Emotions and the psychosocial development of children with and without developmental langauge disorder

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Emotional competence mediates the relation between communication problems and reactive externalizing problems in children with and without Developmental Language Disorder: A longitudinal study.

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ABSTRACT

Language problems are a risk factor for externalizing problems in children, which relation may be mediated by problems in emotional competence, especially when externalizing problems are reactive in nature such as in Oppositional Deviant Disorder (ODD) or reactive aggression. In this longitudinal study we examined the development of externalizing problems (proactive and reactive aggression and ODD symptoms) in children with (n = 98) and without (n = 156) a formal diagnosis of Developmental Language Disorder (DLD; age: 8-16 years). We examined the relations between externalizing problems and children's communication problems (structural, pragmatic and problems communicating about emotions) and the mediating role of emotional competence (emotion recognition and anger dysregulation). Children and their parents participated three times over an 18-month period. Multilevel analyses revealed that problems in emotional competence are a risk factor for the development of reactive, but not for proactive externalizing problems. Increasing emotion recognition and decreasing anger dysregulation were longitudinally related to fewer ODD symptoms in both groups, whereas anger dysregulation related to reactive aggression in children with DLD alone. Pragmatic and emotion communication problems were related to more ODD symptoms, which relations were fully mediated by emotion recognition in both groups and by anger dysregulation in children with DLD. Moreover, anger dysregulation partially mediated the relation between communication problems and reactive aggression in children with DLD. Therefore, in addition to interventions for communication skills, there is a need to address the emotional competence of children with DLD, as this decreases the risk for reactive externalizing problems.

INTRODUCTION

Approximately two children in every classroom experience significant language problems which are not explained by other disorders (Norbury et al., 2016). These children are eligible for a diagnosis of developmental language disorder (DLD) (Bishop, Snowling, Thompson, Greenhalgh, & CATALISE consortium-2, 2017). Children with DLD experience difficulties expressing their own thoughts and wishes through language, and often have misunderstandings with others. These communication problems may cause frustration and negative affect, resulting in externalizing behavior problems, such as aggression or oppositional behavior. Indeed, higher levels of externalizing problems have been found in children with DLD (Lindsay, Dockrell, & Strand, 2007; Maggio et al., 2014; St. Clair, Pickles, Durkin, & Conti-Ramsden, 2011; Van Daal, Verhoeven, & Van Balkom, 2007). By corollary, children with severe externalizing problems also often have language problems, but these language problems go unnoticed in the majority of these children (Hollo, Wehby, Oliver, 2014). However, their language problems may have contributed to the development and maintenance of their externalizing problems (Cohen et al., 1998; Salmon, O'Kearney, Reese, & Fortune, 2016). Therefore, it is important to gain a better understanding of direct and indirect effects of language problems on the development of externalizing problems in order to help professionals recognize and target the underlying causes of these problems.

Language problems have a direct effect on externalizing problems (Chow & Wehby, 2018), but also play a fundamental role in the development of emotional competence, that is the ability to recognize, understand, regulate, and express emotions in an adaptive way in social interactions (Saarni, 1999; Salmon et al., 2016). Problems in emotional competence are in turn important risk factors for the development of externalizing problems (Crick & Dodge, 1996; Fernandez & Johnson, 2016). The current longitudinal study examined externalizing problems in children between 9 and 16 years old with and without a formal diagnosis of DLD. We examined direct factors (severity of communication problems) and indirect risk factors (problems in emotional competence) for the development of externalizing problems.

Externalizing problems in children with Developmental Language Disorder

DLD is a neuro-developmental disorder which causes a significant problem in language development and severe difficulties using language in daily live. Children with DLD often experience problems in the structural aspects of expressive language (e.g. word finding problems, or difficulty making grammatical sentences) and/or in the understanding of language (e.g. small lexicon, difficulty understanding complex phrases, or slow processing of language). Additionally, children often experience problems in the social use of language (the pragmatics), such as ordering information to tell a story and understanding jokes. The communication problems of children with DLD are not explained by other neuro-developmental disorders, hearing loss, or intellectual disabilities (American Psychiatry Association, 2013; Bishop et al., 2017). Language problems are often present form an early age and persist as children became

older (Conti-Ramsden, St Clair, Pickles, & Durkin, 2012). However, the language problems may also appear during middle school when the communicative demands of the environment increase (Poll & Miller, 2013; Snowling, Duff, Nash, & Hulme, 2016).

Communication problems often result in misunderstandings and frustration in social interactions, which may impede the social-emotional development of children with DLD (Hart, Fujiki, Brinton, & Hart, 2004). In children and adolescents with DLD, elevated levels of externalizing problems have been reported both by parents and teachers (Lindsay et al, 2007; Maggio et al., 2014; St. Clair et al., 2011; Timler, 2008; Van Daal et al., 2007), although problems are often not in the clinical range (Beitchman, Brownlie et al., 1996; Lindsay & Dockrell, & Strand, 2007; Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006; St. Clair et al., 2011). Two longitudinal studies found different developmental trajectories of externalizing problems in children with DLD (Lindsay & Dockrell, 2012; St. Clair et al., 2011). Both studies used teacher reports on the Strengths and Difficulties questionnaire (SDQ). Whereas one study found stable levels of externalizing problems from 10 to 12 years of age with increasing levels to the age of 16 (Lindsay & Dockrell, 2012), the other study found decreasing levels of externalizing problems in children and adolescents between the age of 7 and 16, resulting in norm like levels at the age of 16 (St. Clair et al., 2011). However, the adolescents of the latter study themselves reported higher levels of externalizing problems at the age of 16 compared to their peers without DLD on the self-report version of the SDQ (Conti-Ramsden, Mok, Pickels, & Durkin, 2013). The different patterns of results between the two studies may reflect the fact that various forms and functions of externalizing problems such as disobedience, lying, bullying, fighting and anger outbursts were not differentiated. Distinguishing between different forms and functions of externalizing problems may provide a clearer picture of the difficulties of children with DLD.

Distinguishing reactive and proactive externalizing problems in children with DLD

Externalizing problems can be categorized as reactive or proactive behaviors. Reactive externalizing problems have the goal to vent anger, or to harm other persons after provocation or goal thwarting. In contrast, proactive externalizing problems are typically not anger induced, but are more instrumental in nature, such as threatening or manipulating someone to gain something from that person or to gain social status (Crick & Dodge, 1996).

Reactive and proactive externalizing problems often co-occur in children, but different antecedents and developmental routes have been distinguished (Tremblay, 2010; Vitaro, Brendgen, & Tremblay, 2002). For instance, reactive externalizing problems are common in young children but show a sharp decrease between 2 and 4 years of age and decreases further during the primary school years (Tremblay, 2010). This decrease has been linked to improved abilities of emotion understanding and emotion regulation (Fields & Prinz, 1997). In contrast, proactive externalizing problems increase during the primary school years, which reflects the

growing ability of children to plan their actions and manipulate others, related to cognitive growth (Tremblay, 2010).

To date, only one small study (n = 12) examined reactive externalizing problems in children with DLD (Timler, 2008). The study found a trend towards more reactive aggressive reactions of children with DLD between 8 and 12 years old in reaction to hypothetical peer conflict situations compared to their peers without DLD. The teachers of these children also reported that children with DLD more often reacted angrily or aggressively when provoked by their peers.

Proactive aggression has not been examined in children with DLD to date. Some studies have examined rule-breaking, or delinquent behavior of children and adolescents with DLD, but found no differences between children with and without DLD (Maggio et al., 2014; Van Daal et al., 2007; Winstanley, Webb, & Conti-Ramsden, 2018). However, 19-year-olds with DLD reported more convictions than their peers without DLD (Brownlie et al., 2004), but the reasons for these convictions (reactive or proactive) were not described. Overall, children with DLD seem at risk for externalizing problems, but primarily for reactive types of externalizing problems.

Explaining externalizing problems in children with DLD

There is much variation within the group of children with DLD in the severity and developmental trajectories of externalizing problems. Previous studies examined the type and the severity of DLD to explain these individual differences. Although some associations have been found between externalizing problems and more severe pragmatic or expressive language problems (Beitchman, Wilson et al., 1996; St. Clair et al., 2011; Van Daal et al., 2007), other studies found no associations with the severity of expressive and receptive language problems (Conti-Ramsden et al., 2013; Lindsay & Dockrell, 2012; Maggio et al., 2014). Therefore, other factors are likely to play a mediating role. One possibility is that the language problems of children with DLD impede the development of emotional competence which in turn affects the development of externalizing problems, making children with DLD prone to angry, or reactive aggressive behavior. In young children form community samples, the relation between language problems and externalizing problems is mediated by children's emotional competence (Salmon et al., 2016). To date, studies in older samples and in children with clinical levels of language problems are lacking.

Emotional competence in children with DLD

Language is an important prerequisite for the development of emotional competence (Saarni, 1999; Salmon et al., 2016). Emotional competence develops through interaction with the social environment. People learn to recognize, understand, and negotiate each other's wishes through mutual expression of knowledge, wishes and ideas, in which language plays an important role (Dunn, Brown, & Beardsell, 1991; Saarni, 1999). For children with DLD, this

development may be hampered because they experience difficulties understanding the comments and explanations of others, and have difficulty expressing their own ideas and wishes. Moreover, the emotion lexicon of children with DLD is typically smaller compared to their peers (Bakopoulou & Dockrell, 2016). These communication problems have a negative effect on both the quality and the quantity of the social interactions of children with DLD, which may impede their emotional competence development (Andrés-Roqueta, Adrian, Clemente, & Villanueva, 2016; Van den Bedem, Willems, Dockrell, Van Alphen, & Rieffe, 2019; Yuill & Little, 2018). Indeed, children and adolescents experience more difficulties recognizing their own and other's emotions, have difficulties to regulate their emotions, and experience difficulties to communicate about their own emotions (Bakopoulou & Dockrell, 2016; Fujiki, Spackman, Brinton, & Hall, 2004; Van den Bedem et al., 2019; Yuill & Little, 2018).

Problems in emotional competence in turn are important risk factors for the development of externalizing problems (Fernandez & Johnson, 2016). Children who have difficulty regulating their negative emotions, especially anger, can become more irritable and externalize their feelings when provoked (De Castro, Merk, Koops, Veerman, & Bosch, 2005; Rolfh, Holl, Kirsch, Krahé, & Elsner, 2018). Additionally, children who have difficulty recognizing and understanding others´ intentions and emotions, may interpret social interactions as hostile, resulting in more reactive aggressive or oppositional reactions (Crick & Dodge, 1996; De Castro et al., 2005).

Proactive aggression is typically not related to anger dysregulation, as children are thought not to act out of spite or frustration, but rather act in a calculative manner (Crick & Dodge, 1996; Rolfh, Busching, & Krahé, 2017). Nevertheless, when children experience problems in expressing their emotions orally, this may also lead to more proactive aggression. Children who lack skills to communicate about their own emotions may use more behavioral strategies to show others what they want and feel, resulting in more acts of aggression (De Paula & Befi-Lopes, 2013; Fields & Prinz, 1997; Gallagher, 1999).

Present study

Overall, previous studies suggest that externalizing problems are more prevalent in children and adolescents with DLD, although different studies provide mixed results. However, these studies did not differentiate different intentional and more uncontrolled reactive behaviors (Tremblay, 2010). Distinguishing these different externalizing problems may provide a clearer picture of the externalizing problems in children and adolescents with DLD. Therefore, the first aim of the current study was to examine longitudinally reactive (oppositional behavior and reactive aggression) and proactive externalizing problems (proactive aggression) of children with and without DLD between 8 and 16 years old across an 18-month period. We expected more reactive externalizing problems in children with DLD (Timler, 2008), but no differences in proactive problems (Maggio et al., 2014; Van Daal et al., 2007; Winstanley et al., 2018).

The second aim of the study was to examine longitudinally whether emotional competence could explain individual differences in externalizing problems across time. We expected that lower levels of emotional competence would be related to less reactive externalizing problems (De Castro et al., 2005; Rolfh et al., 2018), but not to reduced proactive problems (Crick & Dodge, 1996; Rolfh et al., 2017). Additionally, we expected increasing levels of emotional competence across time to be related to decreasing levels of reactive externalizing within individuals (Fields & Prinz, 1997). Further, we explored whether the strengths of these relations were similar in children with and without DLD. As children with DLD have more difficulties developing their emotional competence, this may be a stronger risk factor for externalizing problems in these children.

The third aim of the study was to examine whether problems in emotional competence mediated the relation between the severity of communication problems and externalizing problems in children with and without DLD. Because previous studies examining the relationships between communication problems and externalizing problems had mixed results, we distinguished between different types of communication problems (St. Clair et al., 2011; Lindsay & Dockrell, 2012; Maggio et al., 2014). We examined relations with structural and pragmatic communication problems, but also specifically whether children had difficulties communicating about their own emotions with others (emotion communication problems; Way et al., 2010). We expected that communication problems would relate to more reactive externalizing problems, but that these relations would be mediated by problems in emotional competence (Figure 1; Fields & Prinz, 1997; Salmon et al., 2016). Additionally, we expected more proactive aggression in children with more communication problems (De Paula & Befi-Lopes, 2013; Fields & Prinz, 1997; Gallagher, 1999), but did not expect that emotional competence mediated this relation (Crick & Dodge, 1996; Rolfh et al., 2017).

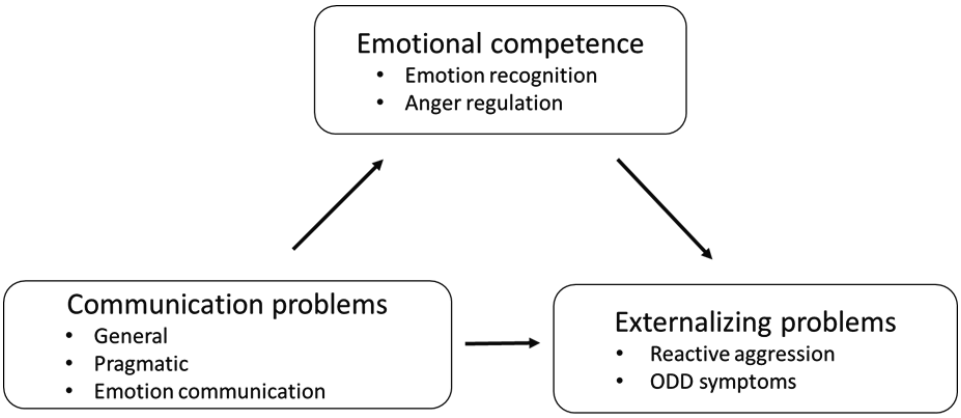

Figure 1. Emotional competence as mediator between communication problems and reactive externalizing problems

METHOD

Design

The present study is part of a larger study on the social-emotional development of children with DLD (Van den Bedem et al., 2019). Children with and without DLD and their parents filled out questionnaires at three time points across 18 months. Children reported on their reactive and proactive aggression, while parents reported on oppositional behavior and emotional competence of their child. Additionally, parents reported on the communication problems of their child at one time point. In the current study, we only reported on children for whom parent reports were available.

Participants

A total of 254 children between 8 and 16 years old participated in the study, of whom 98 children had DLD. Children with DLD were included in the study when they had a formal diagnosis of DLD and no diagnosis of autism spectrum disorder or hearing loss. Most children with DLD attended specialized schools for children with communication problems (72.4%), where they received education in small class rooms with extra support for their language development and more visual support. The other children with DLD attended mainstream schools with specialized help within their schools (27.6%). Children typically have a counsellor who regularly visits the school to advise the teacher and support the child in school work and social issues.

Table 1 Characteristics of participants at Time 1 for children with and without DLD

	With DLD	Without DLD
Number of children - *n*	98	156
Male	47 (48.0%)	68 (43.6%)
Female	51 (52.0%)	88 (56.4%)
Mean Age in years (*SD*)	11.5 (1.1)	11.6 (1.4)
Age range in years, months	9.2–16.3	9.8–15.4
Neighborhood SES***	.00 (1.10)	.66 (1.12)
Range neighborhood SES	-4.19–2.50	-5.24–2.44
PIQ – *n*	92	146
PIQ***	93.8 (13.1)	109.4 (17.1)
Range PIQ	70–140	78–140

Note. The neighborhood SES of the participating parents is determined by the mean level of education, occupation, and income of all adults of a neighborhood compared to the other neighborhoods in the Netherlands ($M = 0.28$, $SD = 1.09$, Range = -6.8 to 3.1); ***$p < .001$

Children without DLD were included when they did not have any diagnosis as indicated by their parents and when their language abilities and performance IQ (PIQ) were within the normal range (95% Confidence Interval of a score of 85 or higher) as tested with two subtests of the Dutch version of the Clinical Evaluation of Language Fundamentals (Kort, Schittekatte, & Compaan, 2008) and two subtests of the Wechsler Intelligence Scale for Children (WISC; Kort et al., 2005).

The groups with and without DLD were comparable in age ($t(160.05) = .27$, $p = .801$) and gender distribution ($X^2(1) = .405$, $p = .604$). Children with DLD had a lower PIQ than their peers without DLD ($t(228.28) = 7.91$, $p < .001$), and lived in neighborhoods with a lower socio-economic status as indicated by their postal code ($t(251) = 4.57$, $p < .001$) (Table 1). Therefore, these variables were controlled in the analyses.

Materials

Externalizing problems were measured with the oppositional-defiant disorder (ODD) scale of the Child Symptom Inventory (CSI; Gadow & Sprafkin, 2002), which measures whether the child often argues with the parent, becomes angry easily, blames others when something goes wrong, and wants to take revenge. Parents indicated on a 4-point Likert scale how often the behavior occurred. Additionally, children reported on their reactive and proactive aggressive behavior using the Instrument for Reactive and Proactive Aggression Self-report (IRPA; Rieffe et al., 2016). Children were presented with five different aggressive behaviors (hitting, pushing, kicking, scolding, or picking a fight) with three reactive reasons: because I was mad, because I was being bullied, or because I was scolded at, and three proactive reasons: because I wanted to be mean, because I thought it was fun, or because I wanted to be the boss. Children reported for each reason whether they had performed the aggressive act (almost) never (1), sometimes (2), or often (3). If children did not perform the aggressive act, they reported never on every question. The validity and reliability of the CSI and the IRPA are good (Gadow & Sprafkin, 2002; Rieffe et al., 2016), as was the reliability in our study for children with and without DLD ($\alpha > .79$; Table 2). Mean scores were obtained for all scales.

Emotional competence was measured with the Emotion Expression Questionnaire (Rieffe, Ketelaar, & Wiefferink, 2010). Parents indicated how often their child correctly recognized the emotions of others (emotion recognition), and how often, how long and how strongly children expressed their anger (anger dysregulation) on a 5-point Likert scale. Both scales have acceptable reliability ($\alpha > .72$; Rieffe et al., 2010), as was found in our study for children with and without DLD ($\alpha > .75$; Table 2). Mean scores were obtained for both scales.

Communication problems were measured with the Child Communication Checklist-second edition (Geurts et al., 2009; Norbury et al., 2004). Parents rated how often their child experiences problems in four structural language areas (speech, syntax, semantics, and coherence) and four pragmatic language areas (initiation of conversations, non-verbal communication, use of context, and stereotypical language use). The sum of the final four scales

gives the pragmatic problems scale, while all scales combined give an indication of the severity of the general communication problems of a child. Standardized scores are available for the Dutch population. The general and pragmatic scales are reliable in children with and without DLD, as was found in our study ($\alpha > .83$; Table 2). However, the separate structural scales are not reliable in children without DLD (Geurts et al., 2009) and were only examined in children with DLD. There were missing data for six children with DLD and 13 children without DLD, due to non-response of the parents or invalid filled-out questionnaires. These children were excluded from the analyses where the CCC-2 was used.

Table 2 Psychometric properties of the questionnaires.

	Range	N items	α Time 1		Grand Means (*SD*)	
			With DLD	Without DLD	With DLD	Without DLD
Externalizing problems						
ODD symptoms	1-4	8	.89	.79	1.76 (.49)	1.65 (.34)
Reactive aggression	1-3	15	.96	.89	1.33 (.40)	1.28 (.24)
Proactive aggression	1-3	15	.91	.91	1.09 (.17)	1.04 (.07)
Emotional competence						
Emotion recognition	1-5	6	.75	.75	3.77 (.56)	4.08 (.53)
Anger dysregulation	1-5	4	.81	.75	2.45 (.74)	2.30 (.56)
Communication problems						
Emotion	1-4	14	.91	.91	2.03 (.58)	1.43 (.42)
General	53-157	56	.83	.87	115.52 (13.65)	73.33 (15.01)
Pragmatic	24-78	28	.83	.79	54.92 (7.46)	35.97 (7.94)
Speech	8 - 24	7	.75		16.10 (3.54)	
Syntax	7 - 20	7	.59		15.29 (2.48)	
Semantics	5 - 18	7	.69		14.21 (1.74)	
Coherence	6 - 20	7	.80		15.00 (2.38)	

Note. N communication problems: Emotion: DLD = 87, without DLD = 151; general and pragmatic: DLD = 92, without DLD = 142.

Additionally, we examined problems children experience when communicating about emotions with the Children Alexthymia Meassure (CAM; Way et al., 2010). Parents rated whether their child had difficulties to communicate about their own emotions, deflected

attempts to talk about emotions, or said that they were fine while they seemed not. Parents reported on a 4-point Likert scale how often problems occurred. As in the validation study (Way et al., 2010), good reliability was found for both groups ($\alpha > .91$; Table 2). Mean scores were obtained. There were missing data for 11 children with DLD and four children without DLD due to non-response of the parents. These children were excluded from the analyses where the CAM was used.

When data were not available from school or medical files, PIQ was measured with two subtests of the WISC (Kort et al., 2005), namely block design and picture arrangement. Eight children with DLD and all children without DLD were tested during the second assessment point. Data were missing for six children with DLD and ten children without DLD due to attrition, or because we did not obtain permission of the parents to test the PIQ.

Procedure

Children with and without DLD were invited to participate in the study through their schools, and through organizations, that help children with DLD in regular education. An active consent procedure was used. Parents reported on the diagnosis of their children, which was verified for the children with DLD in their school or medical files. The study received approval from the ethical committee of Leiden University in the Netherlands.

Children were tested in a quiet room by a test leader who had received an extensive training. We used a detailed protocol for the test session in order to provide the same instructions to participants. At the start of the test session it was stressed that there were no right or wrong answers and that answers were anonymous. Participants could read the questions and answer options on a laptop or tablet. For children with DLD, everything was also read aloud. Children could privately answer the questions by clicking on one of the answer options. Parents filled out anonymized questionnaires about their child on paper or via the internet. The externalizing problems and emotional competence scales were filled out three times, whereas the communication problems and PIQ were measured once during the second measurement.

RESULTS

Group differences

Our first aim was to examine the mean level and development of different externalizing problems of children with and without DLD. We fitted multi-level models using R.3.3.2 (R Development Core Team, 2016) to account for the dependency in the longitudinal data. First, we fitted a basic means model and entered age and control variables (gender, SES, and PIQ) one at the time. Control variables were only kept in the model when they provided a better model fit (as indicated by a significantly lower Akaike's Information Criterion [AIC]). Next, in order to compare the mean levels of externalizing problems of children with and without DLD, diagnosis was added to the model. Additionally, we added the diagnosis x age interaction in order to compare the mean levels of both groups across time.

Table 2 shows the grand means of all study variables. The self-reported levels of aggression and the parent-reported ODD symptoms were generally low in both groups. Approximately half of the children with and without DLD never reported a proactive act of aggression. Reactive aggression and ODD symptoms showed a more diverse distribution, but were positively skewed. Therefore, we used a bootstrap procedure with 5000 bootstrap samples as a robust procedure to deal with non-normally distributed data (Field, 2013). Predictor variables are significant when zero is not in the 95% Confidence Interval (CI).

Below, we report the best fitting multi-level models on group differences (see Appendix A for the fit indices of all models). The level of ODD symptoms, as reported by the parents, was higher in children with DLD compared to children without DLD (B = .11, 95%*CI* [.003, .215]). A decline in ODD symptoms was found in older children in both groups (B = -.04, 95%*CI* [-.061, -.009]). Gender, SES, and PIQ did not provide better model fits and were excluded.

Reactive aggression did not differ in children with and without DLD. Children in both groups reported lower levels of reactive aggression when they were older (B = -.021, 95%*CI* [-.039, -.002] and girls reported lower levels than boys (B = -.077, 95%*CI* [-.151, -.003]. SES and PIQ did not contribute to the model.

The level of proactive aggression also did not differ in children with and without DLD. In both groups a decline with age was found (B = -.013, 95%*CI* [-.021, -.005]. Girls reported lower levels of proactive aggression than boys (B = -.030, 95%*CI* [-.058, -.001]) and PIQ was negatively related to proactive aggression in both groups (B = -.001, 95%*CI* [-.002, -.000]. SES did not contribute to the model.

Additionally, we compared the mean level and development across time of emotion recognition and anger dysregulation in children with and without DLD. Emotion recognition as reported by the parents was lower in children with DLD than in children without DLD (B = -.336, 95%*CI* [-.467, -.207]). An increase was found in older children in both groups (B = .040, 95*%CI* [.005, .074]). Anger dysregulation did not differ in children with and without DLD and showed decreasing levels in older children (B = -.073, 95*%CI* [-.116, -.030]). PIQ, SES, nor gender affected these results.

Finally, the level of communication problems (general, pragmatic, and emotion communication) of children with and without DLD were compared using independent t-tests. Children with DLD had more general, pragmatic, and emotion communication problems compared to children without DLD ($p < .001$).

In summary, we found higher levels of ODD symptoms in children with DLD compared to children without DLD, whereas proactive and reactive aggression were similar in both groups. The three externalizing problems decreased as children became older. Emotion recognition was lower in children with DLD whereas anger dysregulation did not differ between groups. Emotion recognition increased and anger dysregulation decreased as children became

older. Finally, the communication problems were higher in children with DLD than in children without DLD.

Longitudinal relations between emotional competence and externalizing problems

The second aim was to examine whether individual differences in externalizing problems could be explained by children's level and development of emotional competence (see Appendix B for correlations between all study variables). We examined whether between-person differences in emotional competence explained their level of externalizing problems. Therefore, the mean level (of the three measurements) of emotion recognition and anger dysregulation were added to the model. Additionally, the longitudinal data enabled us to examine whether within-person increases in emotional competence related to decreasing levels of externalizing problems across time. Therefore, we added person specific change scores for every time point (Time1 - mean, Time2 - mean, and Time3 - mean) which reflect the changes in emotional competence within individuals across time. Further, we examined whether the relations between emotional competence and externalizing problems were similar in children with and without DLD by adding the interaction terms of diagnosis x emotion recognition (mean and change) and diagnosis x anger dysregulation (mean and change). Non-significant predictors were excluded from the model.

The level of ODD symptoms was longitudinally related to emotion recognition and anger dysregulation. Higher mean levels of emotion recognition (*B* = -.198, 95%*CI* [-.286, -.123]) as well as within-person growth in emotion recognition (*B* = -119, 95%*CI* [-.189, -.050]) were related to fewer ODD symptoms as reported by the parents. However, when anger dysregulation was added to the model the mean level of emotion recognition was not significant anymore (Table 3). The mean level of anger dysregulation was related to more ODD symptoms in both groups, which relation was stronger in children with DLD as indicated by the significant interaction effect. Additionally, longitudinal increases in anger dysregulation within children were related to increasing levels of ODD symptoms in both groups. When anger dysregulation was added to the model, the difference in the level of ODD symptoms between children with and without DLD was no longer significant. These findings suggest that problems in emotional competence explain the higher levels of ODD symptoms in children with DLD. Moreover, increasing emotional competence across time relates to decreasing levels of ODD symptoms in children with and without DLD.

Reactive aggression was not explained by emotion recognition (mean and change) and was excluded from the model. The mean level of anger dysregulation did contribute to higher levels of reported reactive aggression, but only in children with DLD, as indicated by the significant interaction effect. Changes across time within individuals in anger dysregulation did not contribute to changes in reactive aggression (Table 3). Additionally, proactive aggression was unrelated to emotion recognition and anger dysregulation after bootstrapping. These findings suggest that children with DLD who have more anger dysregulation are at risk for

higher levels of reactive aggression, but not proactive aggression. Growth in emotional competence across time did not relate to lower levels of reactive and proactive aggression in both groups.

Table 3 Regression weights with 95% CI for best fitting models with emotion recognition and anger dysregulation predicting reactive externalizing problems

		Reactive aggression	ODD symptoms
Age		-.021 [-.031, .008]	-.007 [-.024, .010]
Gender		**-.073[-.149, -.005]**	-
Diagnosis		**-.404 [-.707, -.057]**	-.207 [-.436, .021]
Emotion recognition	Mean	**-**	-.049 [-.112, 013]
	Change	**-**	**-.108 [-.177, -.038]**
Anger dysregulation	Mean	.041 [-.014, .118]	**.384 [.312, .455]**
	Change	.018 [-.052, .094]	**.133 [.060, .207]**
Diagnosis x	Mean	**.182 [.025, .312]**	**.105 [.003, .208]**
Anger dysregulation	Change	.090 [-.037, .230]	.092 [-.044, .229]

Note. Significant regression weights are bold.

Mediating role of emotional competence in the relation of communication problems and externalizing problems

The third aim was to examine whether the relations between externalizing problems and communication problems were mediated by children's emotional competence (Figure 1). First, we examined the direct path of communication problems to externalizing problems. We reran the best fitting models as described above excluding children with missing data on the CCC or CAM. Then the severity of communication problems (general [structural language and pragmatic scales combined], or pragmatic and emotion communication), as well as the interaction effects with diagnosis, were added to the model.

Pragmatic problems (B = .012, 95%*CI* [.006, .018]) and emotion communication problems (B = .264, 95%*CI* [.118, .391]) related to higher levels of ODD symptoms in both groups. Reactive aggression was higher in children with more emotion communication problems in both groups (B = .092, 95%*CI* [.006, .178]) and in children with DLD with more general (B = .009, 95%*CI* [.003, .015]), or pragmatic communication problems (B = .015, 95%*CI* [.003, .026]), whereas no relations were found for children without DLD (B = .-.001, 95%*CI* [-.004, .001]; B = .-.001, 95%*CI* [-.008, .004] respectively). When the CCC scales (speech, syntax, semantics, coherence, pragmatics) were examined separately in children with DLD, only semantic and pragmatic problems related to more reactive aggression.

Proactive aggression was positively related to more emotion communication problems in both groups (B = .043, 95%*CI* [.014, .073]). Additionally, proactive aggression was related

to more general communication problems, but only in children with DLD (*B* = .002, 95%*CI* [.000, .005]), but when the separate CCC scales were examined in children with DLD, none of them reached significance, suggesting that these relations were not strong.

Second, we examined the direct path of communication problems to emotional competence. Emotion recognition was related to fewer general, pragmatic, and emotion communication problems in both groups (*B* = -.012, 95%*CI* [-.016, -.007]; *B* = -.028, 95%*CI* [-.035, -.020]; *B* = -.484, 95%*CI* [-.626, .341] respectively). When the structural language scales were examined separately in children with DLD, none of them were significant, whereas the pragmatic scale was (*B* = -.035, 95%*CI* [-.048, -.022]). Anger dysregulation was related to more general and pragmatic and emotion communication problems in both groups (*B* = .004, 95%*CI* [.001, .008]; *B* = .012 95%*CI* [.005, .019]; *B* = .371, 95%*CI* [.212, .530] respectively). However, when the structural language scales were examined separately in children with DLD, none of them reached significance, whereas the syntactic and pragmatic problems were borderline significant in children with DLD (*p* = .083; *p* = .077).

Third, we examined the indirect route of communication problems through emotional competence to reactive externalizing problems (Figure 1). Therefore, we added the (emotion) communication problems scales which contributed to the prediction of externalizing problems to the analyses with emotional competence. Mediation was not examined in proactive aggression, because it was unrelated to emotional competence.

The level of ODD symptoms was related to the severity of communication problems (pragmatic, and emotion communication) and the two indices for emotional competence in both groups. However, when the communicative and emotional factors were combined, communication problems did not add to the model in addition to the indices of emotional competence, suggesting mediation. Therefore, we performed direct tests of mediation using 10,000 clustered bootstraps to test the indirect paths of pragmatic problems and emotion communication problems, through emotion recognition and anger dysregulation to ODD symptoms (Hayes, 2013). The results indicated that the relations between pragmatic problems or emotion communication problems and ODD symptoms were mediated by the mean level of emotion recognition (*B* = -.035, 95%*CI* [-.307, -.080]; *B* = -.033, 95%*CI* [-.094, -.020] respectively). The results showed that more communication problems were related to lower levels of emotion recognition, which in turn predicted higher levels of ODD symptoms in children with and without DLD.

Anger dysregulation was not a mediating factor of the relation between communication problems and ODD symptoms when both groups were examined together. However, because anger dysregulation was more strongly related to ODD symptoms in children with DLD, we also performed this test of mediation for the DLD group alone. Within the DLD group, increasing levels of anger dysregulation across time mediated the relation between ODD symptoms and pragmatic problems (*B* = .007, 95%*CI* [.002, .024]), or emotion communication problems (*B* = .129, 95%*CI* [.065, .342]). The results showed that lower levels of

communication problems were related to decreasing levels of anger dysregulation across time, which in turn predicted decreasing ODD symptoms in children with DLD.

Reactive aggression was related to more communication problems (semantic problems and pragmatic problems) and more mean anger dysregulation only in children with DLD. Therefore, mediation was only tested in children with DLD. Semantic problems contributed to the prediction of reactive aggression in addition to anger dysregulation (B = .057, 95%CI [.016, .089]) and anger dysregulation did not mediate the relation between semantic problems and reactive aggression. However, the relation between pragmatic problems and reactive aggression was mediated by changes in anger dysregulation across time (B = -.119, 95%CI [-.484, -.0002). Children with DLD with lower levels of pragmatic problems had decreasing levels of anger dysregulation across time, which related to decreasing reactive aggression.

DISCUSSION

In the present study, different types of externalizing problems were examined longitudinally in children with and without DLD. Based on parent reports, children with DLD had more ODD symptoms than children without DLD, whereas no differences were found in self-reported levels of reactive and proactive aggression. Overall, the level of externalizing problems, especially proactive aggression, was low in both groups and the mean level of externalizing problems of children with and without DLD decreased as children became older. However, there was marked individual variation within both groups in the level and development across time. We aimed to explain individual differences between children with and without DLD and within children across time by examining the longitudinal relations with emotional competence and the severity of communication problems.

In line with our expectation, we found that children's emotional competence was unrelated to their level of proactive aggression, whereas emotion communication problems did explain higher levels of proactive aggression in children with and without DLD. Furthermore, we found longitudinal relations between the indices for emotional competence and the two reactive externalizing problems (ODD symptoms and reactive aggression). However, these relations were more consistent in children with DLD than in children without DLD. Moreover, our results confirmed our expectation that emotional competence mediated the relation between the severity of communication problems and reactive externalizing problems, especially in children with DLD. The findings will be discussed in more detail below.

Relations between emotional competence and externalizing problems

Emotional competence contributed to the prediction of fewer ODD symptoms in both groups. Specifically, children with increasing emotion recognition and lower or decreasing anger dysregulation across time had fewer ODD symptoms. Interestingly, the relation between anger dysregulation and ODD symptoms was stronger in children with DLD. Moreover, when anger dysregulation was controlled, the difference in ODD symptoms between children with

and without DLD was no longer significant, suggesting that the problems children with DLD experience are driven by problems in emotion regulation. Additionally, lower levels of pragmatic and emotion communication problems were related to fewer ODD symptoms, but these relations were mediated by children's emotion recognition and, in children with DLD, by their anger dysregulation. These findings are in line with our expectations that communication problems can impede the development of emotional competence resulting in more reactive externalizing problems.

In children with DLD, more anger dysregulation was also related to reactive aggression. Additionally, more severe communication problems related to more reactive aggression, which relation was partially mediated by anger dysregulation. Children with DLD with less pragmatic problems had fewer problems regulating their anger, which in turn contributed to the prediction of lower levels of reactive aggression. However, semantic problems remained significant over and above anger dysregulation. Semantic problems refer to difficulties understanding the meaning of words and sentences, and difficulties to confer meaning when children try to express themselves. Pragmatic problems are also important for the understanding of others, but refer to difficulties understanding the meaning behind the words: such as in figurative speech and in the understanding of non-verbal communication (Norbury et al., 2004). Pragmatic and semantic problems both make it difficult to understand the intentions of others, which can lead to more hostile interpretations of social situations. Hostile interpretations are in turn an important predictor of reactive aggression (Crick & Dodge, 1996). Our findings suggest that both these communication problems as well as anger dysregulation were risk factors for reactive aggression in children with DLD.

In children without DLD, no relation between emotional competence and reactive aggression was found. Although anger dysregulation is thought to be a risk factor for the development of reactive aggression, this relation is specifically found in clinical samples (De Castro et al., 2005), whereas no or weaker relations are reported in community samples (Skripkauskaite et al., 2015; Rolfh et al., 2018), which is in line with our findings. Moreover, other factors, such as negative peer interactions, seem to mediate the relation between emotion dysregulation and reactive aggression (Rolfh et al., 2017).

Level of externalizing problems

In contrast to our expectations, we did not find different levels of reactive aggression in children with and without DLD. This may be partly due to the larger age range in our study compared to the study by Timler (2008), because the older children in our study reported fewer externalizing problems. Additionally, our measure of reactive aggression focussed on physical and verbal acts of aggression while Timler (2008) also measured other reactive behaviour, such as reacting angry. These non-aggressive reactive problems were captured in the ODD symptoms' questionnaire. These ODD symptoms were higher in children with DLD than in children without DLD.

Overall, the level of externalizing problems of children with DLD was quite low. The children in our study were all diagnosed with DLD at an early age and had received special support to diminish the negative effects of DLD through speech and language therapy, special education, or school counsellors. This may have protected the development of more extreme levels of externalizing problems, as has been found in children with unrecognized language problems (Cohen et al., 1998; Gallagher, 1999; Hollo et al., 2014; Winstanley et al., 2018).

When language problems go unnoticed, similar processes as in children with DLD may contribute to the development and maintenance of externalizing problems. Communicative frustration in children may lead to more negative affect, while children at the same time gain less experience understanding, regulating, and expressing their emotions in constructive ways, contributing to more externalizing problems. Moreover, when children receive treatment for externalizing problems, it is likely that children with language difficulties will not benefit from these interventions to the same extent as children with more advanced communication skills. For instance, cognitive-behavioral therapy or group-based interventions place large demands on children's language abilities (Glickman, 2008). Recognizing these language problems, and awareness of the relation between language and externalizing problems and the mediating role of emotional competence seems crucial to help professionals recognize and treat the underlying problems causing externalizing behaviour (Chow & Wehby, 2018; Gallagher, 1998; Winstanley et al., 2018).

Limitations and future directions

Common measure variance may have influenced our results. In the analyses predicting proactive and reactive aggression we used both child and parent reports, but the analyses on ODD symptoms included only parent reports. This may have artificially inflated these relations. Although these effects are most prominent when questionnaires are similar in topic and formulation, which was not the case in our study (Podsakoff, MacKenzie, Lee, Podsakoff, 2003), future studies should try to gain information from multiple informants. This may also be beneficial to gain better understanding of the contexts in which externalizing problems appear, because the behaviour of children is likely to be dependent on the context they are in (e.g., at school or at home; Lindsay et al., 2007) and with whom they are interacting (parents, teachers, friends, or other peers).

Another limitation was that the communication problems were only measured once. Therefore, we were unable to examine the longitudinal effects of changes in the communication problems of children across time. Future studies should not only include longitudinal measures of general, pragmatic and emotion communication, but ideally start the study in younger ages, as the developments we examined already start early in life.

Concluding remarks

Although interventions for children with DLD typically focus on their language problems, our study suggests that the secondary effects of language problems in emotional competence should not be overlooked. Children use language throughout their lives to be in contact with others. These social interactions are crucial for social learning (Dunn et al., 1991; Eisenberg et al., 1993; Piaget, 1932/1965). When the development of emotional competence is delayed as a consequence of DLD, problems in emotional competence are likely to further diminish the chances for children to experience positive social interactions with others and learn from these experiences (Hart et al., 2004; Van den Bedem et al., 2019). In interventions we should ask ourselves which learning opportunities children are missing, so that we are able to focus our attention on those developments, parallel with language interventions.

Appendix A Goodness of fit (AIC and log likelihood test) of the different models

Model	Reactive aggression	Proactive aggression	ODD symptoms	Emotion recognition	Anger dysregulation
Basic means model	405.5	-566.4	450.9	1037.6	1285.5
With addition of age and control variables:					
1. Age	396.9**	-579.3***	439.5***	1036.8	1261.3***
2. Gender	394.8*	-580.4	440.5	1038.7	1261.8
3. SES	396.8	-577.3	441.5	1036.3	12.61.3
Controlling for PIQ:					
Best model without children with missing PIQ:	Model 2: 375.6	Model 1: -564.3	Model 1: 424.2	Model 1: 978.7	Model 1: 1217.5
4. PIQ	376.3	-569.1**	424.9	979.0	1216.5
4a. PIQ and Gender	-	-571.1*	-	-	-
5. Diagnosis * PIQ	379.7	-576.1*	425.1	978.0	1217.6
With control variables and diagnosis:					
6. Diagnosis	395.4	-572.7	436.8*	1015.1***	1260.6
7. Diagnosis*age	395.7	-572.4	437.0	1015.8	1261.8
With control variables and Emotional competence (EC), compared to:	Model 2	Model 4a	Model 6		
8. Emotion recognition	393.8	-569.5	403.0***		
9. Diagnosis x emotion recognition	395.0	-566.6	401.4		
10. Anger dysregulation	375.3***	-573.8*	162.8***		
11. Diagnosis x anger dysregulation	367.8**	-574.8	158.9*		
With control variables and emotion communication problems (CAM):					
Best model, without children with missing CAM data:	Model 2: 346.2	Model 4a: -564.2	Model 6: 379.8	Model 6: 923.0	Model 1: 1149.4
12. CAM	340.1**	-574.2***	353.7***	871.2***	1122.5***
13. Diagnosis x CAM	342.2	-573.4	354.0	872.8	1124.0
With control variables and CCC: general communication score (GCS), or pragmatics:					
Best model, without children with missing CCC data:	Model 2: 355.8	Model 4a: -522.0	Model 6: 371.9	Model 6: 874.4	Model 1: 1118.0
14. GCS	354.6	-523.5	369.0*	847.9***	1111.9**
15. Diagnosis x GCS	348.5**	-526.2*	369.4	848.8	1115.7
16. Pragmatics	354.3	-522.6	358.5***	831.8***	1106.5***
17. Diagnosis x pragmatics	350.8*	-525.9*	359.4	832.1	1109.0
With control variables, EC and CAM:					
Best model with EC, without children with missing CAM:	Model 10: 325.4	-	Model 11: 135.8	-	-
19. CAM	325.3	-	135.7	-	-

20. Diagnosis x CAM	326.9	-	135.2	-	-
With control variables, EC and CCC:					
Best model with EC, without children with missing CCC:	Model 10 DLD only: 202.7	-	Model 11: 123.08	-	-
21. Semantic problems	197.7**	-	-	-	-
23. Pragmatic problems	200.9	-	122.5	-	-
24. Diagnosis x pragmatics	-	-	123.8	-	-

Note. *$p < .05$, **$p < .01$, ***$p < .001$; For some models a better model fit was found, whereas the added predictor was not significant after bootstrapping. This was the case for: reactive aggression: positive relation with pragmatic problems in children with DLD, but not in children without DLD (model 15), and positive contribution of CAM in addition to ACS*diagnosis (model 16); proactive aggression: negative relation with PIQ in children without DLD, but not in children with DLD (model 5) and positive relation with mean anger dysregulation in both groups (model 10); ODD symptoms: a positive relation with GCS in both groups (model 12).

Appendix B Pearson's correlations between all variables with in the upper right corner the correlations for all children together and in the bottom left corner the correlations separately for the two groups (children without DLD/ children with DLD.

	1	2	3	4	5	6	7	8	9	10	11
1. Reactive	1	.56***	.33***	-.17**	.27***	-.11	-.04	.03	.10	.10	.19**
2. Proactive	**.43*****/.65*****	1	.25***	-.07	.12	-.16*	-.13*	-.01	.16*	.14*	.22**
3. ODD	**.01/.54*****	01/.32**	1	-.30***	-.27***	-.17**	-.05	-.01	.21**	.28***	.36***
4. ER	-.14/-.17	-.05/-.03	-26***/-.38***	1	-.34***	.13*	.19**	.10	-.42***	-.47***	-.52***
5. Anger dysreg.	**13/.40*****	-.01/.15	**67*****/.79*****	-.28***/-.40***	1	-.16*	-.07	.09	.17*	.23**	.32***
6. Age	-.03/-15*	-.08/-.19	-.12/-.16	.06/.18	-.11/-.17	1		.03	.01	-.01	-.03
7. PIQ	-.00/-.02	**-.20*/.09**	.10/-.11	-.01/.21*	.04/-.19	**-.27**/ .05**	1	.11	-.41***	-.36***	-.24**
8. SES	.02/.06	.07/.06	.01/-.02	-.03/.20*	.08/.09	-.27**/-.05	.05/-.09	1	-.27***	-.28***	-.26***
9. GCS	**-.07/.30****	-.05/. 14	.09/.25*	-.32***/ -41***	.13/.14	.09/-.13	**-.20*/.12**	.00/-.05	1	.96***	.52***
10. Pragmatic	**-.03/.26***	-.06/.12	.23**/.31**	-.39***/-.50***	.23**/.21*	-.00/-.07	-.09/.04	.04/-.19	.91***/.88***	1	.56***
11. CAM	.09/.22*	.06/.12	.25**/.43***	-.37***/-.55***	.36***/.35**	-.02/.03	.06/-.13	-.08/-.25*	.14/.32**	.20*/ .41***	1

Note. *p<.05, **p < .01; ***p < .001; Relations in children with and without DLD were significantly different (bold) for reactive aggression with proactive aggression: Z = -2.41*, ODD: Z = -4.55***; anger dysregulation: Z = -2.24*; general communication problems z = -2.67**; and pragmatic problems: Z = -2.08*. Additionally, differences were found for the relations between proactive aggression and ODD: Z = -2.46*; ODD and anger dysregulation: Z = -2.00*; PIQ and age: Z * - 2.46*; PIQ and proactive aggression: Z = 2.20*; and PIQ and general communication problems: z = -2.28*.

“Sometimes I want to tell teachers what exactly I have and what I find difficult, but they often just don't listen. Then they say: "You are a normal student. You are in school like everyone else." So I sometimes feel inferior. Some teachers know, but they see me as a happy girl skipping around at school, but they don't know what exactly is bothering me or if I'm angry, what exactly happens to me. And because I sometimes don't understand things they say, I sometimes have to think about it longer. If I don't understand something, they want to explain it to me, but sometimes I still don't understand it and then they say, "Oh, come on, you just have to pay attention." I am a girl who then often talks back to teachers.