

Internalizing, externalizing and attention problems in dyslexia

Anne Elisabeth Dahle* and Ann-Mari Knivsberg†

National Centre for Reading Educational and Research, University of Stavanger, Stavanger, Norway

(Received 15 March 2011; accepted 17 January 2013)

The aim of this study was to investigate if children with dyslexia displayed more behavioural/emotional problems than normal readers did. Twenty-six children with dyslexia and a control of 26 children without reading problems participated in the study. The mean age in the dyslexia group was 9 years and 8 months and in the control group 9 years and 10 months. The estimated mean intelligence quotient score was 94 in the dyslexia and 100 in the control group. Parents and teachers provided information on behaviour through Child Behavior Checklist and Teacher's Report Form. Only teachers reported significant group differences. Ratings from both groups showed, however, higher mean values of internalizing, externalizing and total problem behaviour in the dyslexia group compared to controls. Parents informed on a higher number of participants with dyslexia to have internalizing behaviour above the clinical cut-off point, while teachers reported a higher number with externalizing behaviour. Both parents and teachers reported significantly more attention problems in the dyslexia than in the control group.

Keywords: dyslexia; internalizing problems; externalizing problems; attention problems

Dyslexia is a developmental disorder characterized by problems in word reading, spelling and rapid automatized naming (Hulme and Snowling 2009; Romani, Olson, and Di Betta 2005; Willburger et al. 2008; Wolf and Bowers 1999, 2000). Various behavioural problems have been reported to coexist with dyslexia (Heiervang et al. 2001; Willcutt, Betjemann, Wadsworth, et al., 2007b; Willcutt and Gaffney-Brown 2004; Willcutt and Pennington 2000a, 2000b). There are, however, relatively few Scandinavian studies in this field (Dahle, Knivsberg, and Andreassen 2011; Heiervang et al. 2001; Undheim 2003), and only a few of the studies have inspected behavioural problems reported from both parents and teachers. This is important as Scandinavian parents and teachers tend to report less problem behaviour than what has been found in children and adolescents in other countries (Achenbach and Rescorla 2007; Larsson and Drugli 2011; Willcutt, Betjemann, Wadsworth, et al., 2007b). It may lead to difficulties in identifying behavioural problems in children with dyslexia in the educational system in Scandinavia. Knowledge about coexisting difficulties in children with dyslexia is important when intervention programmes are planned and implemented as prognoses are poorer when two or more difficulties occur together (Willcutt and Gaffney-Brown 2004). Coexisting difficulties will

*Corresponding author. Email: anne.e.dahle@uis.no

†Co-author Ann-Mari Knivsberg died in February 2013.

influence academic skills negatively, and problems in both reading and behaviour will be more severe than for one disorder (Willcutt et al. 2007a). Consequently, Scandinavian children with dyslexia will be extra vulnerable if we do not succeed in identifying co-occurring behavioural difficulties. This was the rationale for the current study where 26 ten-year-old Norwegian children with dyslexia, due to phonological deficits, participated. They all attended ordinary classes. The question raised was if these children's development was negatively influenced by behavioural problems, in addition to their dyslexia.

Dyslexia is a specific language-based disorder of constitutional origin (Lyon 1995). Vellutino and Fletcher (2005) have indicated that weak phonological coding may cause problems that can contribute to reading difficulties, particularly poor reading comprehension and problems with storing and retrieval of words in speech, and according to Hulme and Snowling (2009) there is strong evidence for a phonological deficit in children with dyslexia. No specific biological marker can, so far, be used to identify dyslexia. The disorder has characteristic persistent problems that can be observed in decoding and spelling (Snowling and Hulme 2011). Problems with reading speed and spelling are more persistent and difficult to remediate (Hulme and Snowling 2009), while most children over time develop accurate word decoding (Torgesen 2005). Accordingly, dyslexia may cause severe problems in the development of academic skills.

Various terms are used in the research literature to describe behaviour that may give cause for concern, such as children with problem behaviour, children at risk, high-risk children (Campbell 2002; Knivsberg et al. 1998) and behavioural problems (Heiervang et al. 2001). All terms indicate social and/or emotional problem, but do not provide specific information about the behaviour.

Earlier studies on dyslexia have often described the behaviour as externalizing or internalizing. The term internalizing behaviour refers to problems that are mainly within the self, as anxiety, depression, somatic complaints and withdrawal (Achenbach and Rescorla 2001). Externalizing behaviour involves conflicts with other people and their expectations for the child and is characterized by aggression and rule-breaking behaviour (Achenbach and Rescorla 2001). In addition, social problems, thought problems and attention problems are terms describing important behavioural traits. The term 'total behavioural problems' is used by Achenbach and Rescorla (2001) to include all the mentioned behaviours.

Several researchers have reported more anxiety (Carroll et al. 2005; Goldston et al., 2007; Heiervang et al. 2001; Willcutt and Pennington 2000b) and depression (Arnold et al. 2005; Boetsch, Green, and Pennington 1996; Maughan and Langton 2008) than expected by chance in children and adolescents with dyslexia. In a recent Norwegian study, Knivsberg and Andreassen (2008) examined children with severe dyslexia and a matched control group. They found significantly more internalizing, externalizing, attention problems and total behavioural problems in the dyslexia group, reported by teachers, parents and the participants themselves. Willcutt and Pennington (2000b) have also reported that children with reading disabilities exhibited significantly more internalizing and externalizing problems than did the controls. A Norwegian study by Heiervang et al. (2001) examined problem behaviour in a group of children with dyslexia and a control group. They found that teachers, parents and the students reported more internalizing and externalizing problems in the dyslexia than in the control group. Parents and teachers also reported significantly more attention problems.

Significantly more hostile-aggressive and anxious-fearful behaviour was reported in children with dyslexia by parents and teachers in Smart, Sanson, and Prior's (1996) study, and Boetsch, Green, and Pennington (1996) found significantly more depressive symptoms in children with dyslexia than in controls.

Several studies have examined attention problems and attention deficit/hyperactivity disorders (AD/HD) in children with dyslexia (Dykman and Ackerman 1991; Heiervang et al. 2001; Knivsberg and Andreassen 2008; Willcutt, Betjemann, Wadsworth, et al. 2007b; Willcutt and Gaffney-Brown 2004; Willcutt and Pennington 2000a; Willcutt, Pennington, and DeFries 2000). These studies reported more attention problems in children with dyslexia or that persons with dyslexia were more likely to meet the criteria for AD/HD than did normal readers. Willcutt and Gaffney-Brown (2004) reported, from the ongoing twin-study in Colorado (DeFries et al. 1997), that dyslexia and AD/HD co-occur more frequently than expected by chance. They found close to 40% overlap between dyslexia and AD/HD. More than 60% of children and adolescents with dyslexia also met the criteria for at least one additional, emotional or behavioural disorder (Willcutt and Gaffney-Brown 2004). Willcutt and Pennington (2000a) found stronger correlations between reading disabilities and AD/HD for symptoms of inattention than for symptoms of hyperactivity/impulsivity. These findings are in line with studies by Hinshaw (1992) and Chhabildas, Pennington, and Willcutt (2001). Both studies showed more inattention than hyperactivity/impulsivity in reading difficulties both in clinical and non-referred samples.

The aim of the present study was to contribute to further knowledge in this field examining whether children with dyslexia display clinically significant behavioural and attention problems. We hypothesized that more behavioural problems would be detected in a group of children with dyslexia than in a matched control group.

Methods

Participants

Twenty-six children with dyslexia, because of a phonological deficit, and a control group of 26 children without reading problems participated in this study. Each group consisted of 19 boys and 7 girls. The mean age for the children with dyslexia were 9 years and 8 months ($SD = 3.5$, range = 110–122 months) and for the controls 9 years and 10 months ($SD = 3.16$, range = 114–123 months). The mean intellectual level in the dyslexia group was estimated by Wechsler Intelligence Scale for Children – third Edition (WISC-III) with a total intelligence quotient (IQ) of 94 ($SD = 13.1$, range = 71–120), and for the controls 100 ($SD = 14.1$, range = 74–126).

The participating children were identified from a group of 298 children, 150 boys and 148 girls. The group represented 94% of all fourth graders from 19 normal classes in 9 schools in a rural municipality in Norway. All the children's orthographic word reading skills were first screened with a word-chain test with 90 word-chains (Høien and Tønnesen 1998), each with 4 words written together without inter-word spaces. The task was to dissect each word-chain and identify as many words as possible in four minutes. This test is widely used in Sweden and Norway (Høien and Tønnesen 1998; Jacobson 1993; Wolff 2005), and a low score can indicate dyslexia (Høien and Tønnesen 1998). The screening results in the

group of 298 children showed nearly normal distribution on word reading (skewness = 0.20, kurtosis = -0.36).

Thereafter the 20% of the students obtaining the lowest scores on the word-chain test were individually tested in word reading and spelling. This testing identified 26 children with the characteristic traits of dyslexia, and they formed the dyslexia group. The assessment with the word-chain test showed a mean value of 10.42 (SD = 2.6) in orthographic word reading for this group. The control group had a mean value of 22.31 (SD = 5.9).

Materials

To identify the children with dyslexia, word reading was assessed with two tests from a standardized Norwegian computer-based test battery (Oftedal and Høien 1997). The tests included 24 words and 24 non-words which varied in length, numbers of syllables and phonological and orthographic complexity. Accuracy and speed were measured. Spelling was assessed with a word dictation test consisting of 24 words with varying length and varying phonological and orthographic complexity. Results on the word-chain test, the word reading test and the spelling test, used to identify the dyslexia group, all showed large effect sizes and very low *p* values. This reduces the challenge of increased Type 1 error.

Phonological synthesis was tested with the subtest sound-blending from the Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk et al. 1998). A test from the Norwegian Gjessing material (1979) was used to evaluate skills in phonological analysis. A word- and syllable-reversal task, consisting of 20 compound words and 15 words with two syllables, was applied to assess the ability to break down words into syllables and to reverse the orders of syllables within words, for example, sunshine—shine-sun, fluent—ent-flu.

In order to test the children's ability in rapid automatized naming (RAN), tasks from the Comprehensive Test of Phonological Processes (CTOPP) (Wagner, Torgesen, and Rashotte, 1999) were used. The children's storing and retrieval of words were tested with tasks from a Norwegian test battery (Duna, Frost, and Godøy 2001). The task was to retrieve from memory as many different animals, and thereafter as many different kinds of food as possible in one minute. A phonological task in which the children should produce words starting with the phonemes /s/ and /l/ was also administered.

Information on internalizing and externalizing behaviour and about attention was obtained from parents with Child Behavior Checklist (CBCL) and from teachers with Teacher's Report Form (TRF) (Achenbach and Rescorla 2001). Both instruments are standardized for the age band 6–18 years with separate norms for boys and girls. The items are divided into eight syndrome scales called Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Rule-Breaking Behavior and Aggressive Behavior. The results from the first three subscales can be summarized into a composite score of internalizing behaviour, and the last two subscales into a composite score of externalizing behaviour. The Achenbach instruments are used in more than 80 cultures, but for interpretation of results it should be noted that severity of behavioural problems is differently rated in different countries and cultures (Achenbach and Rescorla 2007). Research results illustrating this is presented in a

separate manual, in which countries or cultures are divided into three rating groups on a scale from 1 to 3, equivalent of lower, medium and higher ratings.

The 19 teachers were asked to find children to the control group among the 298 children, for example, a boy, correct age and intellectual level (above, below or at normal level). They were thereafter assessed individually with the subtests Vocabulary and Block Design, from WISC-III (Wechsler 1991) to estimate the intellectual level. According to Sattler (2001), these two subtests correlate highly with total WISC-III score, and the sum of the scaled scores on these two subtests can be converted into an estimate of Full Scale IQ (Sattler 2001).

Procedure

The local authorities approved the study, and it was recommended by the Norwegian Social Science Data Services. Participation was based on informed and written consent from parents, and they could withdraw their children from the project at any time. The children were asked orally to participate in the study. The schools forwarded project information to the parents. Additional information was given to interested parents by telephone or email. The assessment was conducted by the first author and a colleague, trained in testing procedures. Testing took place at the children's home schools. Children who performed at least one standard deviation below the mean in word recognition, in word reading and in spelling formed the dyslexia group. The selected cut-off point is common in Scandinavian research when referring to reading difficulties (i.e. Gustafson et al. 2011; Høien-Tengesdal and Tønnessen 2011; Kempe, Gustafson, and Samuelsson 2011; Niemi et al., 2011). The 19 teachers were individually informed both about how the class has performed and more in detail about the educational challenges related to the children identified with dyslexia and/or behavioural problems.

Twenty-six children without reading and spelling problems formed the control group. These children came from the same 19 classes as the children with dyslexia, and it is consequently unlikely that eventual differences in reading skills could be attributed to teaching methods. The control group received the same test battery as the children with dyslexia. Tests from different test batteries were used to show group differences in phonological and reading-related skills.

The children in both groups were assessed with the two subtests from WISC-III (Wechsler 1991). Parents and teachers gave information on behaviour.

A matched design that makes it possible to control for some variables of importance (Mertens 2010) was used. The participants with and without dyslexia were matched on age and gender. The groups differed in reading, but influence from age and gender was reduced to assure that registered differences were related to reading differences.

Results

There were no significant differences in age or estimated IQ between the two groups. Because of the skewed distribution of scores, non-parametric Mann–Whitney *U* tests were carried out to test group differences. Effect sizes, Cohen's *d* (0.2 = small effect, 0.5 = medium effect and 0.8 = large effect) (Cohen 1988), illustrate the degree of association between the groups (Pallant 2007) and were calculated. Table 1 presents

Table 1. Sample characteristics: means and standard deviations of reading, spelling and related tasks in the dyslexia group ($N=26$) and controls ($N=26$).

	Children with dyslexia M (SD)	Controls M (SD)	<i>p</i> Value	Effect size (Cohen's <i>d</i>)
Word-chain test	10.42 (2.58)	22.31 (5.95)	0.000	2.59
Word reading (max. =24)				
Accuracy	20.54 (2.53)	22.73 (1.37)	0.000	1.1
Speed (sec.)	54.19 (19.92)	28.04 (10.14)	0.000	1.7
Spelling accuracy (max. =24)	15.58 (2.97)	20.58 (2.28)	0.000	1.9
Non-word reading (max. =24)				
Accuracy	19.08 (4.13)	21.00 (1.83)	ns	
Speed (sec.)	65.31 (24.37)	50.58 (19.50)	0.017	0.7
Phonological tasks				
Word-manipulating (max. =20)	17.58 (2.00)	19.15 (1.35)	0.001	0.9
Syllable-manipulating (max. =15)	5.23 (3.58)	8.04 (3.74)	0.009	0.8
Sound-blending, words (ITPA) (max. =24)	21.96 (1.40)	22.62 (1.72)	0.042	0.4
Phonological analysis (max. =36)	34.92 (1.65)	35.65 (0.69)	ns	
RAN (CTOPP), speed (sec.)				
Objects	82.19 (22.44)	71.19 (9.26)	0.051	0.6
Digits	43.73 (6.97)	40.27 (8.42)	ns	
Letters	44.15 (7.48)	39.31 (5.79)	0.015	0.7
Retrieval of words (in 60 sec.)				
Food	11.81 (3.50)	14.35 (3.91)	0.019	0.7
Animals	12.58 (3.79)	12.58 (2.60)	ns	
Words starting with "S"	09.00 (3.11)	10.92 (2.87)	0.030	0.6
Words starting with "L"	07.19 (2.30)	8.96 (2.57)	0.008	0.7

CTOPP, Comprehensive Test of Phonological Processes; ITPA, Illinois Test of Psycholinguistic Abilities.
p Value = Mann-Whitney *U* test.

results from reading and reading-related tasks, means, standard deviations, *p* values and effect sizes for the groups.

As expected, controls performed significantly better than children with dyslexia on nearly all the reading and reading-related tasks.

The main objective of the study was to examine if children with dyslexia demonstrated more additional behavioural/emotional problems than children without reading problems. For interpretation of the results it should be noted that parents and teachers in Nordic studies have reported less problem behaviour (Bilenberg 1999; Hannesdottir and Einarsdottir 1995; Heiervang et al. 2001; Knivsberg and Andreassen 2008; Larsson and Frisk 1999; Nøvik 1999) than reported from studies in other countries and cultures.

Raw scores on CBCL and TRF were transformed into T scores. This enables comparison between the results from the different schemes and syndrome scales (Achenbach and Rescorla 2001). Information from parents and teachers about the children's internalizing, externalizing and total problem behaviour is shown in Table 2.

As can be seen from Table 2, teachers reported significant differences between the groups, and the effect sizes showed large group differences in internalizing,

Table 2. T-score means and standard deviations of behavioural problems in children with dyslexia and controls reported by parents ($N = 26$) and teachers ($N = 26$).

	Children with dyslexia M (SD)	Controls M (SD)	p Value	Effect size (Cohen's d)
CBCL				
Internalizing problems	50.31 (12.21)	44.69 (9.47)	ns	
Externalizing problems	46.69 (11.49)	43.23 (9.46)	ns	
Total problems	48.65 (11.25)	42.08 (10.12)	ns	
TRF				
Internalizing problems	47.92 (8.63)	41.92 (6.18)	0.006	0.8
Externalizing problems	51.23 (8.48)	45.27 (6.89)	0.009	0.8
Total problems	51.19 (7.68)	40.62 (9.82)	0.000	1.2

Note: Differences between groups are expressed as p values and effect sizes.

CBCL, Child Behavior Checklist; TRF, Teacher's Report Form; p value = Mann-Whitney U test.

externalizing and total problem behaviour. Parents reported higher mean values of behavioural problems in children with dyslexia than in controls, but these differences were not significant. The manual with reports on rating levels in various countries includes CBCL results, but not TRF results for Norwegian samples (Achenbach and Rescorla 2007). A Norwegian population-based study on TRF has recently been published (Drugli and Larsson 2010). The norms, so far presented, do, however, not include all the eight syndromes and do not include T scores. Therefore, US norms, which are at level 2, were used. According to US norms a T score of 60 or more is significant for internalizing, externalizing and total problems. A T score of 60 corresponds to the 84th percentile. Scores between 60 and 63 points indicate problems, but are called a borderline area because false positives may emerge. Scores above 63, corresponding to the 90th percentile, indicate problem behaviour (Achenbach and Rescorla 2001). Table 3 shows the number of children with and without dyslexia scoring in the borderline area or above.

Parents and teachers reported a higher number of children with dyslexia than controls to display internalizing, externalizing and total problem behaviour within the borderline and the clinical area. Parents reported six boys with dyslexia (23.1%) and two control boys showing internalizing problem behaviour above the 84th percentile, while teachers only reported three boys with dyslexia in the same area. Four boys and one girl with dyslexia (19%) and one control boy were reported by the teachers to have externalizing behavioural problems above the 84th percentile. Parents reported three boys with dyslexia and two controls to meet the same criteria. It is interesting to note that some children with problem behaviour were identified by both parents and teachers, and some were identified by only one of the information groups. Only one girl was identified by her teacher with externalizing and total problem behaviour in the clinical range.

Table 4 presents parents' and teachers' information of significant differences on the eight syndrome scales in the two participating groups.

Parent's ratings were only significant for attention problems with effect size at medium level. There was also a tendency reported on the scales Anxious Depressed ($p < 0.06$), Social Problems ($p < 0.07$) and Aggressive Behaviour ($p < 0.09$). Teachers

Table 3. Children with T scores for internalizing (Int.), externalizing (Ext.) and total behaviour problem (total) above clinical cut-off points.

Group	Sex	CBCL			TRF		
		Int.	Ext.	Total	Int.	Ext.	Total
D	M	67*	58	63	60	51	52
D	F	33	57	43	50	68*	60
D	M	65*	48	58	53	59	60
D	M	65*	46	53	48	41	40
D	M	41	44	44	38	56	60
D	M	82*	73*	75*	47	65*	62
D	M	52	65*	60	48	62	54
D	M	50	33	39	65*	61	59
D	M	65*	65*	68*	65*	62	62
D	M	61	58	62	55	51	54
C	M	61	58	60	53	67*	67*
C	M	50	64*	53	38	41	32
C	M	58	61	55	38	41	32
C	M	63	33	45	38	41	32

Note: Bold indicates T scores above the 84th percentile; *indicates T scores above the 90th percentile. D, children with dyslexia; C, controls; M, male; F, female; CBCL, Child Behavior Checklist; TRF, Teacher's Report Form.

reported the dyslexia group to display significantly more attention problems. In addition, they rated children with dyslexia to be significantly more anxious and depressed and to show more social problems and aggressive behaviour than controls. In these areas the effect sizes ranged from medium to large effects (0.50–0.83). The results obtained from teachers also showed significantly more inattention ($p < 0.001$) and hyperactivity/impulsivity for the dyslexia group than controls ($p < 0.04$). On the other syndrome scales there were no significant differences.

Table 4. Syndrome scale scores with significant differences for children with and without dyslexia reported by parents and teachers.

	Children with dyslexia ($N = 26$)	Controls ($N = 26$)		Effect size (Cohen's d)
	M (SD)	M (SD)	p -Value	
CBCL				
Attention problems	56.77 (8.18)	53.77 (5.93)	0.008	0.4
TRF				
Anxious depressed	53.35 (5.28)	51.08 (2.61)	0.048	0.6
Withdrawn/depressed	52.73 (3.48)	50.58 (1.21)	0.005	0.8
Social problems	54.96 (4.93)	51.38 (3.67)	0.001	0.8
Attention problems	54.00 (4.48)	51.73 (4.18)	0.006	0.5
Aggressive behaviour	55.12 (5.90)	51.38 (3.68)	0.006	0.8

Note: T-score means (M), standard deviations (SD) and differences between the means expressed as p values and effect sizes are presented.

CBCL, Child Behavior Checklist; TRF, Teacher's Report Form; p value = Mann-Whitney U test.

Discussion

The present study examined the co-occurrence of dyslexia and behavioural problems. Twenty-six Norwegian children with dyslexia and a pairwise matched control group participated.

The information from the teachers confirmed our hypothesis while inspecting differences in the groups' means. Significantly more internalizing, externalizing and total behavioural problems were detected in the group with dyslexia than in the control group. Teachers rated children with dyslexia as displaying significantly more attention problems, social problems, aggressive behaviour, depressive traits and withdrawal. Parents reported children with dyslexia to demonstrate higher mean values of problem behaviour in the same behavioural domains, but the findings were significant for attention problems only.

Parents reported, however, higher mean scores on internalizing behaviour than teachers. This may explain why parents rated a higher number of children in the dyslexia group with internalizing problems above the clinical cut-off points than teachers did. The same phenomenon was registered in the study by Knivsberg and Andreassen (2008) where parents reported internalizing problems for more than half of the students with severe dyslexia, while externalizing problems were reported for about a quarter of the group. The children in the present study were attending ordinary classes, and to our knowledge they had not received a diagnosis of dyslexia or of any behavioural difficulties before the assessment. It was, therefore, unlikely to find the same level of behavioural problems as in the study by Knivsberg and Andreassen (2008). In the latter study and in the study by Boetsch and colleagues (1996), parents rated more children in the dyslexia group to demonstrate both internalizing and externalizing problems above the clinical cut-off levels than teachers did. Teachers in the present study, however, rated more children to have externalizing problems above the clinical cut-off points. Heiervang et al. (2001) only provided information of the number of children with total problem behaviour above the clinical cut-off point which rules out a comparison regarding this aspect.

The fact that teachers, in the present study and in the study by Knivsberg and Andreassen (2008), have reported a lower number of children with internalizing behavioural problems above the clinical cut-off levels than parents may raise the question of possible underreporting of internalizing behaviour by Norwegian teachers, compared to findings from other countries, for example, Willcutt, Betjemann, Wadsworth et al. (2007b). Another explanation is that the discrepancy reflects the Norwegian school-culture more than a real difference. Inclusion has been the official school policy for years, and pupils do not receive marks for behaviour. Norwegian teachers are careful when describing pupils' behaviour, aware of the fact that they may contribute to labelling a youth's behaviour in a negative way. The discrepancy might also be due to a comparatively high expertise of Scandinavian parents – or teachers or to a relatively high quality of existing Norwegian studies. In the present study, parents rated six of the children with dyslexia to display internalizing problem behaviour above the clinical cut-off point using the US norms for cut-off. The mean T score for children without problem behaviour is 50 (SD = 10) (Achenbach and Rescorla 2001). It is interesting to register that Norwegian teachers in our study reported children with dyslexia as displaying internalizing behaviour below this mean. The controls are rated nearly 1 SD below the mean for American samples.

Ratings of problem behaviour done by American parents are categorized at level 2, and from Norwegian parents at level 1 (Achenbach and Rescorla 2007). This indicates that Norwegian parents in general report less problem behaviour for their children than American parents do. Two recent, large studies illustrate that this is also the case for Norwegian teachers (Drugli and Larsson 2010; Larsson and Drugli 2011; Lurie and Clifford 2006). In the studies by Knivsberg and Andreassen (2008), and Heiervang et al. (2001), teachers reported less problem behaviour than parents, and we might, therefore, assume that Norwegian teachers would be placed at level 1, which is the same level as the parents. This is also in accordance with the results from a study of Grietens et al. (2004), where parents, especially mothers, tended to report more problems than teachers. According to Larsson and Drugli (2011) findings related to teacher ratings from the other Scandinavian countries seemed to be more mixed than those seen in Norwegian studies. Another question to reflect on is whether the differences in ratings from parents and teachers might indicate that children from different countries actually show a real difference in degree of problem behaviour. Further research is needed to shed light on these reflections.

Causal relationship between dyslexia and internalizing problems cannot be detected from the studies carried out. What is known is that the internalizing behaviour often continues into adulthood. In a follow-up study of adults diagnosed with dyslexia as 10-year-olds (Undheim 2003), more psychiatric problems and a higher percentage of unemployment were found. Also Maughan et al. (2003) found more depressed mood in adolescents with reading problems. Snowling, Muter, and Carroll (2007) likewise reported behaviour and emotional difficulties in a follow-up study of young adolescents with dyslexia, and in a study by McNulty (2003) it was indicated that low self-esteem may in fact be experienced since early childhood. It is, therefore, a cause for concern if Norwegian teachers fail to identify internalizing problems in children with dyslexia.

Attention problems are previously reported to coexist with dyslexia (Ackerman and Dykman 1995; Semrud-Clikeman et al. 1992; Shaywitz and Shaywitz 2008; Willcutt and Gaffney-Brown 2004; Willcutt and Pennington 2000a), and our results are in accordance with this. In the present study, the level of attention problems was highest in parents' reports. This is in line with the recent findings by Knivsberg and Andreassen (2008), where parents reported more attention problems than teachers and the children themselves did. However, Heiervang et al. (2001) also found significantly more attention problems in the group with dyslexia compared to controls, but in their study teachers reported more problems than parents and the children did. It would have been interesting to register the children's own evaluations of their behaviour in our study, but Youth Self Report (Achenbach and Rescorla 2001) can only be applied to youth aged between 11 and 18 years.

In the present study, teachers reported significantly more inattention and hyperactive behaviour in the dyslexia group compared to controls. This is in accordance with what Willcutt, Betjemann, Wadsworth, et al. (2007b) found between pre-reading skills and parental reported symptoms of attention and hyperactivity/impulsivity. In a recent study by Shaywitz and Shaywitz (2008), the close relationship between reading and attention is highlighted. The researchers suggest that attentional mechanisms are more important in reading than previously assumed and that disruptions of these attentional mechanisms play a critical role in reading acquisition and may cause reading difficulties. This raises an interesting question and reflects the increased research focus on causality between dyslexia and different kind of

behavioural problems. The present study was, however, not designed or conducted to answer whether the same aetiological risk factors can cause both dyslexia and different behavioural problems, or if one diagnosis tends to be the primary one.

A pairwise matched design is favourable with small sample sizes (Hulley et al. 2007) to achieve balance (Bruhn and McKenzie 2008). With the conservative nonparametric statistics and a small sample size significant differences are more difficult to obtain than with parametric statistics and larger samples. This consequently strengthens our results.

The observation forms, CBCL and TRF, have nearly the same questions, but are constructed to be used in different settings, at home and at school. This may partly explain why parents' and teachers' perceptions differ. In addition parents and teachers might be a part of the behavioural problems, because the way they treat a child and react to his or her needs, influences the way a child reacts. This aspect might result in some differences in the ratings from parents and teachers. Another question to consider is the probability that the lower teacher ratings of internalizing problems reflect the Norwegian school-culture more than a real difference in the children's behaviour in different settings. Parents and teachers have, however, reported differently on children's behaviour in other studies (Dahle et al. 2011; Hartman et al. 2007; Heiervang et al. 2001; Knivsberg and Andreassen 2008).

A next question to raise is consequently if CBCL and TRF screen internalizing and externalizing problem behaviours equally well. According to Larsson and Drugli (2011), teachers tend to report more boys than girls with externalizing behaviour, and they also report more externalizing than internalizing problems in boys. The difference in behaviour rating might reflect that behaviour depends on the respective setting, which could be different at home or at school. The results might also express that boys actually show more externalizing behaviour than girls or that teachers tend to interpret boys' and girls' behaviour differently. It was, however, not possible to examine gender differences in the present study, due to the low number of girls participating.

A reflection we share with the above-mentioned researchers is that teachers may observe and report more externalizing behaviours during a school day due to disruptions of classroom work and, therefore, tend to overlook internalizing problems. On the CBCL it is also reported higher detecting of externalizing than internalizing problems (Bilenberg 1999; Larsson and Frisk 1999). But, on the other hand, it is possible that parents tend to be more sensitive for internalizing problems in their own child, and the problems may be easier to detect in a home setting. Current knowledge illustrates that further research is needed in this area.

Another question to consider is whether parents and teachers are more sensitive for other difficulties like behavioural problems when they are dealing with children with dyslexia and that this might influence their ratings. In the present study none of the children had got a diagnosis of dyslexia before the study started, and consequently the informants' ratings should not be biased by this aspect.

To summarize, the results from the present study showed that children with dyslexia displayed more behavioural and emotional problems than controls did, and that parents reported a higher number of children in the dyslexia group to display internalizing behaviour above the clinical cut-off points than teachers did. In line with the Norwegian-based population study (Drugli and Larsson 2010; Larsson and Drugli 2011), teachers rated more children with externalizing than internalizing behaviour. This could have been expected for parents' ratings as CBCL and TRF are, as previously described, reported to detect externalizing behaviour better than

internalizing behaviour. The opposite is the result in the current study as parents reported a higher number of children with dyslexia to have internalizing problems.

Group sizes were relatively small, and results should therefore be treated with caution. The same results were, however, also registered in another Norwegian study (Knivsberg and Andreassen 2008). A question raised in the light of the results in these two studies is if Norwegian teachers underreport internalizing problems in children with dyslexia. To identify behaviour and attention problems in children with dyslexia as early as possible is imperative because intervention is often more problematic and the prognosis poorer when two or more difficulties occur simultaneously (Willcutt and Gaffney-Brown 2004). Results from intervention studies and longitudinal studies in this area are limited, and intervention in one problem area may not necessarily have positive influence on the other problem area, according to Maughan and Langton (2008). Consequently, intervention has to be directed at both areas to achieve the best possible results (Maughan and Langton 2008).

Our knowledge society puts increasing demands on reading skills. These skills are important for daily life functioning, social well-being, academic achievement, studies and job opportunities as well as mental health. Further research is needed to shed light on how behavioural problems in children with dyslexia can most effectively be detected as early as possible, how widespread it is, what causes such problems and also on what seemed to be a tendency for Norwegian teachers to underreport internalizing behaviour in children with dyslexia.

References

- Achenbach, T. M., and L. A. Rescorla. 2001. *Manual for the ASEBA School-Age Forms & Profiles*. Burlington, VT: Research Center for Children, Youth & Families, University of Vermont.
- Achenbach, T. M., and L. A. Rescorla. 2007. *Multicultural Supplement to the Manual for the ASEBA School-Age Forms & Profiles*. Burlington, VT: Research Center for Children, Youth & Families, University of Vermont.
- Ackerman, P. T., and R. A. Dykman. 1995. "Reading-Disabled Students with and without Comorbid Arithmetic Disability." *Developmental Neuropsychology* 11 (3): 351–371. doi:10.1080/87565649509540625.
- Arnold, E. M., D. B. Goldston, A. K. Walsh, B. A. Reboussin, S. S. Daniel, E. Hickman, and F. B. Wood. 2005. "Severity of Emotional and Behavioral Problems among Poor and Typical Readers." *Journal of Abnormal Child Psychology* 33 (2): 205–217. doi:10.1007/s10802-005-1828-9.
- Bilenberg, N. 1999. "The Child Behavior Checklist (CBCL) and Related Material: Standardization and Validation in Danish Population Based and Clinically Based Samples." *Acta Psychiatrica Scandinavia Supplement* 398: 100. doi:10.1111/j.1600-0447.1999.tb10703.x.
- Boetsch, E. A., P. A. Green, and B. F. Pennington. 1996. "Psychosocial Correlates of Dyslexia across the Life Span." *Development and Psychopathology* 8 (3): 539–562. doi:10.1017/S0954579400007264.
- Bruhn, M., and D. McKenzie. 2008. *In Pursuit of Balance: Randomization in Practice in Development Field Experiments*, Washington, DC: The World Bank, Development Research Group, Finance and Private Sector Team.
- Campbell, S. B. 2002. *Behavior Problems in Preschool Children: Clinical and Developmental Issues*. New York: Guilford Press.
- Carroll, J. M., B. Maughan, R. Goodman, and H. Meltzer. 2005. "Literacy Difficulties and Psychiatric Disorders: Evidence for Comorbidity." *Journal for Child Psychology and Psychiatry* 46 (5): 524–532. doi:10.1111/j.1469-7610.2004.00366.x.
- Chhabildas, N., B. F. Pennington, and E. G. Willcutt. 2001. "A Comparison of the Cognitive Deficits in the DSM-IV Subtypes of ADHD." *Journal of Abnormal Child Psychology* 29 (6): 529–540. doi:10.1023/A:1012281226028.

- Cohen, J. W. 1988. *Statistical Power Analyses for the Behavioral Sciences*. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Dahle, A. E., A.- M. Knivsberg, and A. B. Andreassen. 2011. "Coexisting Problem Behaviour in Severe Dyslexia." *Journal of Research in Special Educational Needs* 11 (3): 162–170. doi:10.1111/j.1471-3802.2010.01190.x.
- DeFries, J. C., P. A. Filipek, D. W. Fulkner, R. K. Olson, B. F. Pennington, S. D. Smith, and B. W. Wise. 1997. "Colorado Learning Disabilities Research Center." *Learning Disabilities: A Multidisciplinary Journal* 8 (1): 7–19.
- Drugli, M. B., and B. Larsson. 2010. "Psykisk helse blant norske skolebarn i 1.-7.klasse [Mental health in Norwegian school children 1.-7. level]." *Spesialpedagogikk* 3: 4–11. <http://uit.no/Content/184732/Psykisk%20helse%20blant%20norske%20skolebarn%20i%201.%20-%207.%20klasse.pdf>.
- Duna, K. E., J. Frost, and O. Godøy. 2001. *Arbeidsprøven* [Dynamic assessment of reading and spelling]. Oslo: Bredtvet Competence Centre. [in Norwegian]
- Dykman, R. A., and P. T. Ackerman. 1991. "Attention Deficit Disorder and Specific Reading Disability: Separate but often Overlapping Disorders." *Journal of Learning Disabilities* 24 (2): 96–103. doi:10.1177/002221949102400206.
- Gjessing, H. J. 1979. *Prøver for analyse av lese- og skrivevansker. Håndbok og instruksjoner* [Tests for analyzing reading and writing disabilities. Handbook and instructions]. Oslo: Universitetsforlaget. [in Norwegian]
- Goldston, D. B., A. Walsh, E. M. Arnold, B. A. Reboussin, S. S. Daniel, A. Erkanli, D. Nutter, E. Hickman, G. Palmes, E. Snider, and F. B. Wood. 2007. "Reading Problems, Psychiatric Disorders, and Functional Impairment from mid- to late Adolescence." *Journal of the American Academy of Child and Adolescent Psychiatry* 46 (1): 25–32. doi:10.1097/01.chi.0000242241.77302.f4.
- Grietens, H., P. Onghena, P. Prinzie, E. Gadeyne, V. Van Assche, P. Ghesquière, and W. Hellinckx. 2004. "Comparison of Mothers', Fathers', and Teachers' Reports on Problem Behaviour in 5- to 6-year-old Children." *Journal of Psychopathology and Behavioral Assessment* 26 (2): 137–146. doi:10.1023/B:JOBA.0000013661.14995.59.
- Gustafson, S., L. Fälth, I. Svensson, T. Tjus, and M. Heimann. 2011. "Effects of Three Interventions on the Reading Skills of Children with Reading Disabilities in Grade 2." *Journal of Learning Disabilities* 44 (2): 123–135. doi:10.1177/0022219410391187.
- Hannesdóttir, H., and S. Einarsdóttir. 1995. "The Icelandic Child Mental Health Study: An Epidemiological Study of Icelandic Children 2–18 Years of Age using the Child Behavior Checklist as a Screening Instrument." *European Child & Adolescent Psychiatry* 4 (4): 237–248. doi:10.1007/BF01980488.
- Hartman, C. A., S. H. Rhee, E. G. Willcutt, and B. F. Pennington. 2007. "Modeling Rater Disagreement for ADHD: Are Parents or Teachers Biased?" *Journal of Abnormal Child Psychology* 35 (4): 536–542. doi:10.1007/s10802-007-9110-y.
- Heiervang, E., A. Lund, and S. Jim. 2001. "Behaviour Problems in Children with Dyslexia." *Nordic Journal of Psychiatry* 55 (4): 251–256. doi:10.1080/080394801681019101.
- Hinshaw, S. P. 1992. "Externalizing Behavior Problems and Academic Underachievement in Childhood and Adolescence: Causal Relationships and Underlying Mechanisms." *Psychological Bulletin* 111 (1): 127–155. doi:10.1037/0033-2909.111.1.127.
- Hulley, S. B., S. R. Cummings, W. S. Browner, D. G. Grady, and T. B. Newman. 2007. *Designing Clinical Research*. 3rd. ed. Philadelphia, PA: Lippincott Williams & Wilkins.
- Hulme, C., and M. J. Snowling. 2009. *Developmental Disorders of Language Learning and Cognition*. Chichester: Wiley-Blackwell.
- Høien, T., and G. Tønnesen. 1998. *Håndbok til Ordkjedetesten* [Handbook to the Word-chaintest]. Stavanger: Stiftelsen Dysleksisforskning. [in Norwegian]
- Høien-Tengesdal, I., and F.- E. Tønnesen. 2011. "The Relationship between Phonological Skills and Word Decoding." *Scandinavian Journal of Psychology* 52 (1): 93–103. doi:10.1111/j.1467-9450.2010.00856.x.
- Jacobson, C. 1993. *Manual til ordkedjor* [Manual to the word-chains]. Stockholm: Psykologförlaget. [in Swedish]
- Kempe, C., S. Gustafson, and S. Samuelsson. 2011. "A Longitudinal Study of Early Reading Difficulties and Subsequent Problem Behaviors." *Scandinavian Journal of Psychology* 52 (3): 242–250. doi:10.1111/j.1467-9450.2011.00870.x.

- Kirk, S. A., W. D. Kirk, J. D. McCarthy, H. D. Nygaard, and H.- J. Gjessing. 1998. *ITPA: Illinois test of psycholinguistic abilities: Håndbok med instruksjoner og normer* [ITPA: Illinois test of psycholinguistic abilities: Handbook and instructions]. Oslo: Skolepsykologi – Materiellservice. [in Norwegian]
- Knivsberg, A.- M., and A. B. Andreassen. 2008. "Behaviour, Attention and Cognition in Severe Dyslexia." *Nordic Journal of Psychiatry* 62 (1): 59–65. doi:[10.1080/08039480801970098](https://doi.org/10.1080/08039480801970098).
- Knivsberg, A.- M., K. L. Reichelt, M. Nødland, and F. E. Tønnessen. 1998. "Biochemical Abnormalities in Six-year-old Children with Problem Behaviour." *Nordisk tidsskrift for spesialundervisning [Nordic Journal of Special Education]* 2: 74–85.
- Larsson, B., and M. B. Drugli. 2011. "School Competence and Emotional/Behavioral Problems among Norwegian School Children as Rated by Teachers on the Teacher Report Form." *Scandinavian Journal of Psychology* 52 (6): 553–559. doi:[10.1111/j.1467-9450.2011.00889.x](https://doi.org/10.1111/j.1467-9450.2011.00889.x).
- Larsson, B., and M. Frisk. 1999. "Social Competence and Emotional/Behaviour Problems in 6–16 year old Swedish School Children." *European Child and Adolescent Psychiatry* 8: 24–33. doi:[10.1007/s007870050080](https://doi.org/10.1007/s007870050080).
- Lurie, J., and G. Clifford. 2006. *Teachers' Perceptions of Emotional and Behavioural Problems in 6–12 year old Norwegian School Children*, 1–57. Trondheim: Barnevernet utviklingscenter i Midt-Norge [Regional Child protection Research Unit].
- Lyon, G. R. 1995. "Toward a Definition of Dyslexia." *Annals of Dyslexia* 45 (1): 3–27. doi:[10.1007/BF02648210](https://doi.org/10.1007/BF02648210).
- Maughan, B., and E. G. Langton. 2008. "Leseferdighet og psykiske vansker [Literacy and emotional difficulties, in Norwegian]." In *Lesevansker og livsvansker - om dysleksi og psykisk helse* [Reading difficulties and life problems- about dyslexia and mental health], edited by F. E. Tønnessen, E. Bru, and E. Heiervang, 111–120. Stavanger: Hertervig Akadmisk. [in Norwegian]
- Maughan, B., R. Rowe, R. Loeber, and M. Stouthamer-Loeber. 2003. "Reading Problems and Depressed Mood." *Journal of Abnormal Child Psychology* 31 (2): 219–229. doi:[10.1023/A:1022534527021](https://doi.org/10.1023/A:1022534527021).
- McNulty, M. A. 2003. "Dyslexia and the Life Course." *Journal of Learning Disabilities* 36 (4): 363–381. doi:[10.1177/00222194030360040701](https://doi.org/10.1177/00222194030360040701).
- Mertens, D. M. 2010. *Research and Evaluation in Education and Psychology: Integrating Diversity with Quantitative, Qualitative, and Mixed Methods*. 3rd ed. Los Angeles, CA: Sage.
- Niemi, P., J.- E. Nurmi, A.- L. Lyyra, M.- K. Lerkkanen, J. Lepola, E. Poskiparta, and A.- M. Poikkeus. 2011. "Task Avoidance, Number Skills and Parental Learning Difficulties as Predictors of Poor Response to Instruction." *Journal of Learning Disabilities* 44 (5): 459–471. doi:[10.1177/0022219411410290](https://doi.org/10.1177/0022219411410290).
- Nøvik, T. S. 1999. *Validity and Use of the Child Behavior Checklist in Norwegian Children and Adolescents: An Epidemiological and Clinical Study*. Oslo: Centre for Child and Adolescent Psychiatry, Department Group of Psychiatry, University of Oslo.
- Oftedal, M. P, and T. Høien. 1997. *Håndbok til KOAP. Kartlegging av ordavkodingsprosesser* [Handbook to KOAP. Assessment of word decoding processes]. Stavanger: Stiftelsen Dysleksiforskning. [in Norwegian]
- Pallant, J. 2007. *SPSS Survival Manual*. 3rd ed. Glasgow: Open University Press.
- Romani, C., A. Olson, and A. Di Betta. 2005. "Spelling Disorders." In *The Science of Reading: A Handbook*, edited by M. J. Snowling and C. Hulme, 431–448. Malden, MA: Blackwell.
- Sattler, J. M. 2001. *Assessment of Children Cognitive Applications*. 4th ed. San Diego, CA: J.M. Sattler.
- Semrud-Clikeman, M., J. Biederman, S. Sprich-Buckminster, B. K. Lehman, S. V. Faraone, and D. Norman. 1992. "Comorbidity between ADDH and Learning Disability: A Review and Report in a Clinically Referred Sample." *Journal of the American Academy of Child and Adolescent Psychiatry* 31 (3): 439–448. doi:[10.1097/00004583-199205000-00009](https://doi.org/10.1097/00004583-199205000-00009).
- Shaywitz, S. E., and B. A. Shaywitz. 2008. "Paying Attention to Reading: The Neurobiology of Reading and Dyslexia." *Development and Psychopathology* 20: 1329–1349. doi:[10.1017/S0954579408000631](https://doi.org/10.1017/S0954579408000631).

- Smart, D., A. Sanson, and M. Prior. 1996. "Connections between Reading Disability and Behavior Problems: Testing Temporal and Causal Hypotheses." *Journal of Abnormal Child Psychology* 24 (3): 363–383. doi:[10.1007/BF01441636](https://doi.org/10.1007/BF01441636).
- Snowling, M. J., and C. Hulme. 2011. "Evidence-based Interventions for Reading and Language Difficulties: Creating a Virtuous Circle." *British Journal of Educational Psychology* 81 (1): 1–23. doi:[10.1111/j.2044-8279.2010.02014.x](https://doi.org/10.1111/j.2044-8279.2010.02014.x).
- Snowling, M. J., V. Muter, and J. M. Carroll. 2007. "Children at Family Risk of Dyslexia: A Follow-up Study in Early Adolescence." *Journal of Child Psychology and Psychiatry* 48 (6): 609–618. doi:[10.1111/j.1469-7610.2006.01725.x](https://doi.org/10.1111/j.1469-7610.2006.01725.x).
- Torgesen, J. K. 2005. "Recent Discoveries on Remedial Interventions for Children with Dyslexia." In *The Science of Reading: A Handbook*, edited by M. J. Snowling and C. Hulme, 521–537. Malden, MA: Blackwell.
- Undheim, A. M. 2003. "Dyslexia and Psychosocial Factors: A Follow-up Study of Young Norwegian Adults with a History of Dyslexia in Childhood." *Nordic Journal of Psychiatry* 57 (3): 221–226. doi:[10.1080/08039480310001391](https://doi.org/10.1080/08039480310001391).
- Vellutino, F. R., and J. M. Fletcher. 2005. "Developmental Dyslexia." *The Science of Reading. A Handbook*, edited by M. J. Snowling and C. Hulme, 362–378. Malden, MA: Blackwell.
- Wagner, R. K., J. K. Torgesen, and C. A. Rashotte. 1999. *Comprehensive Test of Phonological Processes*. Austin, TX: Pro-Ed.
- Wechsler, D. 1991. *Wechsler's Intelligence Scale for Children*. 3rd ed. San Antonio, TX: The Psychological Corporation.
- Willburger, E., B. Fussenegger, K. Moll, G. Wood, and K. Landerl. 2008. "Naming Speed in Dyslexia and Dyscalculia." *Learning and Individual Differences* 18 (2): 224–236. doi:[10.1016/j.lindif.2008.01.003](https://doi.org/10.1016/j.lindif.2008.01.003).
- Willcutt, E. G., R. S. Betjemann, B. F. Pennington, R. K. Olson, J. C. DeFries, and S. J. Wadsworth. 2007a. "Longitudinal Study of Reading Disability and Attention-Deficit/Hyperactivity Disorder: Implications for Education." *Mind, Brain, and Education* 1 (4): 181–192. doi:[10.1111/j.1751-228X.2007.00019.x](https://doi.org/10.1111/j.1751-228X.2007.00019.x).
- Willcutt, E. G., R. S. Betjemann, S. J. Wadsworth, S. Samuelsson, R. Corley, J. C. DeFries, B. Byrne, B. F. Pennington, and R. K. Olson. 2007b. "Preschool Twin Study of the Relation between Attention-Deficit/hyperactivity Disorder and Pre-reading Skills." *Reading and Writing* 20 (12): 103–125. doi:[10.1007/s11145-006-9020-3](https://doi.org/10.1007/s11145-006-9020-3).
- Willcutt, E. G., and R. Gaffney-Brown. 2004. "Etiology of Dyslexia ADHD and Related Difficulties: Using Genetic Methods to Understand Comorbidity." *Perspectives of the International Dyslexia Association* 30: 12–15.
- Willcutt, E. G., and B. F. Pennington. 2000a. "Comorbidity of Reading Disability and Attention Deficit/Hyperactivity Disorder: Differences by Gender and Subtype." *Journal of Learning Disabilities* 33 (2): 179–191. doi:[10.1177/002221940003300206](https://doi.org/10.1177/002221940003300206).
- Willcutt, E. G., and B. F. Pennington. 2000b. "Psychiatric Comorbidity in Children and Adolescents with Reading Disability." *Journal of Child Psychology and Psychiatry* 41 (8): 1039–1048. doi:[10.1111/1469-7610.00691](https://doi.org/10.1111/1469-7610.00691).
- Willcutt, E. G., B. F. Pennington, and J. C. DeFries. 2000. "Etiology of Inattention and Hyperactivity/Impulsivity in a Community Sample of Twins with Learning Difficulties." *Journal of Abnormal Child Psychology* 28 (2): 149–159. doi:[10.1023/A:1005170730653](https://doi.org/10.1023/A:1005170730653).
- Wolf, M., and P. G. Bowers. 1999. "The Double-Deficit Hypothesis for the Developmental Dyslexias." *Journal of Educational Psychology* 91 (3): 415–438. doi:[10.1037/0022-0663.91.3.415](https://doi.org/10.1037/0022-0663.91.3.415).
- Wolf, M., and P. G. Bowers. 2000. "Naming-Speed Processes and Developmental Reading Disabilities: An Introduction to the Special Issue on the Double-Deficit Hypothesis." *Journal of Learning Disabilities* 33 (4): 322–324. doi:[10.1177/002221940003300404](https://doi.org/10.1177/002221940003300404).
- Wolff, U. 2005. "Characteristics and Varieties of Poor Readers." Ph.D. diss., Acta Universitatis Gothoburgensis.