

A systematic review of the academic achievement of primary and secondary school-aged students with developmental language disorder

Autism & Developmental Language Impairments
Volume 7: 1–33
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DOI: 10.1177/23969415221099397
journals.sagepub.com/home/dli



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Abstract

Background and aims: The ability to communicate is a fundamental skill required to participate in school. Students with Developmental Language Disorder (DLD) have persistent and significant language difficulties that impact daily functioning. However, the impact of DLD on the academic achievement of primary and secondary school-aged students has received limited attention.

Methods: A systematic review of the empirical research published between 2008 and 2020 was undertaken to identify studies that have examined the academic achievement of school-aged students with DLD within curriculum areas. A total of 44 studies were identified that met inclusion criteria for review.

Results: Students with DLD demonstrated difficulties with academic achievement across all measured curriculum areas compared to their typically developing peers. Most studies focused on literacy skills, including reading, spelling, writing and narratives.

Conclusions and implications: The performance of students with DLD was heterogeneous with individual students demonstrating relative strengths in some areas of academic achievement. The implications of these results for educational practices and future research are discussed.

Keywords

Developmental language disorder, academic achievement, school-aged

Introduction

Developmental Language Disorder (DLD) is a lifelong neurodevelopmental condition affecting approximately 7% of the population, characterised by a significant and persistent

impairment in the understanding and use of language, resulting in significant impact on everyday functioning (Bishop et al., 2016, 2017; Norbury et al., 2016). DLD is not associated with known biomedical conditions (e.g. Autism

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Spectrum Disorder, brain injury, hearing impairment, intellectual disability); however, it can be related to environmental and biological risk factors (e.g. low socio-economic status, birth complications), and comorbid conditions (e.g. Attention Deficit Hyperactivity Disorder, Developmental Coordination Disorder, Speech Sound Disorder; Bishop et al., 2017). The term DLD encompasses earlier terminology, such as Specific Language Impairment (SLI) and related terms (e.g. Language Disorder, Language Impairment, Language Learning Disability), and will be used accordingly in this paper. Students with DLD are a heterogeneous population with differing levels of ability in terms of strengths and needs across language domains, including syntax, morphology, semantics, pragmatics, and phonology (Bishop et al., 2017), and modalities (receptive, expressive, reading, writing). DLD has lifelong implications with students obtaining lower vocational qualifications and less skilled employment as adults (Conti-Ramsden et al., 2017; Johnson et al., 2010), and is broadly associated with reduced academic achievement (Conti-Ramsden et al., 2009). However, to date, the impacts of DLD on academic achievement at school has not been *systematically* reviewed. Considering the importance of academic achievement to post-school opportunities, a better understanding of academic achievement of students with DLD is needed to inform educational practices and future research.

Language and learning profiles of students with DLD

The ability to understand and use language is critical for succeeding at school (Adlof & Hogan, 2018). Students learn by listening and responding to spoken language used by their teacher in the classroom, as well as by understanding and producing written language. These skills also enable students to demonstrate their knowledge in assignments or exams (Australia: National Curriculum, Australian Curriculum Assessment and Report Authority, 2014; UK, Key Stages, Department of Education, 2013, US: Common Core Standards, National Governor's Association, 2010). Spoken language lays the foundation for reading achievement (Catts, Bridges, et al., 2008; Catts, Fey, et al., 1999) with 17–50% of students with DLD having a comorbid reading disability (Catts, 1993; Catts et al., 2005). The importance of spoken language for successful reading is clearly represented in the Simple View of Reading (Gough & Tunmer, 1986), that depicts reading comprehension as the product of word recognition and listening comprehension. It is unsurprising, therefore, that many students with DLD experience significant difficulties in acquiring and developing their reading skills compared to typically developing peers (Catts et al., 2008), with a flow-on effect to writing and spelling. Given the importance of proficient spoken language skills to participate in learning, students with DLD tend to fall behind their

typically developing peers at school (Conti-Ramsden et al., 2017; Johnson et al., 2010).

Several longitudinal studies report a connection between spoken language, non-verbal IQ, and literacy as potential predictors of performance at school (Clegg et al., 2005; Conti-Ramsden et al., 2009; Durkin et al., 2009; Snowling et al., 2001; Young et al., 2002). Although a diagnosis of DLD excludes intellectual disability (IQ below SS 70) and no discrepancy between verbal and non-verbal cognitive ability is needed for diagnosis, many students with DLD demonstrate low average non-verbal IQ (SS 70–85). Moreover, non-verbal IQ is significantly associated with student performance in literacy, numeracy, and classroom-based learning, as well as being a strong predictor of performance on academic examinations (Conti-Ramsden et al., 2009; Dockrell et al., 2011). Spoken language, non-verbal IQ, and literacy impact performance on student learning in core curriculum areas, such as English, Mathematics, and Science, but their contribution varies depending on the curriculum subject (Conti-Ramsden et al., 2009; Durkin et al., 2015). In summary, students with DLD may be at greater risk of academic failure across several curriculum areas compared to typically developing peers.

Curriculum areas

Academic achievement refers to the knowledge, understanding, and skills acquired through the learning process at school, which includes literacy (reading, writing, spelling, narratives) and numeracy (Catts et al., 2005; Cross et al., 2019; Williams et al., 2013). Even though the specific subjects of academic achievement differ by country (Australia: National Curriculum, Australian Curriculum Assessment and Report Authority, 2014; United Kingdom (UK), Key Stages, Department of Education, 2013, United States of America (USA): Common Core Standards, National Governor's Association, 2010), literacy and numeracy are core curriculum areas. Students with DLD may demonstrate particular difficulties with literacy (i.e. reading comprehension) due to challenges in oral language comprehension at word (vocabulary), sentence (syntax) and text level (oral narrative skills), which affects their ability to fully comprehend written materials (Bishop et al., 2017; Catts et al., 2005; Gillam & Gillam, 2016).

Current study

Spoken language competence is critical for success at school. This study systematically examines current empirical research related to the academic achievement of students with DLD, who by definition have a significant and persistent impairment in the understanding and use of language. The key findings may contribute to our

understanding of strengths and areas of need, in addition to informing support for students with DLD and guiding future research in this area. The research questions for the study are: (1) What academic achievements have been measured in current research? and (2) What are the reported academic achievements of students with DLD? We anticipate, given the strong links between spoken and written language, an emphasis on literacy skills in previous research. We predict, given the foundational role spoken language plays for literacy and accessing the curriculum more broadly, that the academic achievement of students with DLD will be lower than typically developing peers (i.e. those without diagnosed developmental conditions). In addition, we report on factors associated with outcomes where they are identified.

Method

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIMA) Checklist (Moher et al., 2009) to identify studies relevant to the academic achievement of school-aged students with DLD. The review was registered with the international Prospective Register of Systematic Reviews (PROSPERO) (registration number: CRD42018109323).

Database searches

Search terms to locate DLD research were based on regularly utilised terminology by Bishop (2010) and Reilly et al. (2014) and included: Language impair*, Specific language impair*, Primary language impair*, Language learning impair*, Language learning disab*, Language disorder*, Developmental language disorder*, Developmental language impair*, Developmental language disab*, Developmental language difficult*, Developmental dysphas*, Developmental aphas*, Language delay*, Spoken language impair*, Speech language impair* and Expressive phonology. Relevant education literature was identified using the terms school*, education*, academic achievement, academic outcome, and academic performance.

Searches were conducted using allied health and education electronic databases (CINAHL, Psycinfo, Embase, ERIC, Scopus) in June 2018 and again in June 2020. Procedures were identical for the searches by searching language impairment terms before adding Boolean operators, such as 'and', for the educational search terms. To focus on school-aged students, age range key words for database searches were also added (Child*, Student*). The searches were then filtered to exclude literature prior to 2008 to ensure relevance to current school and educational policy.

Inclusion and exclusion criteria

Studies were included if they were quantitative group studies published in a peer-reviewed journal in English between 2008 and 2020, and addressed the academic achievement of school-aged students with DLD. Studies were excluded if they were: published prior to 2008; qualitative, single case study designs or grey literature; focused on language outcomes (rather than academic achievement); investigated the effectiveness of specific interventions for students with DLD; or investigated populations with Language Disorder comorbid to a biomedical condition (e.g. Autism Spectrum Disorder) as the primary participants (Bishop et al., 2017).

Review process

An initial database search (2018) yielded 4,368 publications with 2,150 duplicates identified. The titles and abstracts of the remaining 2,218 were screened for relevance by the first author. In total, 2,162 publications were eliminated due to inclusion of populations with Language Disorder comorbid to a biomedical condition, language outcomes or investigated specific interventions. A random number generator was used to select approximately 10% of the 2,218 articles to evaluate reliability of inclusion/exclusion criteria. A second reviewer then reviewed 219 articles. There was 100% agreement on papers meeting the inclusion criteria ($n = 3$) and 91.09% agreement on papers meeting the exclusion criteria (214 out of 216). The two discrepancies focused on language outcomes, specific interventions, or a population with Language Disorder comorbid to a biomedical condition. This was resolved via discussion and these articles were subsequently excluded. Overall, agreement was substantial (Cohen's $\kappa = 0.74$). This review resulted in 56 full text publications being assessed for eligibility, which were read by the first author, and 22 additional studies were excluded because they (a) did not sufficiently describe the criteria utilised to confirm diagnosis of DLD (e.g. did not define the cut-off point for language scores) or (b) did not primarily investigate academic achievement for students with DLD. Additionally, the reference lists of identified publications were searched to ensure no relevant publications had been missed. No additional publications were identified.

In 2020, database searches were repeated for 2018–2020 and yielded a total of 1,057 publications with 235 duplicates identified. The titles and abstracts of the remaining 822 were screened for relevance by the first author. This resulted in 12 publications being assessed for eligibility with 2 being excluded. Figure 1 provides an overview of the complete process. Overall, 44 publications were included in this systematic review following application of inclusion and exclusion criteria.

Data extraction

Data extracted for each publication included: (a) research questions addressed in the study, (b) diagnosis and criteria for diagnosis, (c) recruitment details, (d) sample size, (e) demographics of population, including age, location and educational setting, (f) measurement tools used, and (g) outcomes relating to literacy, numeracy, or broader academics (encompassing multiple curriculum areas). The papers were reviewed for curriculum specific outcomes, including: reading, spelling, writing, narratives, and numeracy. In addition, variables associated with these outcomes (e.g. language, literacy, cognition) were qualitatively collated for each study.

Methodological quality

The quality of the papers was reviewed using the McMaster Critical Review Form for Quantitative Studies (Law et al., 1998). Six questions were used to determine study quality, including: (1) is the study design relevant to address the study aim?, (2) is the sample described in detail? (3) is the sample size justified?, (4) is there no identified potential sample/subject selection bias?, (5) are the outcome measures valid and reliable?, and (6) are the results reported in terms of statistical significance (including effect sizes)? The first author completed the quality review for all papers. A second blind reviewer, who had experience reviewing methodological quality, reviewed 20% of the papers with 83% consensus with the first author. Further discussion revealed a difference in view on whether the sample size was justified, and any potential sample/subject selection bias that may be present. These areas were reviewed until 100% consensus was reached.

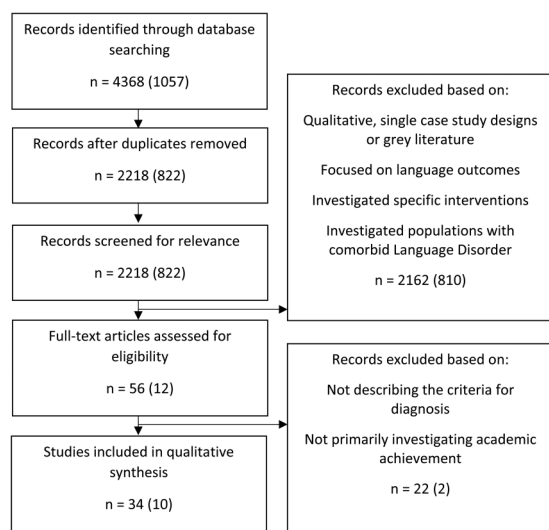


Figure 1. PRISMA flow diagram (Moher et al., 2009), with studies identified in 2018 (2020 additions in brackets).

Results

Study design and quality

Study quality varied; see Table 1. All studies incorporated a relevant design to address the study aims, and provided valid and reliable outcome measures. Most studies reported statistical significance (including effect sizes) with exceptions of Kouri (2020), Lammertink et al. (2020), and Stoeckel et al. (2013). Of the 44 studies, 15 studies had no potential sample or subject selection bias. Three of the studies justified the selection of sample size; 34 studies described their sample in detail.

Participant characteristics

Details of participant characteristics reported in each study varied; see Table 2. The age of participants recruited for each study ranged from 3 years; 8 months to 19 years with 11,745 participants across 44 studies. Three studies did not report specific age ranges or means. Diagnostic label use was inconsistent across studies. While the majority used Specific Language Impairment ($n = 27$), studies also referred to DLD ($n = 8$), Language Disorder ($n = 1$), Language Impairment ($n = 5$), and Language Learning Disability ($n = 2$). Of the 44 studies, 27 used the diagnostic category of SLI with at least ≥ 1 standard deviation (SD) below the mean on a standardised language assessment with non-verbal IQ $\geq$ SS 85 in the absence of hearing deficits and comorbid conditions affecting language.

Setting

All 44 studies reported on the educational placement of participants. Enrolment was mixed across primary only (33 studies), secondary only (2 studies) and both primary and secondary (9 studies). Fourteen studies reported they recruited participants from a specialist setting, including special schools and language units.

Country

While publication in English was an inclusion criterion, 16 studies were conducted in countries where English was not the national language, including: Brazil, Chile, Denmark, Finland, France, Italy, the Netherlands, and Spain. Nine of these studies included monolingual national speakers, two included bilingual national speakers, and the linguistic status of the remaining five were not stated. Most data collection was undertaken in predominantly English-speaking countries with 12 studies conducted in the UK, 12 in the USA, three in Canada, and one that took place across sites in the USA and Canada. Sixteen of these studies included monolingual English speakers only, two included

Table 1. Methodological quality of studies.

Author	Alignment of design/aim	Details of sample	Justification of sample size	Sample bias	Validity and reliability	Statistically significant
<i>Broad academic achievement</i>						
Aguilar-Mediavilla et al. (2019)	Y	Y	Y	Y	Y	Y
Alloway et al. (2017)	Y	Y	N	N	Y	Y
Conti-Ramsden et al. (2009)	Y	Y	N	N	Y	Y
Durkin et al. (2015)	Y	Y	Y	N	Y	Y
<i>Broad literacy achievement</i>						
Freed et al., (2011)	Y	Y	N	N	Y	Y
Snowling, et al. (2016)	Y	Y	N	Y	Y	Y
Tambyraja, et al. (2015)	Y	Y	N	Y	Y	Y
van Weerdenburg et al. (2009)	Y	N	N	Y	Y	Y
<i>Reading</i>						
Blom et al. (2017)	Y	N	N	N	Y	Y
Brizzolara et al. (2011)	Y	Y	N	N	Y	Y
Catts et al. (2008)	Y	Y	N	Y	Y	Y
Catts et al. (2012)	Y	Y	N	Y	Y	Y
Coloma et al. (2015)	Y	Y	N	Y	Y	Y
Coloma et al. (2020)	Y	Y	N	N	Y	Y
De Groot et al. (2015)	Y	Y	N	N	Y	Y
Gough Kenyon et al. (2018)	Y	Y	N	N	Y	Y
Isoaho et al. (2016)	Y	N	N	N	Y	Y
Kouri (2020)	Y	N	N	N	Y	N
Lammertink et al. (2020)	Y	N	N	N	Y	N
Palikara et al. (2011)	Y	Y	N	N	Y	Y
Pedott et al. (2017)	Y	Y	N	N	Y	Y
Zourou et al. (2010)	Y	Y	N	N	Y	Y
<i>Spelling</i>						
Broc et al. (2013)	Y	Y	N	N	Y	Y
Cordewener et al. (2012)	Y	N	N	N	Y	Y
Deacon et al. (2014)	Y	Y	N	N	Y	Y
Godin, et al. (2018)	Y	N	N	N	Y	Y
Larkin et al. (2013)	Y	Y	N	N	Y	Y
McCarthy et al. (2012)	Y	Y	N	Y	Y	Y
Werfel et al. (2019)	Y	Y	Y	Y	Y	Y
<i>Writing</i>						
Brouwer (2012)	Y	Y	N	Y	Y	Y
Favart et al. (2016)	Y	Y	N	N	Y	Y
Koutsoftas (2016)	Y	Y	N	Y	Y	Y
Koutsoftas & Gray (2012)	Y	Y	N	Y	Y	Y
Stoeckel et al. (2013)	Y	Y	N	Y	Y	N

(continued)

Table 1. Continued.

Author	Alignment of design/aim	Details of sample	Justification of sample size	Sample bias	Validity and reliability	Statistically significant
Stuart et al. (2020)	Y	Z	Z	Z	Y	Y
Williams et al. (2013)	Y	Y	Z	Z	Y	Y
<i>Narratives</i>						
Blom & Boerma (2016)	Y	Y	Z	Z	Y	Y
Colozzo et al. (2011)	Y	Y	Z	Y	Y	Y
Duinmeijer, et al. (2012)	Y	Y	Z	Z	Y	Y
Epstein & Phillips (2009)	Y	Z	Z	Z	Y	Y
Govindarajan & Paradis (2019)	Y	Z	Z	Z	Y	Y
<i>Numeracy achievement</i>						
Alt et al. (2014)	Y	Y	Z	Y	Y	Y
Durkin et al. (2013)	Y	Y	Z	Z	Y	Y
Fyfe et al. (2019)	Y	Y	Z	Z	Y	Y

Is the study design relevant to address the study aim?; Is the sample described in detail?; Is the sample size justified?; Is there no identified potential sample/ subject selection bias?; Are the outcome measures valid and reliable?; Are the results reported in terms of statistical significance (including effect sizes)?.

bilingual speakers, and a further nine with the main language of participants not stated.

Areas of academic achievement

The first research question investigated the academic achievements that have been measured in current research. As outlined in Table 2, the studies described below focused on a range of academic achievements. Research relating to (a) broad academic, (b) literacy and (c) numeracy achievement was identified. The majority of the studies (84%) addressed literacy skills in students with DLD. Reading, spelling, writing, and narratives were frequently reported as specific literacy skills. These areas of academic achievement will be discussed in turn to answer our second research question.

Broad academic achievement

Four studies investigating primary and secondary students with DLD found they achieved lower results compared to typically developing peers across multiple curriculum areas. In a longitudinal study, Aguilar-Mediavilla et al. (2019) reported the academic achievement of 14 Spanish-Catalan students (M age = 12.40 years) with DLD, who were recruited at age 5. Students with DLD achieved significantly lower results (large effect size) than typically developing peers across Science, Art, Physical Education, Languages (Spanish, Catalan, and English), and Mathematics. In a larger study of 120 adolescents (M age = 17.33 years), students with DLD achieved lower results than typically developing peers on national examinations in English, Maths, and Science (Conti-Ramsden et al., 2009). Spoken language, non-verbal IQ, and literacy abilities at 11 were found to be strong predictors of performance at 17 years of age.

To investigate academic achievements in more detail, Durkin et al. (2015), measured the influence of performance IQ and language ability across receptive and expressive domains (i.e. performance on a battery of standardised assessments) on English, Mathematics, and Science. They found that language ability was a strong predictor of success in English, while performance IQ was the strongest predictor for Mathematics. Both language ability and performance IQ were strong predictors of outcomes in Science (large effect size). The impact of IQ was also supported in a study by Alloway et al. (2017) who investigated the impact of IQ on the academic achievement of 40 students with DLD (M age = 9.96 years) in the areas of spelling and Mathematics, and found they performed significantly lower than typically developing peers.

Broad literacy achievement

Literacy achievement was evaluated in 37 out of 44 studies (84%). Four of these studies used composite measures

Table 2. Overview of studies included in review by area of academic achievement.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
<i>I. Broad academic achievement</i>							
Aguilar-Medavilla et al. (2019)	n = 28 DLD: n = 14 TD: n = 14	DLD: Time 1 – M = 5.73 Time 2 – M = 12.40 TD: Time 1 – M = 5.84 Time 2 – M = 11.90	Developmental Language Disorder Criteria: • Language ability ($\geq$ 1SD below the mean on a standardised language assessment) • Non-verbal IQ (>85) • No hearing deficit • No comorbid conditions affecting language Diagnostic Assessment: • Navarra Oral Language Test-Revised • Wechsler Preschool and Primary Scale of Intelligence • Grammatical structures comprehension test • Developmental Neuropsychological Assessment (Spanish adaption; sentence repetition subtest)	• Official academic reports, including Science and Social Knowledge, Artistic Education, Physical Education, Spanish language, Catalan language, English language and Mathematics	Primary	Spain	Bilingual (Catalan-Spanish)
Alloway et al. (2017)	n = 114 SLI: n = 40 TD: n = 50 Dyslexia: n = 24	SLI: M = 9.96 TD: M = 9.87 Dyslexia: M = 11.28	Specific Language Impairment Criteria: • Languages ability ($SS \leq 85$) • No hearing deficit • No Attention Deficit Disorder or Attention Deficit Hyperactivity Disorder Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals • Automated Working Memory Assessment • Wechsler Abbreviated Scale of Intelligence	• Wechsler Individual Achievement Test – 2 nd Edition	Primary	United Kingdom	Not stated
Conti-Ramsden et al. (2009)	n = 241 SLI: n = 120 TD: n = 121	SLI: M = 17.33 TD: M = 17.33	Specific Language Impairment Criteria: • Language ability ($\geq$ 1SD below the mean at 1 time point) • Performance IQ (≥ 80) • No hearing deficit • No comorbid condition affecting language Assessment at Time 1 (Key Stage 2):	• Key Stage 2, Key Stage 3 and Key Stage 4 examination results, including English, Mathematics and Science	Secondary (including specialist settings)	United Kingdom	Monolingual (English)

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Durkin et al. (2015)	n = 176	Time 1: M = 7.08 Time 2: M = 10.91	- Expressive Vocabulary Test - Clinical Evaluation of Language Fundamentals – Revised (word associations, recalling sentences subtests) - British Picture Vocabulary Scale – 2nd Edition - Test for Reception of Grammar - Wechsler Objective Reading Dimensions (single word reading, reading comprehension subtests) - Wechsler Intelligence Scale for Children – 3rd Edition (short form)	National Curriculum Key Stage 2 teacher assessment and test results	Primary (including specialist settings)	United Kingdom	Monolingual (English)/ Bilingual n = 22 (languages other than English at home)
			Assessment at Time 2 (Key stage 4): - Clinical Evaluation of Language Fundamentals – Revised (recalling sentences, word classes subtests) - Wechsler Intelligence Scale for Children – 3rd Edition - Wechsler Objective Reading Dimensions (single word reading, reading comprehension subtests) Specific Language Impairment Criteria: - Language ability (> 1SD below the mean) - Performance IQ (within 1SD of the mean) - No hearing deficit - No comorbid condition affecting language Assessment at Time 1: - Test for Reception of Grammar - Bus Story Test - Raven's Coloured Progressive Matrices Assessment at Time 2: - Test for Reception of Grammar - Clinical Evaluation of Language Fundamentals – Revised (recalling sentences subtest) - Wechsler Intelligence Scale for Children – 3rd Edition (block				

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
<i>2. Broad literacy achievement</i>							
Freed et al., (2011)	n = 71 SLI: n = 12 Pragmatic language impairment: n = 59	SLI: M = 7.75 Pragmatic language impairment: M = 8.50	design, picture completion subtests) Specific Language Impairment Criteria: • Language ability (SS-8 on Assessment of Comprehension and Expression and/or SS-80 on the Test for Reception) • Non-verbal IQ (average range) • No hearing deficit • No speech sound disorder • No comorbid condition affecting language Diagnostic Assessment: • Children's Communication Checklist – 2nd Edition • Raven's Coloured Progressive Matrices • Assessment of Comprehension and Expression (naming subtest) • Test for Reception of Grammar – 2nd Edition • Clinical Evaluation of Language Fundamentals – 4th Edition	• Wechsler Individual Achievement Test – 2nd Edition (word reading, reading comprehension, written expression subtests)	Primary	United Kingdom	Monolingual (English)
Snowling et al. (2016)	n = 220 Resolving LI: n = 45 Emerging LI: n = 21 Persisting LI: n = 42 TD: n = 145	Resolving LI: Time 1 – M = 3.66 Time 3 – M = 5.66 Time 5 – M = 8.16 Emerging LI: Time 1 – M = 3.66 Time 3 – M = 5.58 Time 5 – M = 7.75 Persisting LI: Time 1 – M = 3.66 Time 3 – M = 5.58 Time 5 – M = 7.91 TD: Time 1 – M = 3.75 Time 3 – M = 5.66 Time 5 – M = 8.25	Language Impairment Criteria at Time 1: • Language abilities (failed 2 out of 4 standardised language assessments) • Non-verbal IQ (average range) Assessment at Time 1: • Clinical Evaluation of Language Fundamentals: Preschool – 2nd Edition or Clinical Evaluation of Language Fundamentals – 4th Edition • Test of Early Grammatical Impairment Assessment at Time 3 and 5: • Clinical Evaluation of Language Fundamentals: Preschool – 2nd	• Expressive One Word Picture Vocabulary Test • Receptive One Word Picture Vocabulary Test • York Assessment of Reading Comprehension (letter knowledge, phoneme deletion, passage reading subtests) • Rapid automatized naming • Single Word Reading Test • Graded Nonword Reading Test • Wechsler Individual Assessment Test – 2nd Edition (spelling subtest)	Primary	United Kingdom	Not stated

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Tambyraja, et al. (2015)	n = 272	M = 6.43	Edition or Clinical Evaluation of Language Fundamentals – 4th Edition • Test of Early Grammatical Impairment • Test for Reception of Grammar – 2nd Edition Language Impairment Criteria: • Language ability ($\geq 2SD$ below the mean on a standardised language assessment) • Cognition (average) Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – 4th Edition (word structure, concepts & following directions subtests)	• Woodcock-Johnson Tests of Achievement – 3rd Edition (picture vocabulary, letter-word identification subtests) • Catts deletion task	Primary	United States of America	Not stated
van Weerdenburg et al. (2009)	n = 137	Time 1: M = 8.41	Specific Language Impairment Criteria: • Language ability • Non-verbal IQ (average) • No hearing deficit • No comorbid condition affecting language • No behavioural difficulties Diagnostic Assessment: • Dutch Language Proficiency Test for All Children • Raven's Coloured Progressive Matrices	Time 1: • Articulation • Definition • Function words • Kaufman-Assessment Battery for Children (word order, number recall) • Lindamood Auditory Conceptualisation • Morphology • Nonword repetition • Productive vocabulary • Receptive vocabulary • Sentence production • Story comprehension • Syllable series repetition • Syntactic patterns • Word repetition Time 2: • Word decoding 1 • Word decoding 2 • Word decoding 3 • One Minute Test Decoding • Nonword decoding • Reading comprehension	Primary (specialist setting)	Netherlands	Monolingual (Dutch)
2a. Reading Blom et al. (2017)	n = 118 SLI: n = 31 TD: n = 61 Deaf and	SLI: M = 14.1 TD: M = 11.2 Deaf and hard-of-hearing: M = 13.9	Specific Language Impairment Criteria: • Language ability (severe impairment)	• Pre-test questionnaire • Post-test questionnaires • Two-syllable version of the	Primary, secondary	Netherlands	Not stated

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
	hard-of-hearing: $n = 26$		- No hearing deficit Diagnostic Assessment: - Not stated	paper-and-pencil lexical decision task (Van Bon, 2009) - Peabody Picture Vocabulary Test – 3rd Edition (Netherlands) - Forward and backward digit span task (Kort et al., 2005) - Corsi Block task - Raven's Standard Progressive Matrices test			
Brizzolara et al. (2011)	$n = 48$ SLI: $n = 16$ TD: $n = 32$	Time 1: $M = 5.08$ Time 2: SLI – $M = 16.41$ TD – $M = 16.33$	Specific Language Impairment Criteria: - Language ability (impairment on 1 or more standardised assessments of expressive and/or receptive language) - Performance IQ (≥ 85) - No sensory, neurological or psychiatric deficits Assessment at Time 1: - Leiter International Performance Scale - Test di Comprensione Grammaticale per Bambini (receptive grammar) - Test di Vocabolario Figurato (expressive vocabulary) - Test di Ripetizione Grammaticale per Bambini (sentence repetition) - Language samples - Test di Articolazione (expressive phonology) - Test of word serial recall (Brizzolara and Casalini, 2002) Assessment at Time 2: - Peabody Picture Vocabulary Test - Wechsler Intelligence Scale for Children – Revised or Wechsler Adult Intelligence Scale (comprehension subtests) - Test di Vocabolario Figurato (expressive vocabulary) - Sentence repetition - Language sample - Batterie per la Valutazione dell'Attenzione Uditiva e della Memoria di Lavoro Fonologica	Time 2: - Measure of test comprehension and decoding speed (in seconds) using a standardised passage - Diagnosi dei Disturbi Ortografici in età evolutiva (spelling)	Secondary	Italy	Not stated

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Catts et al. (2008)	n = 604 LI: n = 225 TD: n = 379	Grades 2-10 (no age range or mean stated)	nell/Etá Evolutiva (phonological working memory) Language Impairment Criteria: - Language abilities (≥ 1.25 SD below the mean on ≥ 2 out of 5 language composite scores) - No sensory or neurological deficits Diagnostic Assessment: - Test of Language Development – 2: Primary - Narrative story task (Culatta, Page & Ellis, 1983) - Wechsler Preschool and Primary Scale of Intelligence – Revised	- Woodcock Reading Mastery Tests – Revised - Gray Oral Reading Test – 3rd Edition - Diagnostic Achievement Battery – 2nd Edition (reading comprehension subtest) - Qualitative Reading Inventory – 2nd Edition	Primary, secondary	United States of America	Monolingual (English)
Catts et al. (2012)	n = 493 SLI: n = 100 TD: n = 246 Specific non-verbal cognitive deficit: n = 72 Non-specific language impairment: n = 75	Grades 2-10 (no age range or mean stated)	Specific Language Impairment Criteria: - Language abilities (≥ 1.25 SD below the mean on ≥ 2 out of 5 language composite scores) - No sensory or neurological deficits Diagnostic Assessment: - Test of Language Development – 2: Primary - Wechsler Preschool and Primary Scale of Intelligence-Revised	- Woodcock Reading Master Test – Revised (passage comprehension subtest) - Gray Oral Reading Test – 3 (comprehension subtest) - Diagnostic Achievement Battery – 2nd Edition - Qualitative Reading Inventory – 2nd Edition - Peabody Picture Vocabulary Test-Revised	Primary, secondary	United States of America	Monolingual (English)
Coloma et al. (2015)	n = 19 SLI: n = 10 TD: n = 9	SLI: M = 6.5 TD: M = 6.75	Specific Language Impairment Criteria: - Language abilities (low performance on two standardised tests with Chilean norms) - Non-verbal IQ (>25th percentile) - No hearing deficit Diagnostic Assessment: - Exploratory Test of Spanish Grammar - Raven's Coloured Progressive Matrices	- Language sample - Test for Evaluating Narrative Development - Prueba de Complejidad de Lectura (reading decoding and reading comprehension)	Primary	Chile	Monolingual (Spanish)

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Coloma et al. (2020)	n = 48 SLI: n = 24 TD: n = 24	SLI: Time 1: M = 7.7 Time 2: M = 9.6 TD: Time 1: M = 7.5 Time 2: M = 9.6	Specific Language Impairment Criteria: • Language abilities (low performance on two standardised language assessments with Chilean norms) • Non-verbal IQ (>25th percentile) • No hearing deficit	• Woodcock-Munoz Language Survey - Revised (Spanish version; vocabulary, letter-word identification, passage comprehension subtests) • Narrative Development Assessment • Test of Reading and Writing in Spanish (passage comprehension subtest)	Primary (including specialist setting)	Chile	Monolingual (Spanish)
De Groot et al. (2015)	n = 1267 SLI: n = 26 TD: n = 1090 Reading disability: n = 126 Reading disability + SLI: n = 30	SLI: M = 10.7 TD: M = 10.3 Reading disability: M = 10.6 Reading disability + SLI: M = 10.2	Diagnostic Assessment: • Exploratory Test of Spanish Grammar • Raven's Coloured Progressive Matrices Specific Language Impairment Criteria: • Language ability ($\geq 1.5SD$ below the mean on two standardised language assessments) • IQ (>80) • No hearing deficit • No visual deficit • No comorbid conditions affecting language • Six months of speech therapy with no significant improvements • Reduced social-educational participation Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – 4 th Edition (Netherlands) • Dutch Language Test for Children • Wechsler Non Verbal Scale of Ability (Netherlands), Dutch Snijders-Oomen Non Verbal Test of Intelligence or Wechsler Intelligence Scale of Cognition – 3 rd Edition (Netherlands)	• Continu Benoemen en Woorden Lezen (Test for Continuous Naming and Word Reading) • De Klepel • Fonemische Analyse Test Revised	Primary, secondary (including specialist settings)	Netherlands	Not stated
Gough Kenyon et al. (2018)	n = 44 DLD: n = 14 TD: n = 16 Low language proficiency: n = 14	DLD: M = 11.15 TD: M = 11.26 Low language proficiency: M = 11.24	Developmental Language Disorder Criteria: • Language ability ($\geq 1.25SD$)	• Test of Word Reading Efficiency - 2nd Edition (sight word efficacy, phonemic decoding efficacy subtests) • Wechsler Individual	Primary	United Kingdom	Not stated

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Isoaho et al. (2016)	n = 43	7.00-10.00	below the mean on a receptive and expressive language task)	Achievement Test - 2nd Edition (reading comprehension subtest)	Primary	Finland	Monolingual (Finnish)
			• Previous diagnosis of Language Disorder or Speech, Language and Communication Need • Receiving education support				
Kouri (2020)	n = 60 DLD: n = 28 TD: n = 32 Adults: n = 19	DLD (Year 2-3): M = 8.75 DLD (Year 4-5): M = 10.41	Diagnostic Assessment:		Primary	United States of America	Monolingual (English)
			• Clinical Evaluation of Language Fundamentals – 4th Edition (recalling sentences, word classes subtests) • Children's Communication Checklist – 2nd Edition • Test for Reception of Grammar – 2nd Edition • Wechsler Abbreviated Scale of Intelligence – 2nd Edition (matrix reasoning subtest)	• Ala-aasten Lukutesti (Finnish reading test) • Boston naming test (Finnish version) • Test for rapid serial naming (Finnish version)			
Lammertink et al. (2020)	n = 72 DLD: n = 36 TD: n = 36	DLD: M = 9.08 TD: M = 9.08	Specific Language Impairment Criteria:		Primary	Netherlands	Not stated
			• International Classification of Disease – 10th Edition (categories F80.1 or F80.2)	• 44 different English phonograms			
Lammertink et al. (2020)	n = 72 DLD: n = 36 TD: n = 36	DLD: M = 9.08 TD: M = 9.08	Diagnostic Assessment:		Primary	Netherlands	Not stated
			• Not stated • Developmental Language Disorder • Language ability ($\geq$ 1SD below the mean on 2 or more subtests and $\geq$ 1SD below the mean on receptive and/or expressive language) • History of speech and language services • History of academic difficulties	• Visual Statistical Learning task • Word reading test (Brus & Voeten, 1979) • De Klepel			
Lammertink et al. (2020)	n = 72 DLD: n = 36 TD: n = 36	DLD: M = 9.08 TD: M = 9.08	Diagnostic Assessment:		Primary	Netherlands	Not stated
			• Clinical Evaluation of Language Fundamentals – 4th Edition • Test of Non-verbal Intelligence – 3rd Edition	• 44 different English phonograms			
Lammertink et al. (2020)	n = 72 DLD: n = 36 TD: n = 36	DLD: M = 9.08 TD: M = 9.08	Developmental Language Disorder Criteria:		Primary	Netherlands	Not stated
			• Language ability ($\geq$ 1.5SD below the mean on 2 out of 4 subtests	• Visual Statistical Learning task • Word reading test (Brus & Voeten, 1979) • De Klepel			

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Palikara et al. (2011)	n = 98 SLI: n = 56 TD: n = 42	Childhood: M = 8.00 Adolescence: M = 13.91	of a standardised language assessment) • Non-verbal IQ ($\geq 17^{\text{th}}$ percentile score on standardised assessment) • No hearing deficit • No comorbid condition affecting language • One parent who is a native Dutch speaker Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – 4 th Edition (Sentence Recall subtest) • Peabody Picture Vocabulary Test – 4 th Edition • Raven Coloured Progressive Matrices	• Schoolvaardigheidstoets spelling (spelling test) • Dot Matrix Forward • Dot Matrix Backward • Tel Mee! TEA-CH			
			Specific Language Impairment Criteria: • Language abilities (significant difficulties) • Non-verbal IQ (average range) • No comorbid conditions affecting language Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – UK (formulated sentences, listening to paragraphs subtests) • Test for Reception of Grammar – 2 nd Edition • British Picture Vocabulary Scale 2 • British Ability Scales 2 (matrices subtest)	• British Ability Scales 2 (word reading scale) • Test of Word Reading Efficiency (sight word efficiency, phonetic decoding efficiency subtests) • Wechsler Objective Reading Dimensions (reading comprehension subscale)	Primary, secondary (including specialist setting)	United Kingdom	Not stated
Pedott et al. (2017)	n = 60 SLI: n = 12 TD: n = 48	7.00–9.91 (2nd or 3rd grade)	Specific Language Impairment Criteria: • Language ability (2SD below the mean on 2 or more standardised language assessments) • No hearing deficit • Non-verbal IQ (average range) • No comorbid conditions affecting language • Confirmed diagnosis of SLI	• Visual Phonological Sensitivity Test (equal alliteration, equal rhyme identification subtests)	Primary	Brazil	Monolingual (Brazilian Portuguese)

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Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Zourou et al. (2010)	n = 40 SLI: n = 20 TD: n = 20	Time 1 – Group 1: M = 5.25 Group 2: M = 6.16	- Undergoing speech therapy - Diagnostic Assessment: - Teste de Linguagem Infantil (child language test) - Specific Language Impairment Criteria: - Language ability ($\geq$ 1SD below the mean on 2 or more standardised language assessments) - Performance IQ (>85) - No hearing deficit - No visual deficit - Diagnostic Assessment: - Les nouvelles épreuves pour l'examen du langage (New Tasks for Language Evaluation) - Battery for Rapid Evaluation of Cognitive Functions neuropsychological test (picture completion subtest) - Test of Grammatical Closure	Time 1: - Forced-choice phoneme-deletion task (Sanchez et al., 2007) Time 2: - Outil de dépistage des dyslexies (Tool for Dyslexia Screening) - Kaufman-ABC (reading-decoding, reading-understanding subtests) - Battery for Rapid Evaluation of Cognitive Functions neuropsychological test (spelling subtest)	Primary	France	Monolingual (French)
2b. Spelling Broc et al. (2013)	n = 72 SLI: n = 24 TD: n = 48	Group 1 – SLI: M = 8.94 Group 2 – SLI: M = 14.33 Group 3 – TD: M = 8.85 Group 4 – TD: M = 14.05	- Specific Language Impairment Criteria: - Language abilities ($\geq$ 1.25SD below the mean on two standardised language assessments; met ICD-10 classification for expressive language disorder (F80.1)) - Performance IQ (>80) - No comorbid conditions - Diagnostic Assessment: - Bilan Informatisé du Langage Oral (computerised assessment of oral language) - Nouvelles Épreuves pour l'Examen du Langage (New Tasks for the Language Assessment) - Langage Oral, Langage Ecrit,	- Outil de Dépistage des Dyslexies (dyslexia screening tool; word dictation situation) - Developing Literacy in Different Contexts and Different Languages 1997-2001 project inspired the communicative narrative situation	Primary, secondary	France	Monolingual (French)

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Cordewener et al. (2012)	n = 98 SLI: n = 59 TD: n = 39	SLI: M = 6.85 TD: M = 6.64	Mémoire et Attention (oral language, written language, memory and attention) • Wechsler's Intelligence Scale Specific Language Impairment Criteria: • No hearing deficit Diagnostic Assessment: • Not stated • Specific Language Impairment Criteria: • Language ability ($\geq$ 1SD below the mean on Clinical Evaluation of Language Fundamentals – 4 th Edition Core Language Score) • Non-verbal IQ (>85) Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – 4 th Edition • Test of Non-verbal Intelligence	• Grapheme-knowledge test • Scale Progression in Spelling Abilities 1 Dictation 2 • Spelling task developed by Deacon & Dhooge (2010) • Morphological awareness task based on Carlisle (1988)	Primary (specialist setting only)	Netherlands	Monolingual (Dutch)/ Bilingual
Deacon et al. (2014)	n = 51 SLI: n = 17 TD: n = 34	Group 1 – SLI: M = 9.16 Group 2 – TD: M = 7.41 Group 3 – TD: M = 9.00	• Developmental Language Disorder Criteria: • Language ability • Non-verbal IQ (within normal limits) • No hearing deficit • No comorbid ADHD Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – 4 th Edition (French Canadian version; phonological awareness subtest) • Peabody Picture Vocabulary Test (French Canadian version) • Test of Non-verbal Intelligence - 3rd Edition	• Experimental dictation spelling test	Primary (including specialist setting)	Canada	Monolingual (English)
Godin, et al. (2018)	n = 32 DLD: n = 16 TD: n = 15	Group 1 – DLD: M = 8.41 Group 2 – DLD: M = 8.58 Group 3 – TD: M = 7.66	• Specific Language Impairment Criteria: • Language ability ($\geq$ 1SD below the mean on 2 out of three standardised language assessments) • Non-verbal IQ (within the average range)	• Non-word spelling task (Bourassa & Treiman, 2003) • Morphological spelling task	Primary (including specialist setting)	United Kingdom	Monolingual (English)
Larkin et al. (2013)	n = 45 SLI: n = 15 TD: n = 30	Group 1 – SLI: M = 9.41 Group 2 – TD: M = 7.58 Group 3 – TD: M = 9.41					

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Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
McCarthy et al. (2012)	n = 129 SLI: n = 43 TD: n = 47 Dyslexia: n = 21 SLI + Dyslexia: n = 18	Kindergarten, 2nd, 4th, 8th and 10th Grade (no age range or mean stated)	- No hearing deficit Diagnostic Assessment: - Test for the Reception of Grammar – 2nd Edition - British Picture Vocabulary Scale – 3rd Edition - Clinical Evaluation of Language Fundamentals – 4th Edition (recalling sentences subtest) - British Ability Scales – 2nd Edition Specific Language Impairment Criteria: - Language ability (below average composite scores in Kindergarten) - Non-verbal IQ (average) - No comorbid conditions affecting language Diagnostic Assessment: - Test of Language Development – Primary:2 - Clinical Evaluation of Language Fundamentals – 3rd Edition - Peabody Picture Vocabulary Test – Revised - Comprehensive Receptive and Expressive Vocabulary Test - Wechsler Intelligence Scale for Children – 3rd Edition - Woodcock Reading Mastery Test – Revised	Test of Written Spelling - 3rd Edition	Primary, secondary	United States of America	Monolingual (English)
Werfel et al. (2019)	n = 64 SLI: n = 32 TD: n = 32	SLI: M = 9.33 TD: M = 8.76	Specific Language Impairment Criteria: - Language ability (SS < 85 on Core Language Score of Clinical Evaluation of Language Fundamentals – 4th Edition) - Non-verbal IQ (SS > 85) - No hearing deficit Diagnostic Assessment: - Clinical Evaluation of Language Fundamentals – 4th Edition (subtests to calculate the Core Language Score)	- Test of Written Spelling - 4th Edition - Comprehensive Test of Phonological Process - Test of Morphological Structure - Orthographic Constraints Test - Peabody Individual Achievement Test – Revised (spelling recognition subtest) - Peabody Picture Vocabulary Test – 4th Edition	Primary	United States of America	Monolingual (English)

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Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
2c. Writing Brouwer (2012)	n = 272 LI: n = 33 TD: n = 239	LI + TD: Group 1 – M = 8.00 LI + TD: Group 2 – M = 9.00 LI + TD: Group 3 – M = 10.00	• Test of Non-verbal Intelligence – 4th Edition - Language Impairment Criteria: • Language ability (>20 SS points lower on 1 or more standardised language assessments) • Performance IQ (>85) • No hearing deficit • No comorbid conditions • Significant impact on academic achievement - Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – 4th Edition • Comprehensive Assessment of Spoken Language • Test of Language Development: Primary – 4th Edition • Wechsler Intelligence Scale for Children – 4th Edition • Comprehensive Test of Non-verbal Intelligence – 2nd Edition	• Test of Written Spelling - 4th Edition • Adapted version of Bouffard et al.'s scale (2003) • Academic Self-Regulation Questionnaire	Primary	United States of America	Not stated
Favart et al. (2016)	n = 72 SLI: n = 24 TD: n = 48	Group 1 – SLI: M = 8.94 Group 2 – SLI: M = 14.33 Group 3 – TD: M = 8.85 Group 4 – TD: M = 14.05	- Specific Language Impairment Criteria: • Language ability (≥ 1.25 SD below the mean on a standardised language assessment; receptive language within normal limits) • Performance IQ (>80) • No comorbid conditions affecting language - Diagnostic Assessment: • Bilan Informatisé du Langage Oral au cycle 2 (Computerised Assessment of Oral Language for 5-7 year old children) • Nouvelles Epreuves pour l'Examen du Langage (New Tasks for the Language Assessment) • Bilan Informatisé due Langage Oral 3 et au Collège (Computerised Assessment of	• Narrative composition task inspired by Berman (2005), Berman et al. (2002), Berman and Verhoeven (2002).	Primary, secondary	France	Monolingual (French)

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Koursoftas (2016)	n = 64 LLD: n = 32 TD: n = 32	LLD: M = 10.94 TD: M = 10.88	Oral Language for 8-10 year old children, and at middle school)				
			- Batterie Language Oral et Ecrite, - Mémoire, Attention (Test Oral and Written Language, Memory, Attention) - Wechsler Intelligence Scale for Children – 3rd Edition				
Koursoftas & Gray (2012)	n = 56 LLD: n = 26 TD: n = 30	LLD: M = 10.77 TD: M = 10.35	Language Learning Disability Criteria:	- Parent & Teacher Questionnaire - Group Reading and Diagnostic Evaluation (sentence comprehension, paragraph comprehension, vocabulary subtests) - Writing process task	Primary, specialist setting	United States of America	Monolingual (English)
			- Language ability (not stated) - Performance IQ (within normal limits) - No hearing deficit - Accessing specialised education services				
Stoeckel et al. (2013)	n = 5,694 Speech-language impairment: n = 295 TD: n = 5,399	M = 19.00	Diagnostic Assessment:				
			- Not stated - Language Learning Disability Criteria: - Language ability - Non-verbal IQ (within normal limits) - No hearing deficit - No grade repeated - Receiving special education support or therapy from a speech pathologist or both	Handwriting screener adapted from Graham et al. (1998)	Primary	United States of America	Monolingual (English)
Stuart et al. (2020)	n = 90 Group 1 – DLD: n = 30 Group 2 – TD: n = 30 Group 3 – TD: n = 30	Group 1 – DLD: M = 9.91 Group 2 – TD: M = 9.83 Group 3 – TD: M = 8.08	Diagnostic Assessment:	Clinical Evaluation of Language Fundamentals – 4th Edition	Writing performance measures	United States of America	Not stated
			Speech-Language Impairment Criteria:	- Language ability ($\geq 2SD$ below the mean on standardised language assessments) - IQ (> 50) - No hearing deficit	Primary, secondary		
Stuart et al. (2020)	n = 90 Group 1 – DLD: n = 30 Group 2 – TD: n = 30 Group 3 – TD: n = 30	Group 1 – DLD: M = 9.91 Group 2 – TD: M = 9.83 Group 3 – TD: M = 8.08	Diagnostic Assessment:	- Test of Language Development - Peabody Picture Vocabulary Test - Woodcock-Johnson - Stanford-Binet	Test of Word Reading Efficiency	United Kingdom	Monolingual (English)
			Developmental Language Disorder Criteria:	Language ability ($\geq 2SD$ below	Wechsler Objective Language Dimensions		

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Williams et al. (2013)	n = 45 SLI: n = 15 TD: n = 30	Group 1 – SLI: M = 9.41 Group 2 – TD: M = 9.33 Group 3 – TD: M = 7.50	the mean on a standardised language assessment)				
			- Non-verbal IQ (>85) - Experiencing significant language-based learning needs Diagnostic Assessment: - Clinical Evaluation of Language Fundamentals – 4th Edition (UK) - British Picture Vocabulary Scales – 2nd Edition - British Ability Scales – 2nd Edition				
Williams et al. (2013)	n = 45 SLI: n = 15 TD: n = 30	Group 1 – SLI: M = 9.41 Group 2 – TD: M = 9.33 Group 3 – TD: M = 7.50	Specific Language Impairment	- Wechsler Objective Language Dimensions - Children's Test of Nonword Repetition	Primary (including specialist setting)	United Kingdom	Not stated
			Criteria: - Language ability ($\leq$1SD below the mean on 2 out of 3 standardised language assessments) - Non-verbal IQ (within normal limit) Diagnostic Assessment: - Test for the Reception of Grammar – 2nd Edition - British Picture Vocabulary Scale – 3rd Edition - Clinical Evaluation of Language Fundamentals – 4th Edition (recalling sentences subtest) - British Ability Scales – 2nd Edition (Matrices subtest)				
2d. Narratives Blom & Boerma (2016)	n = 129 LI: n = 84 TD: n = 45	LI: Time 1 – M = 5.97 Time 2 – M = 6.91 TD: Time 1 – M = 5.89 Time 2 – M = 6.84	Language Impairment	- Multilingual Assessment Instrument for Narratives - Peabody Picture Vocabulary Test – 3rd Edition (Netherlands) - Automated Working Memory Assessment (adapted) - Continuous Performance Task	Primary (including special settings)	Netherlands	Monolingual (Dutch)
			Criteria: - Language ability ($\geq$2SD below the mean on standardised language assessment or $\geq$1.5SD below the mean on 2 out of 4 subscales on >2 standardised language assessments) - Non-verbal IQ (>70) - No hearing deficit - No speech sound disorder Diagnostic Assessment: - Taaltoets Alle Kinderen (Language Test All Children) - Wechsler Non-verbal Scale of Ability				

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Colozzo et al. (2011)	n = 66 SLI: n = 33 TD: n = 33	Canada: SLI: M = 9.00 TD: M = 9.16 USA: SLI: M = 7.50 TD: M = 7.41	Specific Language Impairment Criteria (Canada): • Language ability ($\geq$ 1SD below the mean on 2 or more subtests of a standardised language assessment) • Cognition (within normal limits) • No hearing deficit • No comorbid conditions Assessment (Canada): • Clinical Evaluation of Language Fundamentals – 3 rd Edition • Test of Non-verbal Intelligence – 3 rd Edition Criteria (United States of America): • EpiSLI criteria (Tomblin et al., 1997) • Language ability ($\geq$ 1.5SD below the mean on a standardised language assessment) • Cognition (within normal limits) • No hearing deficit (including no more than 2 episodes of otitis media in the previous 12 months) • No visual deficit • No comorbid conditions • No speech sound disorder Assessment (United States of America): • Test of Language Development – Primary • Kaufman Brief Intelligence Test	• Test of Narrative Language	Primary	Canada, United States of America	Monolingual (English)
Duinmeijer et al. (2012)	n = 72 SLI: n = 34 TD: n = 38	SLI: M = 7.40 TD: M = 7.90	Specific Language Impairment Criteria: • Language ability (based on standardised language assessment and language sample) • Cognition (within normal limits) • No hearing deficit • No comorbid conditions Diagnostic Assessment: • Peabody Picture Vocabulary Test – 3 rd Edition (Netherlands)	• The Bus Story (Dutch) • Frog: Where Are You?	Primary	Netherlands	Not stated

(continued)

Table 2. Continued.

Author	Sample size	Age range (years)	Diagnosis	Measures	Setting	Country	Monolingual/Bilingual
Epstein & Phillips (2009)	n = 8	M = 7.58	• Test of Everyday Attention for Children • Wechsler Intelligence Scale for Children (digit span task) • California Verbal Learning Test, Children's Version (Dutch; word list recall task) Specific Language Impairment Criteria: • Language ability (diagnosis of receptive and/or expressive SLI) • No pragmatic difficulties Diagnostic Assessment: • Not stated Developmental Language Disorder Criteria: • Non-verbal cognition (within normal limits) • No hearing deficit Diagnostic Assessment: • Alberta Language Environment Questionnaire • Columbia Mental Maturity Scales	• Frog, Where Are You? • Conversational Map procedure (McCabe and Rollin, 1994)	Primary (including specialist setting)	United Kingdom	Not stated
Govindarajan & Paradis (2019)	n = 87 DLD: n = 24 TD: n = 63	DLD: M = 5.60 TD: M = 5.78	Specific Language Impairment Criteria: • Language ability (≥ 1 SD below the mean on standardised language assessment) • Non-verbal IQ (> 70) • No hearing deficit • No visual deficit • No comorbid conditions Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – 4th Edition • Kaufman Assessment Battery for Children – 2nd Edition Specific Language Impairment Criteria: • Language ability (≥ 1 SD below the mean on a standardised language assessment) • Performance IQ (within 1 SD of the mean)	• The Edmonton Narrative Norms Instrument	Primary	Canada	Multilingual
3. Numeracy achievement Alk et al. (2014)	n = 61 SLI: n = 20 Native English: n = 13 English Language Learner: n = 20	SLI: M = 8.25 Native English: M = 7.83 English Language Learner: M = 8.16	Specific Language Impairment Criteria: • Language ability (≥ 1 SD below the mean on standardised language assessment) • Non-verbal IQ (> 70) • No hearing deficit • No visual deficit • No comorbid conditions Diagnostic Assessment: • Clinical Evaluation of Language Fundamentals – 4th Edition • Kaufman Assessment Battery for Children – 2nd Edition Specific Language Impairment Criteria: • Language ability (≥ 1 SD below the mean on a standardised language assessment) • Performance IQ (within 1 SD of the mean)	• KeyMath3 • Modified KeyMath3 (translated to Spanish)	Primary	United States of America	Not stated
Durkin et al. (2013)	n = 229	Time 1: M = 7.08 Time 2: M = 8.08	Specific Language Impairment Criteria: • Language ability (≥ 1 SD below the mean on a standardised language assessment) • Performance IQ (within 1 SD of the mean)	• British Ability Scales	Primary (including specialist setting)	United Kingdom	Monolingual (English)

(continued)

across a range of literacy skills that did not fit specific subcategories of literacy skills. These studies included a group profile of literacy skills (Freed et al., 2011) and developmental trajectories of language and literacy measures (Snowling et al., 2016; Tambyraja et al., 2015; van Weerdenburg et al., 2009). A study of 71 students with DLD (M age = 7.75 years) found these students presented with significant impairments in all aspects of literacy measured, including word reading, non-word reading, reading comprehension, and written expression (Freed et al., 2011). To better understand the connection between language ability and literacy achievement, Snowling et al. (2016) identified three language impairment trajectories (persistent, emerging, and resolving) from preschool (M age = 3.66 years) to school years in their cohort of 220 students. They found that students with DLD (emerging and persistent) performed significantly lower (large effect size) on literacy achievement in comparison to typically developing peers by age 8. Tambyraja et al. (2015) followed a group of 272 students (M age = 6.43 years) over a one-year period to investigate the stability of language and literacy achievement using standardised assessments. Students with DLD were one of the four groups (low language; DLD, average language/low phonological awareness, average language/high phonological awareness, high language) in the cohort identified at the beginning and end of the school year. Some students remained in the same grouping between the start and end of the one-year period; however, the authors reported the group membership changed for 48% of participants between the two time points. A longitudinal study of 137 monolingual Dutch students with DLD (M age = 8.41 years) found they performed more than 1SD below the mean on all measures of language, speech, short term memory, and phonological awareness (van Weerdenburg et al., 2009). The authors suggest the presence of more than one deficit in these measures limited the ability for the student to compensate, which caused the process of learning to read to slow. The remaining 33 studies investigating literacy achievement have been grouped based on the specific skills being reported, including reading, spelling, writing, and narratives.

Reading

Most studies reported significantly lower reading performance and achievement in students with DLD compared to their peers without DLD; however, considerable individual variability was reported, with some students developing average achievement across studies (Brizzolara et al., 2011; Isoaho et al., 2016; Palikara et al., 2011). Fourteen studies specifically addressed the reduced reading achievement in students with DLD. Seven studies used composite measures to evaluate reading achievement over time (Brizzolara et al., 2011; Catts, Bridges, et al., 2008; Catts, Compton, et al., 2012; Coloma et al., 2020; Isoaho et al.,

2016; Palikara et al., 2011; Zourou et al., 2010). The remaining seven studies looked cross-sectionally across specific skills of reading comprehension, letter knowledge, phonological awareness, and visual probability with differing results across these types of studies (Blom et al., 2017; Coloma et al., 2015; De Groot et al., 2015; Gough Kenyon et al., 2018; Kouri, 2020; Lammertink et al., 2020; Pedott et al., 2017).

Students with DLD demonstrated persistently lower reading achievement than typically developing peers over time, and all of these studies support a potential overlap between DLD and a reading disability (i.e. Dyslexia). For example, the majority of 43 primary school-age students (aged 7 to 10 years) with DLD in a Finnish study demonstrated average reading skills in Year 1, but weakened in Year 2 and 3, with the gap widening, and only 20% achieved average or better than average results in reading (Isoaho et al., 2016). Two studies ($n=225$ and $n=100$, respectively) measured reading achievement between Year 2 and Year 10 in the USA (Catts, Bridges, et al., 2008; Catts, Compton, et al., 2012). In contrast to results by Isoaho et al. (2016), these authors found that students with DLD performed consistently lower than typically developing peers in word recognition and word comprehension with no widening of the gap over time. Finally, Coloma et al. (2020) found students with DLD attending Grade 2 and 4 performed lower in reading comprehension tasks than typically developing peers, but did not report whether the gap widened or not.

In a longitudinal study, Zourou et al. (2010) assessed two groups of French speaking students with DLD (Group 1: M age = 5.25 years; Group 2: M age = 6.16 years). Although the children with DLD performed lower than their age-matched typically developing peers on phoneme deletion tasks at Time 1, at Time 2 (2 or 3 years later) the group differences were no longer significant. Another longitudinal study of 16 Italian students with DLD found spoken language measured on a battery of standardised language assessments at the start of school (M age = 5.08 years) was highly correlated with decoding, accuracy, and speed when reading a passage in later schooling (M age = 16.41 years; Brizzolara et al., 2011). In a longitudinal study in the UK, students with DLD ($n=98$) experienced marked difficulties in single word decoding and reading comprehension at 14 and 16 years of age in comparison to typically developing peers, and a strong positive correlation between measures of reading and spoken language was observed (Palikara et al., 2011).

Cross-sectional studies tended to find greater variability in individual performance than was observed in longitudinal studies. One small-scale study ($n=10$) found that Spanish speaking students with DLD (M age = 6.5 years) demonstrated significant difficulties (no effect size reported) in reading comprehension (60%) and decoding (70%), compared to their typically developing peers, with some students

with DLD demonstrating typical reading comprehension (20%; Coloma et al., 2015). A study of 10- to 11-year-old students with DLD ($n = 14$) found they had more difficulties (medium effect size) than typically developing peers with reading comprehension, including literal and inferential meanings (Gough Kenyon et al., 2018). Kouri (2020) reported a delay in decoding skills for 28 primary students with DLD split into 2 groups (M age = 8.75 and 10.41 years), which were similar to younger typically developing peers. They also demonstrated protracted periods of using decoding to read. Pedott et al. (2017) administered an alliteration and rhyme identification task, and found that students with DLD ($n = 12$; ages 7–9 years) obtained significantly lower scores (no effect size reported) than typically developing peers. In a study of 37 students with DLD (M age = 9.08 years), Lammertink et al. (2020) found no evidence to support the hypothesis that reading difficulties were related to predicting shapes of words when reading, as they performed similarly to their typically developing peers. When reading a collection of documents containing links (hyper-text) that required the reader to navigate their own path, students with DLD ($n = 36$; M age = 14.10 years) did not show additional difficulties in reading comprehension when compared to linear text (Blom et al., 2017). A study by De Groot et al. (2015) assessed rapid naming and phonemic awareness skills in 51 Dutch participants with DLD (aged 8 to 13 years), reading disability, comorbid DLD and reading disability, and typically developing peers. The ‘comorbid’ group performed significantly lower (large effect size) than all other groups, although rapid naming and phonemic awareness had varying degrees of impairment in the DLD and reading disability groups.

Spelling

In the seven studies measuring spelling achievement, students with DLD presented with heterogeneous spelling skills, although they demonstrated a similar progression of development compared to chronologically younger typically developing peers. In comparison to typically developing peers, primary school students with DLD (M age = 6.85 years) knew fewer graphemes (77% typically developing; 20% DLD) and had reduced spelling abilities overall (typically developing 90%; DLD 15%; Cordewener et al., 2012). Both Larkin et al. (2013) and Werfel et al. (2019) found a strong relationship between spoken language and spelling performance (medium to large effect sizes) in 9-year-old students with DLD, resulting in a lower performance than typically developing peers. Furthermore, in a longitudinal study, 8-year-old students with DLD ($n = 16$) presented with a delay in spelling development compared to typically developing peers on standardised measures (large effect size) and frequently made phonologically unacceptable spelling errors (Godin et al., 2018). Two other studies ($n = 17$ and $n = 15$, respectively) supported

the hypothesis of a pattern of delay rather than disorder in students with DLD; 9-year-old students with DLD demonstrated similar patterns in the use of spelling roots and morphology compared to younger children matched for spelling ability (Deacon et al., 2014; Larkin et al., 2013). A study of French primary (M age = 8.94 years) and secondary (M age = 14.33 years) school aged students with DLD ($n = 24$) made phonologically unacceptable errors when spelling that were not present in typically developing peers (Broc et al., 2013). Although they consistently performed lower than typically developing peers of chronological age, participants with DLD had less difficulty with spelling when writing a narrative than when writing single words by dictation. McCarthy et al. (2012) investigated word reading as a predictor of spelling achievement in students with DLD ($n = 43$) and DLD with reading disability ($n = 18$) from kindergarten to Grade 10. They found spelling achievement was impacted by word reading, but not language ability. Children with DLD who experienced no word reading difficulties demonstrated more orthographic related errors compared to typically developing peers (McCarthy et al., 2012).

Writing

Students with DLD across these seven studies showed delayed writing skills relative to typically developing peers. In a retrospective study of 294 students with DLD, 55% demonstrated disordered writing ability on standard scores of writing achievement (Stoeckel et al., 2013). Two studies compared the writing process between 10-year-old students with DLD and typically developing peers. The students with DLD demonstrated lower performance in productivity, lexical diversity, grammatical accuracy, spelling accuracy, and sentence complexity (small to large effect sizes) in narrative and expository writing samples compared to typically developing peers (Koutsoftas, 2016; Koutsoftas & Gray, 2012). Productivity and complexity were related to spelling accuracy, which correlated with spoken language. Consistent with these findings, Williams et al. (2013), found primary aged students with DLD ($n = 15$; M age = 9.42 years) performed similarly to typically developing peers who were approximately two years younger with matched spelling ability. However, participants’ written grammar levels were like those produced by their typically developing age-matched peers. In a study of 33 students with DLD from 8 to 10 years of age, spoken language was a predictor of perceived writing competence when spelling ability, gender, and age were controlled (Brouwer, 2012). The students with DLD reported significantly lower levels of perceived writing competence and autonomous writing motivation than typically developing peers. Favart et al. (2016) found primary (7–11 years) and secondary (12–18 years) school-aged students with DLD ($n = 24$) demonstrated simplified use of connectives (e.g. because,

although) and anaphora (i.e. words referring to an earlier word or phrase, such as she, he). The gap between students with DLD and their typically developing peers was widest during primary school; however, their skills consolidated in secondary school. When using punctuation marks and verbs in written language, students with DLD ($n=30$; M age = 9.91 years) utilised less diversity compared to typically developing peers (Stuart et al., 2020), which suggests they have less sophisticated writing skills.

Narratives

Across the five studies, students with DLD consistently achieved lower results than typically developing peers in oral narrative achievement. A study of 85 students with DLD (M age = 5.75 years) found they performed significantly lower (large effect size) in tasks that involved comprehending, generating, and retelling narratives when compared with typically developing peers (Blom & Boerma, 2016). Govindarajan & Paradis (2019) also found bilingual students with DLD ($M = 5.78$ years) presented with similar difficulties with generating stories compared to typically developing peers. Differences in verbal working memory and sustained auditory attention were found to significantly impact (medium to large effect sizes) the ability of students with DLD ($n = 34$; M age = 7.40 years) to recall plot elements in story generation and retell tasks (Duinmeijer et al., 2012). Colozzo et al. (2011) found the performance of students with DLD (6 to 10 years) was distributed evenly across two different patterns of story generation: the first group included strong content, but demonstrated grammatically weaker language while and the second group included weaker content, but had stronger grammar. When eliciting oral narratives in response to wordless picture books and conversation starters, students with DLD ($n = 8$; M age = 7.58 years) produced more detailed information when given the wordless picture books, but gave higher quality responses in response to conversation starters (Epstein & Phillips, 2009). Govindarajan & Paradis (2019) found story grammar may distinguish bilingual students with DLD ($M = 5.78$ years) from typically developing peers, as they made less efficient use of the quantity and quality of input received.

Numeracy achievement

Three studies showed impairments in numeracy achievement in students with DLD compared to typically developing peers, and the gap was found to widen over time. Compared to typically developing peers, students with DLD ($n = 20$; M age = 8.25 years) performed significantly lower (small to large effect sizes) on mathematical tasks, except when the language and symbolic (i.e. numeral) loads were reduced (Alt et al., 2014). Sources of problems for mathematical difficulties were found to be the

manipulation of mathematical symbols, the use of working memory for patterns, and the combination of complex linguistic syntax plus mathematical symbols. Mathematical calculations were another challenge for students with DLD ($n = 18$; aged 6 to 13 years), but patterning skills were intact and issues with mathematical achievement were shown to be attributed to verbal working memory measured by standardised assessment (Fyfe et al., 2019). To investigate mathematical achievement, Durkin et al. (2013) measured the performance of students with DLD on standardised number skills at age 7. They found students with DLD performed more than 1SD below the mean and the gap widened when assessed again at age 8.

Discussion

We systematically reviewed 44 studies from 2008 to 2020 on the academic achievement of students with DLD attending primary or secondary school. Our first research question addressed what academic achievements have been measured in research since 2008. The results showed the most commonly investigated academic achievement areas related to broad academic achievement, literacy, and numeracy. As anticipated, most studies (37/44; 84%) investigated literacy achievement given theoretical links (Simple View of Reading) between language ability and reading. In addition to the four studies that broadly investigated literacy achievement using composite measures, the remaining 33 studies focused on specific areas of literacy, including reading, spelling, writing, and narratives. Our second research question addressed the reported academic achievement of students with DLD in these areas. Across the 44 studies, at group-level, students with DLD were found to demonstrate challenges in all areas of academic achievement compared to typically developing peers. Significant variability in learning progress was described between individual students with DLD, consistent with the heterogeneity of the condition. It appears individuals with DLD are at risk for academic difficulties; however, progress in academic learning was observed in studies that measured academic achievement over time. The quality of the studies and limitations will be discussed before recommending future directions for research.

Heterogeneity

Results highlighted the heterogeneity of academic achievement in students with DLD, as some students showed significantly lower performance compared with typically developing peers, whereas others performed in the average range across primary and secondary school. Specifically, Brizzolara et al. (2011), Coloma et al. (2015), and Isoaho et al. (2016) identified individual students with DLD who developed average reading comprehension skills. These findings were unexpected when

considering the Simple View of Reading whereby reading comprehension is argued to be the product of word recognition and listening comprehension (as per Gough & Tunmer, 1986), and students with DLD, at group level, have been shown to struggle with both components (Catts et al., 2008). However, each student with DLD has differing levels of difficulty across language domains (e.g. syntax, morphology, semantics, pragmatics, and phonology) that will impact academic achievement. Further, heterogeneity may also relate to individual differences in non-verbal IQ and literacy skills (Conti-Ramsden et al., 2009; Durkin et al., 2015). Taken together, students with DLD show vulnerability to lower academic achievement; however, at an individual level there is variability in performance from significantly below age expectations to within age or grade expectations.

Learning progress of students with DLD

The evidence suggests that students with DLD may follow a delayed pattern of academic achievement across reading and spelling regardless of the language spoken (Brazilian Portuguese, Dutch, English, Finnish, French, Italian, Spanish). For example, when examining learning progress longitudinally, Isoaho et al. (2016) reported a 'Matthew Effect' (i.e. a widening gap over time) in reading skills based on standardised measures between Finnish speaking students with DLD and typically developing peers, which was observed in Grades 1–3. Moreover, Catts et al. (2008) found the gap remained consistent between Grades 2 and 10. In spelling development, students with DLD followed a typical progression that matched younger typically developing peers. While lower than expected, the trajectory for progress is not atypical (Deacon et al., 2014; Larkin et al., 2013; Werfel et al., 2019). Students with DLD had challenges with numeracy overall; however, one study found outcomes were better when the language and symbolic (i.e. numeral) loads were reduced (Alt et al., 2014). A recent scoping review by Cross et al. (2019) supports this variability, as they found students with DLD presented with some typical numeracy achievement on number line, magnitude comparison, and conceptual mathematical tasks.

Research quality

The results of this review highlight the need for improvements in the design of future studies (see Table 1), particularly in relation to methodological quality, sampling bias (29/44), and justification of sample size (3/44). The studies in this review also varied in their description of samples, specifically in their use of labels, and cut-off points for language impairment, which may impact the replicability, generalisability, and interpretation of findings. DLD is an inclusive term, and embraces SLI, Language

Disorder, Language Impairment, and Language Learning Disability. However, the reverse is not true, and means not every student with DLD will fit the criteria defined in these studies. Therefore, a consistent and thorough description of samples across studies is required in future research with reference to criteria and terminology (Bishop et al., 2016, 2017). This description should include functional impact in the classroom setting, in line with the current accepted diagnostic criteria (Bishop et al., 2017).

Limitations

While addressing an important gap in the literature of the academic achievement of students with DLD, we acknowledge a number of limitations. First, the analysis of study quality was based on consensus rather than independent rating; however, there was a high level of agreement between raters. The titles and abstracts of the 2020 database search were not screened by a second reviewer to check for relevance due to the substantial agreement reached in the previous search. Second, our search was restricted to studies published in English, although it included studies conducted in languages other than English. As such, there may be additional studies published in other languages that were not included, and our results may not adequately capture the existing research in countries where the national languages are other than English. Third, due to the relatively low study quality, differing comparison groups, and the level of detail reported, it was not possible to quantify the degree of risk of academic failure for students with DLD relative to typically developing peers without potentially over-interpreting the findings.

Future research

This review highlights a number of gaps in the literature ripe for future research. Numeracy achievement is a gap in the literature, whereby multiple studies have addressed literacy skills, but only three studies (Alt et al., 2014; Durkin et al., 2013; Fyfe et al., 2019) addressed numeracy achievement. Further, although 44 studies addressed broad academic, literacy, and numeracy achievements, this does not represent the depth and breadth of the school curriculum. Subjects such as Science, Humanities, and Geography, are significantly underrepresented in current literature. Similarly, studies addressing senior secondary subjects, such as Chemistry, Modern History, and Biology were not identified. This may be attributed to a lack of participation by students with DLD in these subjects or may represent a gap in the literature. Students with DLD included in this study are clearly at risk of academic failure, but the degree of risk remains unclear. Although we observed reading and spelling difficulties in students with DLD regardless of the language spoken, future research may investigate more closely the effects different

orthographies may have on these students' reading and spelling development, as more complex orthographies are known to affect the rate at which students learning to read (e.g. Ziegler & Goswami, 2005). There is a need to use consistent measures of academic achievement, and increase study quality to evaluate the associated academic risks and potential outcomes more clearly for students with DLD across studies.

None of the studies reported the relationship between academic achievement and external factors, such as the educational setting (inclusive vs. special education), pedagogical practices (supports and adjustments), physical environment, technology, assessment practices, and parental involvement. The fact that none of these studies considered how educational supports and adjustments impacted on the reported academic achievement was a clear omission, however we acknowledge the exclusion of qualitative research and intervention studies from this review. A systematic review of studies that investigate the effectiveness of academic supports and adjustments to promote academic achievement for students with DLD is now needed to answer this important question. Future studies to quantify the relationship between students' language profiles and academic achievement should also consider potential mediators and moderators, including the educational approaches that foster or inhibit outcomes. Studies involving the perspectives of key stakeholders, including educators, allied health professionals, parents/caregivers, and students with DLD, that examine supports would also contribute greatly to our understanding of factors influencing academic achievement.

Educational and clinical implications

The results of this review identified three key educational implications. First, most, but not all students with DLD struggle to achieve academically at school, highlighting the need for education systems to provide support so these students have equitable opportunities in education. Improved academic achievement may help address the associated long term educational, mental health, and employment outcomes in adults with DLD (Johnson et al., 2010; Law et al., 2009). Second, students with DLD need support in schools. Educators and speech pathologists are experts in the curriculum and DLD, respectively, and can work together to support students' individual learning across the curriculum. A recent review by Archibald (2017) provides an evidence-based summary of how speech pathologists and educators can provide classroom-based services targeting vocabulary, oral language, phonological awareness, curriculum-based language, and writing. However, further research on the specific types of pedagogical practices and interventions that best support the needs of students with DLD is required. Third, given the heterogeneity and variability over time, there is a need to understand the level of support required by school-aged

students with DLD. Detailed assessments of language, cognition, and literacy will enable progress to be periodically monitored during primary and secondary schooling, and help inform individualised support for students with DLD. Further, viewing academic achievement at a single time point may give a false impression of the student's ability given DLD is a lifelong condition. Therefore, regular ipsative assessment may best inform educational practices.

Conclusion

In summary, the ability to understand and use spoken language is critical to succeed at school, which places students with DLD at increased risk of academic failure. At a group level, students with DLD performed lower than typically developing peers throughout their schooling across the areas measured, including broad academic, literacy, and numeracy achievement. These results highlight the importance of increased advocacy around DLD and its lifelong implications (Bishop et al., 2017; Norbury et al., 2016). At an individual level there was considerable variability ranging from students with DLD performing significantly lower compared to typically developing peers, while others performed in the average range in some areas. Individualised assessment is needed over time to inform the implementation of necessary supports to leverage the learning strengths and areas of need for students with DLD. Until more empirical information becomes available on the specific types of supports needed for students with DLD, we strongly recommend making reasonable adjustments for most, if not all, students with DLD in line with current disability legislation. Within the research we reviewed, there are significant limitations to the study quality, including description of the population and the breadth of academic achievement. To move the field forward, future research needs to use consistent terminology, including descriptions of functional impact, and utilise measures to enable translation into practice. Success at school is the pathway to future educational and vocational opportunities. By better understanding the academic achievement for students with DLD, we can positively impact the trajectory of their lives.

Acknowledgements

We wish to acknowledge the in kind support of Dr Rebecca Armstrong and Ms Rachelle Wicks.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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