely confidential and no names will be published. All researchers involved have an Enhanced Disclosure and Barring Service (DBS) certificate which can be viewed on request. This project is being conducted under the supervision of Dr Michelle St Clair and has been approved by the University of Bath's Department of Psychology Research Ethics Committee (Reference: 15-245).

How to register

Please complete the forms and return in the freepost envelope. Alternatively, you can email bathlangstudy@bath.ac.uk and I can send links to the online questionnaires. If you would like more information, please do not hesitate to contact me or my supervisor, Dr Michelle St Clair, M.C.St.Clair@bath.ac.uk.

Yours faithfully,
Claire Forrest



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psychology-enquiries@bath.ac.uk
www.bath.ac.uk/psychology

Dear Participant,

Invitation to contribute to research

You are invited to be a part of a research project looking at how language ability, social skills and well-being are related to each other.

The aim of the research

By doing this research, we hope to understand how difficulties in language ability influence how you perceive yourself and also how you behave in social situations. This will help us better understand the difficulties that young people with language problems may face and how best to help them.

What will be involved?

Your parent/guardian will fill in short questions regarding your family history of learning difficulties and mental health issues, as well as some additional questions regarding your childhood. You'll be asked to do a series of tasks, including looking at how well you can use language and how well you can understand language. We will also be doing some computer tasks, which will look at what you think about different social situations. We'll also go through some questions about how you've been feeling lately. You'll be able to take breaks when you need, but all the tasks should take 90 minutes in total.

Reward for participating

You will earn £15 for completing the assessments. If you have travelled to the University, we'll also cover that cost.

Completely confidential

All information will be kept completely confidential or secret and your answers will not be linked with your name. All researchers on this project have an Enhanced Disclosure and Barring Service (DBS) certificate which can be viewed on request. This project is being conducted under the supervision of Dr Michelle St Clair and has been approved by the University of Bath's Department of Psychology Research Ethics Committee (Reference: 15-245).

For more information

If you have any questions, you can email bathlangstudy@bath.ac.uk.

Yours faithfully,

Claire Forrest
PhD Researcher

Appendix G.
Information sheets for parents and participants – screening recruitment



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Dear Parent/Guardian,

Invitation to contribute to research

You and your child are invited to participate in a research project that will form part of a PhD at the University of Bath. This project is investigating the relationship between language ability, social skills and well-being.

The aim of the research

By conducting this study we hope to understand how strengths and weaknesses in language ability influence how adolescents perceive themselves and behave in social situations. This will help us gain a better understanding of the difficulties that young people with weaknesses in language may face.

What will be involved?

Initially, you will fill in a short questionnaire regarding your child's developmental history as well as some questions regarding your child's strengths and difficulties. Your child will be asked to fill in a questionnaire regarding their communication abilities. After completing these initial screening questionnaires, you and your child may be contacted for the main testing stage. However, you are under no obligation to participate in future studies and you and your child are free to withdraw from the study at any time.

Reward for participating

In return for your helpful contribution to this research project, you will be entered into a prize draw to win £50 of vouchers. If invited to participate in the further study, your child will be paid £15 upon completion of testing and any travel expenses will be reimbursed.

Completely confidential

All information will be kept completely confidential and no names will be published. All researchers on this project have an Enhanced Disclosure and Barring Service (DBS) certificate which can be viewed on request. This project is being conducted under the supervision of Dr Michelle St Clair and has been approved by the University of Bath's Department of Psychology Research Ethics Committee (Reference: 15-245).

For more information

If you would like more information, please do not hesitate to contact us directly at bathlangstudy@bath.ac.uk. Or to take part in the study, please continue.

Yours faithfully,
Claire Forrest
PhD student



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Dear Participant,

Invitation to contribute to research

You are invited to take part in a research project looking at how language ability, social skills and well-being are related to each other.

The aim of the research

By doing this research, we hope to understand how strengths and weaknesses in language ability influence how you perceive yourself and also how you behave in social situations. This will help us better understand the difficulties that young people with language problems may face and how best to help them.

What will be involved?

Initially, your parent/guardian will fill in a short questionnaire regarding your childhood history (when you started to talk, and things like that) as well as some questions regarding your strengths and difficulties. You'll need to fill in a questionnaire regarding your own communication abilities, which should take less than 20 minutes. After completing this initial questionnaire, you may be contacted for a longer study. However, you are under no obligation to participate in future studies and you are free to withdraw from the study at any time.

Reward for participating In return for your helpful contribution to this research project, you and your parent will be entered into a prize draw to win £50 of vouchers. If invited to participate in the further study, you will be paid £15 upon completion of the tasks and any travel expenses will be reimbursed.

Completely confidential All information will be kept completely confidential or secret and no one will know which answers you filled in. All researchers on this project have an Enhanced Disclosure and Barring Service (DBS) certificate which can be viewed on request.

For more information If you would like more information, please do not hesitate to contact us directly at bathlangstudy@bath.ac.uk. Or to take part in the study, please continue.

Thanks very much,
Claire Forrest
PhD Student

Appendix H. Consent forms for parents and participants



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Email

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Dear parent/caregiver,

After reading this project summary please complete the consent form and questionnaires.

Summary of the project:

- Your child is invited to take part in a project that aims to understand the link between language ability, social skills and well-being.
- You will be asked to fill in a short questionnaire regarding any family history of learning disabilities or mental health problems as well as additional information regarding your child's developmental history. You will also be asked to fill in a questionnaire about your child's strengths and difficulties.
- Your child will be administered tasks to assess their receptive and expressive language skills as well as general cognitive ability. They will then complete computer tasks to assess their social functioning and answer questionnaires about their well-being and friendships.

Contact: If you require any further information or have any questions about this study, please do not hesitate to contact us at bathlangstudy@bath.ac.uk. Alternatively, our supervisor Dr Michelle St Clair can be contacted at: Address: Dr Michelle St Clair, Department of Psychology, University of Bath, BA2 7AY.

Phone: 01225 384393

E-mail: m.c.st.clair@bath.ac.uk

Declaration of parental consent. Please read each statement carefully and tick if you agree.

	Please tick
I confirm that I have read and understood the project summary and have had an opportunity to ask any questions	<input type="radio"/>
I confirm that I understand my child's information will be kept strictly confidential	<input type="radio"/>
I confirm that I consent to having an audio recording made of my child's responses to selected tasks. I understand that this is for research purposes only	<input type="radio"/>
I understand that participation is completely voluntary and my child and myself are free to withdraw from the project at any time, without giving a reason	<input type="radio"/>
I agree that my anonymous data and my child's anonymous data can be used in this project and future research projects	<input type="radio"/>
I agree to give consent for my child to take part in the project	<input type="radio"/>
I agree to consent to take part in the project	<input type="radio"/>

Child's name:

Child's gender:

Male

Female

Child's date of birth (DD/MM/YYYY):

Parent/Guardian's relationship to child:

Mother

Father

Stepmother

Stepfather

Other (Please specify) _____

Email address:

Phone number:



Department of
Psychology



UNIVERSITY OF
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Dear participant,

After reading this project summary, please complete the assent form on the following page.

Summary of the project:

- You are invited to take part in a project that aims to understand the link between language ability, social skills and well-being.
- You will be administered tasks to look at how you understand and use language and will answer questionnaires about friendships and how you've been feeling lately. Then you will be asked to complete some computer tasks to see what you think about different social situations.

Contact: If you require any further information or have any questions about this study, please do not hesitate to contact me at bathlangstudy@bath.ac.uk. Alternatively, my supervisor Dr Michelle St Clair can be contacted at:

Address: Department of Psychology, University of Bath, BA2 7AY

Phone: 01225 384393

E-mail: m.c.st.clair@bath.ac.uk

Declaration of participant assent. Please read each statement carefully and tick if you agree.

	Please tick
I confirm that I have read and understood the information letter and have had the opportunity to ask any questions	<input type="radio"/>
I confirm that I understand that my information will be kept strictly confidential	<input type="radio"/>
I confirm that I consent to having an audio recording made of my responses to selected tests. I understand that this is for research purposes only	<input type="radio"/>
I agree that my anonymous data can be used in this project and in future research	<input type="radio"/>
I understand that participation is completely voluntary and I am free to withdraw from the project at any time, without giving a reason	<input type="radio"/>
I agree to take part in this study	<input type="radio"/>

Name:

Gender:

Male

Female

Date of birth (DD/MM/YYYY):

Email address:

Thank you! Please let the researcher know you have completed the forms and are ready to begin the tasks.

Appendix I.
Background questionnaire for parents



Developmental History Time the child reached motor developmental milestones (crawl/walk):

- Delayed
- Typical
- Fast

Time the child reached speech and language developmental milestones:

- Delayed
- Typical
- Fast

Time the child reached self-help developmental milestones (toilet/dress self):

- Delayed
- Typical
- Fast

Does the child have a history of speech-language problems (suspected or diagnosed)?

- No
- Yes - Stuttering
- Yes - Pronounces words poorly
- Yes - Language developing slowly
- Yes - Doesn't understand others

Has the child ever received speech and language therapy?

- No
- Yes

Please specify why your child received speech and language therapy:

- For speech problems
- For language problems

Please specify dates of speech and language therapy:

- Early years (not currently receiving speech and language therapy)
- Recently received speech and language therapy (not currently receiving speech and language therapy)
- Currently receiving speech and language therapy

Does the child have a history of learning difficulties (suspected or diagnosed)? Please give details.

- No
- Yes - Autism
- Yes - Dyslexia
- Yes - Specific Language Impairment
- Yes - Other _____

Language(s) spoken at home?

- English only
- English plus another language (please specify)

- Another language only (please specify)

Family history Does the child live with biological parents? If no, please give details.

- Yes
- No _____

Are the child's parents married/separated/divorced?

- Married/Cohabiting/Civil Partnership
- Separated
- Divorced

Parent/Guardian's education level:

- Secondary school
- Diploma
- Undergraduate degree
- Postgraduate degree

Parent/Guardian's occupation:

Ages of sibling(s), if any?

Family health history Is there a history of mental health problems (suspected or diagnosed) in the family? Please give details of type of problem and type of family member only (e.g., father, brother).

Is there a history of learning difficulties (suspected or diagnosed) in the family? Please give details.

- No
- Yes - Autism
- Yes - Dyslexia
- Yes - Specific Language Impairment
- Yes - Other _____

Academic history Does the child have an individualised education plan (IEP) or receive extra help outside of school? If yes, please give details.

No

Yes _____

Physical/mental health history Has the child ever seen a psychologist/counsellor?

No

Yes, used to

Yes, currently

Does the child currently take psychiatric medication? If yes, please give details.

No

Yes _____

Does the child currently take any other medication? If yes, please give details.

No

Yes _____

Appendix J.
Social functioning questionnaire for participants



Name:

D.O.B. (DD/MM/YYYY):

Gender:

- Male
- Female

Do you have a best friend?

- Yes
- No

Have you ever had a boyfriend or girlfriend?

- Yes
- No

Are you a member of any clubs? (E.g. sports, social, dancing, etc.).

- Yes
- No

Please give details of the clubs you belong to:

Do you have any other hobbies that you do with friends? (I.e. not as part of an organised club)

Yes

No

Please give details of the hobbies that you partake with friends:

	All of them	Most of them	Some of them	None of them	Don't have any friends
How many of your friends live in the same area as you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many of your friends go to a different school than you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Are your friends mostly boys, mostly girls or a mixture of boys and girls?

- Mostly boys
- Mostly girls
- A mixture of boys and girls
- Don't have any friends

	Most days	At least once a week	At least once a month	Less often than once a month	Never	Don't have any friends
How often do you argue or fall out with your friends?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When you are not at school, how often do you spend time with your friends?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

At the weekend how often do you spend time with your friends, but without adults or older children, doing things like playing in the park, going to the shops or just 'hanging out'?

- Most weekends
- At least once a month
- Less often than once a month
- Never
- Don't have any friends

In the afternoon after school how often do you spend time with your friends, but without adults or older children, doing things like playing in the park, going to the shops or just ‘hanging out’?

- Most days
- At least once a week
- At least once a month
- Less often than once a month
- Never
- Don't have any friends

	Most days	About once a week	About once a month	Every few months	Less often	Never
How often do other children hurt you or pick on you on purpose?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often do you hurt or pick on other children on purpose?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix K. Debrief sheets for parents and participants



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Thank you for taking part in this study. This study is evaluating the relationship between language ability, social skills and well-being. It has been suggested that children with developmental language disorders are at a greater risk of experiencing mental health difficulties in adolescence and adulthood. However, the mechanisms behind this increased risk are currently unknown. This research will gather information about how adolescents with weaknesses in different areas of language (e.g. expressing themselves and understanding others) feel about themselves and others.

Your child has completed tasks that will help us establish whether they have a different way of viewing social situations which might relate to poorer mental well-being and higher rates of mental health problems over time. We aim to determine whether this is due to language difficulties or their related social difficulties, which will help us develop strategies and interventions to help improve the social skills and well-being of young people with language impairments.

If you require any further information please do not hesitate to contact me: bathlangstudy@bath.ac.uk or my supervisor, Dr Michelle St Clair, M.C.St.Clair@bath.ac.uk

Yours faithfully,
Claire Forrest

Email: bathlangstudy@bath.ac.uk
Phone: 01225 386976
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Thank you for taking part in this study. This study is evaluating the relationship between language ability, social skills and well-being. Some children seem to have more problems using and learning language than other children. Children with lower language skills have been shown to be at a greater risk for feeling down or low and have problems getting along with their peers. However, we don't really know why this is the case. This research will help to answer this question and figure out how best to help children with language difficulties achieve better outcomes.

You have completed tasks that will help us figure out whether children with difficulties in language have a different way of viewing social situations, which may be a reason why they sometimes feel depressed or have trouble with their peers. We hope to find out if this is due to their language problems or whether it's more associated with their ability to get along with other people. This might help us figure out how to best help improve the social skills and well-being of young people with language impairments.

If you require any further information please do not hesitate to contact me:
bathlangstudy@bath.ac.uk or my supervisor, Dr Michelle St Clair,
M.C.St.Clair@bath.ac.uk.

Yours sincerely,

Claire Forrest

Email: bathlangstudy@bath.ac.uk
Phone: 01225 386976
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Bath, BA2 7AY

Appendix L.
Brief report for parents



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DD/MM/YYYY

Dear [Parent],

The following profile was generated from the tests and questionnaires administered to [child] on DD/MM/YYYY.

It should be noted that these tasks are just a snapshot of [child's] strengths and abilities and only reflect her performance on that particular day.

COGNITIVE AND LANGUAGE ABILITIES

The Block Design subtest from the Wechsler Intelligence Scale for Children – 4th Edition (WISC-IV) was administered to [child]. This assesses nonverbal fluid reasoning and the ability to mentally organise visual information. She also completed the Recalling Sentences and Word Classes subtests from the Clinical Evaluation of Language Fundamentals – 4th Edition (CELF-4). The Recalling Sentences subtest provides a measure of expressive language, while the Word Classes subtest provides a measure of receptive and expressive vocabulary.

Subtest	Scaled Score	Standard Score*
Block Design		
Recalling Sentences		
Word Classes – Receptive		
Word Classes – Expressive		
Word Classes - Total		

** Please note that these scores are generated from selected subtests and do not form a complete battery of cognitive testing. Therefore, they do not constitute a diagnosis.*

Scaled scores and standard scores enable data to be compared between different measures and provide a measurement of how well an individual performs in relation to their age group. The average scaled score is 10, while the average standard score is 100.

SOCIOEMOTIONAL PARENT REPORT

The Strengths and Difficulties Questionnaire (SDQ) was completed by [child's] mother. This screening questionnaire consists of 25 items measuring psychological attributes and provides an overview of how the parent perceives the child according to six different subscales, in comparison to population norms (aged 4-17 years). Scales range from *Close to average* to *Very high*.

Subscale	Score	Descriptor**
Emotional Problems		
Conduct Problems		
Hyperactivity		
Peer Problems		
Prosocial		
Total Difficulties		

** Please note that these scores provide a rough guide for screening of any difficulties, and should therefore be interpreted with caution. They do not constitute a diagnosis.

SOCIOEMOTIONAL SELF REPORTS

The following questionnaires were completed by [child].

Scale	Score***
Warwick Edinburgh Mental Wellbeing Scale (WEMWBS)	
Perceived Social Support – Friendship scale (PSS-Fr)	
Revised Children's Manifest Anxiety Scale (RCMAS)	
Moods and Feelings Questionnaire (MFQ)	
Social Anxiety Scale for Adolescents (SAS-A)	

***Please note these measures are scaled differently and should not be directly compared. Again, they are screening measures and not a formal diagnostic tool.

The WEMWBS measures mental wellbeing, which is distinct from mental health in that it focuses on positive states only. Participants rate the 14 statements on a scale of 1 “None of the time” to 5 “All of the time” according to how they felt in the past two weeks. Possible scores range from 14-70, therefore this suggests that [child] perceives herself to have a very good level of mental wellbeing.

The PSS-Fr measures how well [child] believes her support needs are met by her relationships with friends. Scores on this “yes/no” questionnaire range from 0-20, with an average score of 15.15. However, it should be noted that this average score has been calculated from a sample of Undergraduate students, therefore norms may be different for [child’s] age range.

The RCMAS measures feelings of anxiety. Participants rate how they have been feeling in the past two weeks on a scale of 0 ‘Never’ to 2 ‘Mostly’, with a possible score ranging from 0-56. Similarly, the MFQ measures depressive thoughts and feelings over the last two weeks, with a possible score ranging from 0-66. [Child] reported low scores on both of these scales, suggesting that she does not perceive herself to have strong feelings of anxiety or depression.

The SAS-A measures how [child] feels in social situations. Items are rated on a scale of 1 ‘Not at all’ to 5 ‘All the time’, with a score of 50 or more reflecting high feelings of social anxiety, while low-socially anxious individuals report a score of 36 or below. Therefore, [child] does not perceive herself to be socially anxious.

Thank you once again to you and [child] for your help with my study. Findings from the entire study will be delivered in a newsletter at a later date.

Yours sincerely,



Claire Forrest
PhD student
University of Bath
C.L.Forrest@bath.ac.uk

Appendix M. Dissemination flyer.

Bath Language Study

Claire Forrest, MSc
University of Bath
bathlangstudy@bath.ac.uk

Bath Language Study

Developmental Language Disorder (DLD)

- significant difficulty with receptive (understanding) or expressive (producing) language
- no known cause (i.e. no hearing impairment, intellectual disability, diagnosis of autism)
- affects approximately 7% of the population



Thank you for participating!

You, your child, or your student participated in my study investigating the relationships between language ability, social skills and wellbeing in adolescents. This leaflet provides some background to the project, describes what your child/student did and what results were found.

I am very grateful for your help. This study forms part of my PhD and will hopefully contribute to the wider research investigating the link between DLD and socioemotional difficulties.

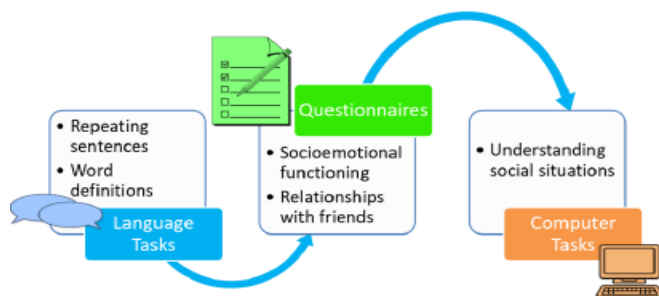
Background

Children with DLD are at greater risk of feelings of anxiety and depression compared to their typical language developing (TLD) peers, particularly in adolescence.

However, it is not clear exactly how this relationship develops. My project aimed to examine whether social difficulties, such as peer problems or social cognition deficits (difficulty understanding social cues) could explain the relationship.

Who participated?

26 participants in DLD group
27 participants in TLD group
19 🍂 34 🌱
13.5 average age in years



Social Outcomes

Has a best friend	85% of DLD group 63% of TLD group
Member of social club	65% of DLD group 96% of TLD group
Never been bullied	39% of DLD group 52% of TLD group

Parent reports of peer problems were **higher** for the DLD group but adolescents reported **no** problems

The DLD group had more difficulty understanding social cues in the computer tasks

- but these difficulties **did not** explain the increased rates of parent-reported peer and emotional problems

Emotional Outcomes

Parent reports of emotional problems were **higher** for the DLD group

Adolescents in both groups reported **similar** levels of wellbeing

Overall Findings


- Peer problems **explain** the relationship between DLD and emotional problems
 - Better friendships could act as a protective factor against emotional problems
- Parents report **more** problems than adolescents
 - Are parents over-reporting? Are adolescents under-reporting?
- These results need to be replicated with a **larger** sample



19th October DLD Awareness Day

Help spread the word!

- DLD is **7 times** more prevalent than autism but many people have not heard of it
- Can you tell at least 2 people about DLD on 19th October?
- Radld.org has stickers and information sheets to download

 Facebook – search RADLD to learn and share facts about DLD

 Twitter - follow @RADLDcam and search #DLDABC and #DevLangDis to get involved!

Further Information

<https://radld.org/>

www.naplic.org.uk/dld/

<http://blog.ican.org.uk/tag/radld/>

Appendix N.

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For use of the Social Adaptation Model (SAM) and the Social Deviance Model (SDM) taken from:

Redmond, S. M., & Rice, M. L. (1998). The socioemotional behaviors of children with SLI: Social Adaptation or Social Deviance? *Journal of Speech, Language and Hearing Research*, 41(3): 688-700

Re: Request for inclusion of figures in PhD thesis

Permissions Asha <Permissions@asha.org>

Tue 15/01/2019 21:12

To: Claire Forrest <clf38@bath.ac.uk>;

Dear Ms. Forrest:

Thank you for contacting ASHA. Permission is granted to reprint Figure 1. Social Adaptation Model and Figure 2. Social Deviance Model from

Journal of Speech, Language and Hearing Research, The socioemotional behaviors of children with SLI: Social Adaptation or Social Deviance?, 1998, 41(3):688-700.

in your forthcoming thesis. Please cite ASHA as the source and note that the figures have been reprinted with permission.

Best regards,

Libby

Libby Bauer

Director of Operations & Product Management

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For use of the Social Information Processing (SIP) model taken from:

Crick, N. R. & Dodge, K. A. 1994. A review and reformulation of Social Information Processing Mechanisms in Children's Social Adjustment. *Psychological Bulletin*. 115(1), 74-101.

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