Can verbal working memory and processing speed distinguish between children who have English as an additional language and children with developmental language disorder?

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ABSTRACT

Background: Children with English as an Additional Language (EAL) often present with language difficulties and make errors that are similar to children with Developmental Language Disorder (DLD). Apparent language difficulties, which may be attributed to a child's EAL status, are instead misunderstood as being a Developmental Language Disorder (DLD) (Raul & Ahyea, 2017). Research illustrates how assessment tools are often biased against children with EAL (Alfano, Holden & Conway, 2016). Following a systematic review of the literature, a corpus of evidence suggested that less-biased assessments, such as tests of Verbal Working Memory (VWM) and Processing Speed can distinguish children with EAL from children with DLD (Sandgren & Holmström, 2015).

Aim: The aim of the research was to ascertain if tests of VWM and Processing Speed could distinguish between children with EAL and children who had a DLD.

Method: Participants from monolingual (n = 15), EAL (n = 15) and DLD (n = 12) groups, who were aged between seven and nine years old, completed literacy and intelligence screening, followed by a Visual Search and Nonword Repetition Test (NRT). completed literacy and intelligence screening, followed by a Visual Search and Nonword Repetition Test (NRT). The latter two tests measured Processing Speed and VWM, respectively.

Results: Influenced by a post-positivist stance, results have indicated that the NRT (i.e., VWM) can distinguish between children who have EAL and children who have a DLD, $p < .001$, $\eta^2 = .457$ (i.e., medium effect, Cohen, 1988). The DLD group also scored lower on the Visual Search task but this did not reach the significance level. Likelihood ratios and tests of specificity and sensitivity using a Receiver Operating Characteristic (ROC) Curve also indicated that the VWM measure had a good degree of accuracy.

Conclusion: Assessments of VWM using non-words may be able to differentiate between children who have EAL and children who have DLD. Such findings could hold implications for educational psychology practice, research and policy, nationally and internationally.

DECLARATION

I hereby declare that this thesis is the result of my own original research and does not contain the work of any other individual, save those identified and acknowledged in the usual way.

Name: _____

Signed: _____

Date: _____

DEDICATION

This thesis is dedicated to the students of Bracken Educate Together National School, Balbriggan, Co. Dublin, who served as the inspiration for the current thesis.

"Education is the passport to the future"

– Malcom X (1964)

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LIST OF ACRONYMNS

AUC	Area Under the Curve
BICS	Basic Interpersonal Communicative Skills
CALP	Cognitive Academic Language Proficiency
CHC	Cattell-Horn-Carroll
CHC C-LIM	Cattell-Horn-Carroll Culture-Language Interpretative Matrix
CSO	Central Statistics Office
DECPsy	Doctorate in Educational and Child Psychology
DEIS	Delivering Equality of Opportunity in Schools
DES	Department of Education and Skills
DLD	Developmental Language Disorder
EAL	English as an Additional Language
EP	Educational Psychologist
ESRI	Economic and Social Research Institute
IASLT	Irish Association of Speech and Language Therapists
ITE	Initial Teacher Education
L1	First Language
L2	Second Language
LSBQ	Language and Social Background Questionnaire
NCCA	National Council for Curriculum and Assessment
NEPS	National Educational Psychological Service
NRT	Nonword Repetition Test
OECD	Organisation for Economic Co-operation and Development
PRI	Perceptual Reasoning Index
PSI	Psychological Society of Ireland
PSW	Pattern of Strengths and Weaknesses

ROC	Receiver Operator Characteristic
RT	Reaction Time
SEN	Special Educational Needs
SLD	Specific Learning Difficulty
SLI	Specific Language Impairment
SLT	Speech and Language Therapist
SASIT-E32	School-Age Sentence Imitation Test-English 32
SPSS	Statistical Package for the Social Sciences Version
TOTPPC	Total Percentage of Phonemes Correct
WASI-II	Wechsler Abbreviated Scale of Intelligence - Second Edition
WIAT-III	Wechsler Individual Achievement Test–Third Edition
WoE	Weight of Evidence
XBA	Cross-Battery Assessment

1.0.CHAPTER ONE
INTRODUCTION

In the influential paper 'Language, Power and Pedagogy: Bilingual Children in the Crossfire', Cummins (2000) alluded to the challenges associated with catering for the needs of children who have English as an Additional Language (EAL). At the core of Cummins' (2008) assertions is that the area of 'assessment is a crucial issue for minority students' (p. 203). According to the most recent Irish definition, children who have EAL typically have a different home language to English despite English being the language of instruction used in school (Department of Education and Skills; DES, 2005a). As the title of Cummins' (2000) magnum opus implies, it appears as though such children are caught in the 'crossfire' in terms of educational provision, namely assessment. Research illustrates that there are difficulties associated with the assessment of children with EAL, resulting in detrimental outcomes for this population (Artiles & Ortiz, 2002). Apparent language difficulties, which may otherwise have been attributed to their EAL status, are instead misunderstood as being Developmental Language Disorder (DLD) (Raul & Ahyea, 2017). Children with EAL often present with language difficulties and make errors that are similar to monolingual children with DLD (Armon-Lotem, 2012; Paradis, 2010). Apparent language difficulties in children with EAL could thus be attributed to a child's EAL status (Ferlis & Xu, 2016). Language impairments typically involve deficits in language comprehension and expression (Schwartz, 2009). In an Irish context, children with suspected DLDs are referred to an educational psychologist (EP) and Speech and Language Therapist (SLT) for assessment (O' Toole & Hickey, 2012). Such assessments can be complex feats for practitioners (Håkansson, 2017). Adding to the difficulties associated with identifying DLDs is the increasing number of children with EAL who are undergoing DLD assessments (Armon-Lotem, de Jong & Meir 2015; O' Toole & Hickey, 2012). This is unsurprising given that the recent influx of children from non-Irish backgrounds has also come to the forefront of educational discourse in recent years. According to the Irish Census for 2016 (Central Statistics Office; CSO, 2017), the number of individuals speaking a foreign language at home accounted for over 600,000 of the Irish population. Amongst this, 20,000 were pre-school children, with 85,000 children attending Irish primary and post-primary schools (CSO, 2017). The Economic and Social Research Institute (ESRI, 2009) found that approximately 60% of Irish schools have newcomer students.

As the population of Ireland is rapidly diversifying (CSO, 2017), appropriate assessment tools appear warranted for this minority, yet significant proportion of society. Tools for disentangling EAL from DLD for a heterogenous group of children are warranted. Data from the ESRI (2009) indicated that newcomer pupils come from diverse linguistic and ethnic backgrounds, and therefore, represent a very heterogeneous group. Current guidelines urge practitioners to assess children in their home language, although this is not always possible in light of diversity in linguistic backgrounds (Boerma & Blom, 2017). O'Toole and Hickey (2012) state that efforts in assessing this population are further hampered by the lack of available standardised tests, as well as a lack of understanding of the language acquisition process and associated theories. Similarities in language profiles of children with EAL and DLD represent significant challenges (Paradis, 2005). Due to the overlap in language characteristics of children with EAL and DLD and given the lack of appropriate tools, increasing numbers of children are being misdiagnosed following the assessment process (Paradis, 2005). Disentangling EAL from DLD has been described by Paradis (2005) as the 'teasing apart of non-fluent and errorful language' so that children with EAL are not provided with a 'mistaken identity' or 'missed identity' (p. 173). Erroneously identifying the presence or indeed absence of a DLD in children with EAL can result in children receiving inappropriate school instruction (Sullivan, 2011). The revised Special Educational Needs (SEN) model (Circular 0013/2017) (DES, 2017) in Ireland also has direct implications for those children who remain either undiagnosed or misdiagnosed as having a DLD.

Current assessments, subsequently, appear to be somewhat biased against children whose first language does not comply with the societal language, resulting in the misidentification of this population (Alfano, Holden & Conway, 2016). Such assessments are typically language-based and tend to focus on the similarities (i.e., language profiles) between children with EAL and DLD (Alfano et al., 2016; Paradis, 2005). Should assessments, therefore, focus on the underlying differences between children with EAL and children with DLD? A thorough review of the literature revealed that children with DLD, typically, have impaired cognitive functioning in terms of verbal working memory, processing speed and attention (Sandgren & Holmström, 2015), whilst typically developing children with EAL should not have impaired functioning in these domains (Laloi, de Jong & Baker, 2017; Marton & Schwartz, 2003; Montgomery et al., 2010; Sandgren & Holmström, 2015). Laloi et al. (2017) suggest that the non-verbal measures of cognitive differences could subsequently serve as diagnostic indices of a DLD in an

EAL population. Numerous authors support this hypothesis (e.g., Sandgren & Holmström, 2015). Given that such assessment tools would require non-verbal responses or the use of novel words (i.e., nonsense words), they could be used with a heterogenous population that is reflective of Ireland's diverse population. However, emerging research has also advocated the use of alternative measures of assessments which warrant exploration. Given the apparent misidentification of DLDs amongst children with EAL, it appears that more accurate assessment tools, for examining the processes underlying DLDs, are required.

1.1. Overview of Thesis

The current study aimed to ascertain the most accurate method of assessing children with EAL for a potential DLD. In an attempt to identify appropriate assessment tools for this purpose, a systematic review of the literature was conducted and is presented in Chapter Two. This will be preceded by a review of current policy and theoretical perspectives associated with second language acquisition. The policy context will also be discussed, with specific reference to Irish and international assessment policy directives. Theoretical and cognitive perspectives will be presented in terms of the key cognitive differences between typically developing EAL children and children with DLDs. This will culminate in a discussion about the potential use of cognitive tools in the assessment of children with EAL. Alternative approaches to assessing children with EAL will be explored, leading to a discussion on the potential adverse effects associated with erroneous assessments. Following the literature and systematic reviews, the aim of the study is refined and defined. It will be determined if the assessment tool can disentangle EAL and DLD participants. Participants will represent a diverse population of children aged between seven and nine years old, who will be assigned to one of three groups; typically developing children with EAL, monolingual children with DLD, and typically developing monolingual children, who will serve as a control group. Chapter Three will highlight the philosophical assumptions, research design, participant details, measures and procedures used to achieve the pivotal aim of the research. Data analysis will ensue, where the specificity (i.e., degree to which the tool can detect the absence of a DLD) and sensitivity (i.e., degree to which the tool can detect the presence of a DLD) will be measured in order to determine if verbal working memory and processing speed can indeed distinguish between the DLD and EAL groups. Chapter Five includes a discussion on the research findings, where future directions are advised in terms of policy, research and practice. Finally, Chapter Six offers a summary and closing remarks.

2.0. CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

As research is still in its infancy in Ireland (O' Toole, 2012), this chapter discusses, and critiques, research conducted internationally in the area of DLD and EAL. Following a brief overview of the evolving definitions of DLD and EAL, the literature review will involve an account of policy perspectives in the context of assessing children with EAL. National policy will be at the forefront of a review of policy directives, whereby national and international policies will be explored. It will be emphasised that there is a need for a more internationally influenced Irish policy regarding the assessment of children with EAL. This will be followed by an exploration of theoretical accounts of language development, in particular the language development of children who have EAL. Notably, the study is rooted within linguistic and cognitive frameworks as they pertain to language development and deficits. This will be followed by an overview of the literature on atypical language development, as well as EAL language development. Cummins' (2000, 2008) seminal Basic Interpersonal Communicative Skills (BICS) and Cognitive Academic Language Proficiency (CALP) theory will be at the core of the discussion on EAL language development. Cognitive perspectives on language development, and indeed, on language deficits will also be discussed. In particular, cognitive abilities such as processing speed, verbal working memory and attention and their potential to accurately assess children with EAL will be explored, culminating in a review of Cattell-Horn-Carroll (CHC) theory (Carroll, 1993). As well as Cummins' (2000, 2008) theory, CHC theory provided the foundations from which the research project was built. From a practice perspective, current and alternative assessment methods for assessing children with EAL will be critiqued, with an emphasis on the adverse outcomes associated with erroneous assessments that can lead to subsequent misdiagnoses of DLD in children with EAL.

Following an overview of theory, practice and policy related to the assessment of children with EAL, this chapter will present a systematic review of potential tools that could distinguish children with EAL from children who have a DLD. In light of Cummins' (2000, 2008) assertion that there is a need for 'an informed, objective analysis of current theory and practice' (p. 201), a systematic review can offer an objective pathway towards the selection and analysis of relevant studies for review (Schlosser,

2007). An a-priori research design was conducted with pre-determined review questions, and subsequent inclusion criteria for the systematic review were created. Following the systematic review, methodological gaps in the current research will be highlighted. These findings have specific implications for practice and research. Chapter Two culminates with an overview of the aims and research questions as they pertain to the ensuing research project.

2.2. Terminological Changes

2.2.1. English as an additional language. As has been aforementioned, the term EAL may be defined as having a different home language to that used in schools (DES, 2005a). In this instance, the child's home language is often known as 'Language 1' or 'L1', whilst their second language, which is typically the language of instruction used in schools, can be regarded as 'L2'. The literature is ubiquitous in its use of the terms 'L1' and 'L2' and these categories are universally recognised. However, the terms used to describe children who are in the process of learning English differ depending on the geographical context. Whilst the term EAL is typically used in Ireland and the United Kingdom, terms such as English Language Learners (ELL) and English as a Second Language (ESL) are used internationally. As is evident from the articles reviewed for the systematic review, an abundance of literature pertaining to children with EAL stems from research conducted in the United States (US). A review of the US literature revealed that children who have EAL are often described as bilinguals, regardless of competence in their L2. For example, Kohnert (2010) defined bilingual learners as those who received 'regular input in two or more languages during the most dynamic period of communication development' (p. 456). The term bilingual is often used interchangeably with the equivalent term of EAL (e.g., Cortazzi & Jin, 2007), albeit EAL is often marked by increased dominance in L1. Finally, it is noteworthy that simply describing a child as 'EAL' does not represent the full spectrum of language abilities or difficulties experienced by children with EAL. Paradis (2016) argued that variability in the language abilities of children with EAL is pivotal in understanding this population. Rather than being a homogenous group, children with EAL are sometimes classified according to language exposure or language ability. Although variations occur in terms of classification, Hutchinson (2018) proposed terms such as 'New to English, Early Acquisition, Developing competence, Competent, or Fluent'.

2.2.2. Developmental language disorder. Developmental Language Disorder (DLD) may be described as a neurodevelopmental disorder where children typically present with receptive and expressive deficits (e.g., morphosyntax) and cognitive deficits (e.g., attention or working memory difficulties) (Ponari, Norbury, Rotaru, Lenci & Vigliocco, 2018). However, there has been some debate surrounding terminological and conceptual issues pertaining to language impairments in children (Norbury & Sonuga-Barke, 2017). Interestingly, over the past 25 years, the term Specific Language Impairment (SLI) was the most commonly adopted term used to describe selective language problems (Norbury & Sonuga-Barke, 2017). However, following the CATALISE consortium (Bishop et al., 2017; Bishop, Snowling, Thompson & Greenhalgh 2016), it was decided that the term 'SLI' may be limited in scope and thus advocated the use of the term DLD. Bishop et al. (2016, 2017) stated that the term DLD reflected recent advancements in knowledge; that is, that language impairments are not 'specific', nor do they occur in isolation, rather language difficulties may involve the interplay between cognitive, learning and behavioural deficits. The terminological change has direct implications on the diagnostic criteria for a language impairment; an average IQ will no longer be a diagnostic requirement for DLD (Bishop et al., 2016). Recent changes in the terminology will be reflected in future international diagnostic guidelines, such as the International Statistical Classification of Diseases and Related Health Problems 11th Revision (ICD-11) (Bishop et al., 2017). In light of these recent advancements, and in line with the goals of the research project, the term DLD will be used throughout the paper. However, as most of the literature pertaining to language disorders use the term SLI, and as most participants will have received a diagnosis of SLI rather than DLD, then the terms will be used interchangeably. Furthermore, despite the evolving terminology, it appears that policy documents still adopt less contemporary terms such as SLI.

2.3. The Policy Context

Nonetheless, assessment protocols related to DLD and EAL are often directly influenced by policymakers (e.g., NCCA, 2007). Therefore, an examination of the socio-political context is essential to our understanding of the service provision and assessments of children with EAL. An analysis of existing policy documents reveals a number of apparent strengths and failures in the assessment of children with EAL in Irish primary and post-primary schools. As well as influential policy advisories, such as the CATALISE

consortium, extant international policies may pave the way for future Irish policy directives.

2.3.1. International legislation and policy. In the influential US legislation, 'No Child Left Behind of 2001' (US Department of Education, 2002), it was argued that there was a need for accurate and unbiased assessment tools for children with EAL. However, this statement may be interpreted as merely rhetorical on a national level as it appears that policies pertaining to the assessment of children with EAL are often enacted by individual US States (Cawthon, 2010). Hutchinson (2018) commended States such as New York and Minnesota, who possess policies specifically for the assessment, provision and categorisation of children with EAL. Hutchinson (2018) also praised recent policy developments in the United Kingdom, whereby schools are urged to categorise children with EAL in one of five categories mentioned in section 2.2.1.

2.3.2. Irish policies. In comparison to our English-speaking counterparts, it appears that Irish policies are lagging behind in terms of EAL policy provision. However, the Organisation for Economic Co-operation and Development (OECD) conducted a review of Irish policies and practice pertaining to the educational provision for children from migrant backgrounds (Taguma, Kim, Wurzburg & Kelly, 2009). In their report, Irish policy initiatives and efforts were commended in terms of language support provision, as well as the availability of language assessment toolkits for ascertaining language proficiency (Taguma et al., 2009). After all, Murtagh and Francis (2012), argued that 'as inclusive education is an important aim of the Irish education policy, additional support is necessary for pupils with limited English proficiency' (p. 202). Albeit, language support provision has since changed, as is highlighted later. Nonetheless, these efforts were reflected in the primary (National Council for Curriculum and Assessment; NCCA, 2006) and post-primary (DES, 2012a) guidelines for teachers and schools. The documents highlighted the importance of assessing children from EAL backgrounds, albeit they provided tenuous advice on how to assess this population. The NCCA (2006) encouraged teachers to be apprehensive in making assumptions about a child's ability based on results from standardised tests, as underperformance on these tests may be attributed to a lack of language proficiency. Both documents also advocated the use of language proficiency toolkits, as typically measured using the Primary School Assessment Kit (Integrate Ireland Language and Training, 2007). The language proficiency tools are used to rate a child's language proficiency from A1 (i.e., lowest), to C2 (i.e., highest) using the Council

of Europe's Common European Framework of Reference for Languages. The DES (2005a) have also published guidelines entitled 'English as an Additional Language in Irish Primary Schools: Guidelines for Teachers', which highlights some assessment and pedagogical approaches for teachers working with children who have EAL.

2.3.3. Education for children with English as an additional language. The DES (2005a) document also includes a revision in order to incorporate changes in educational support for children with EAL. It was stated that each school in Ireland would receive a general allocation of support teachers who will be assigned to both children with EAL and children who have learning difficulties (DES, 2005b). The emergence of the new model of SEN has a direct impact on children who would previously have received language support under the General Allocation Model and EAL Model. According to the recent DES Circular 0013/2017, under the revised allocation of support model, the deployment of resources is now at the discretion of Irish schools. The revised model provides schools with the authority to ascertain what support is suitable for the child based on a number of criteria, including school based assessments of literacy and numeracy. Given the potential inadequacies of school standardised tests for assessing children with EAL, it is possible that children with EAL may be provided with special education support as opposed to specific language support. According to Circular 0013/2017, special education comprises of 'additional support hours' for children with needs which is often provided in a one to one, small group or team teaching setting. Indeed, there is no obligation on schools that children with EAL receive any language support. The overrepresentation of children with EAL in special education is noteworthy as such education may be ineffective in improving language acquisition amongst the EAL population (Artiles & Ortiz, 2002; Keller-Allen, 2006; Sullivan, 2011). The DES (2005b), however, proposed that schools with a high proportion of children with EAL would receive additional support provided by Special Education Teachers.

2.3.4. Apparent shortcomings of Irish policies. The misdiagnoses of children from minority backgrounds may, therefore, be surprising given the recent impetus towards assessment both nationally and internationally. However, despite the plethora of assessment documents, references to the assessment of children with EAL are sparse. It appears that the lack of clear guidelines at a policy level have been reflected at a practice level. In post-primary schools, a DES Inspectorate report concluded that 'only two-fifths of schools had effective assessment procedures for EAL students in mainstream subjects'

(DES, 2012a, p. 40). At primary level, the Inspectorate noted that 'there was a critical absence of comprehensive assessment data in schools' (DES, 2012b, p. 51). Similarly, the OECD report conducted by Taguma et al. (2009) stated that 'there is scope for improvement' in terms of the assessment of children with EAL in Irish schools (p. 31). They called for the translation of ambitious policy directives into practice, with specific reference to the continued development of assessment tools for children with EAL. Specific assessment guidelines as stipulated in Irish educational policy documents include the NCCA's (2007) influential document, 'Assessment in the Primary School: Guidelines for Schools'. However, guidelines in this document have not mandated explicit protocols for the assessment of children from diverse linguistic and cultural backgrounds. Overall, it appears national policy in Ireland relating to children with EAL is somewhat underdeveloped in comparison to their international counterparts. Albeit it must be noted that historical trends in terms of US and United Kingdom immigration have provided such regions with a 'headstart' in terms of policy provision for children with EAL. Nonetheless, the population of Ireland is rapidly diversifying and policy directives should be developing in line with this evolution. The need for purposeful policy provision for children with EAL is an area of urgent need, given that the language profiles of children with EAL, can initially appear similar to children with DLD (Armon-Lotem, 2012; Paradis, 2010). However, evidence suggests that children with DLD and children with EAL follow distinct developmental patterns, whilst some commonalities are also apparent between monolingual and EAL language development. Considerable similarities between EAL and DLD language presentations can result in erroneous assessments.

2.4. Language Development

2.4.1. Atypical language development. With a prevalence of approximately 7.5% (Norbury et al., 2016), children with DLD often experience academic difficulties (Tomblin, Zhang, Buckwalter & Catts 2000), as well as social-emotional difficulties (Yew & O'Kearney, 2013). Research illustrates how DLD is often related to reduced vocabulary and difficulties with comprehension and expression (Ponari et al., 2018). Children with DLD may present with poorer phonological awareness and they may have word retrieval issues (Epstein, Shafer, Melara, & Schwartz, 2014; Laloi et al., 2017). Children with marked language difficulties may also have difficulties with the morphological aspects of language (Özçelik, 2018). Paradis (2005) explain that children with DLD may have difficulties with suffixes (e.g., '-ed' in 'jumped'), plurals, verbs and

content nouns. Specifically, research illustrates that children with DLD may have difficulties with tense morphology, and thus, this difficulty represents a clinical marker of DLD (Rice & Wexler, 1996).

According to Weismer and Kaushanskaya (2010), early EAL language development may mirror that of DLD language development. Specifically, children with EAL may make similar errors to children with DLD, such as morphological errors (Weismer & Kaushanskaya, 2010). As has been aforementioned, morphological errors are one of the pivotal markers of DLD. In fact, a wealth of research has indicated that the language profiles of children with DLD and children with EAL (i.e., in their L2) share significant commonalities (Crago & Paradis, 2003; Windsor & Kohnert, 2004). For example, Mak, Tribushinina, Lomako, Gagarina, Abrosova and Sanders (2017) claimed that children with EAL may have less developed language skills than their typically developing monolingual peers. Underdeveloped language skills may be attributed to insufficient exposure to the L1, non-native L2 instruction and cross-linguistic issues, inter alia (Mak et al., 2017). Paradis (2005) also argued that children with EAL and DLD should be typically developing in all areas outside of language, further increasing the likelihood of erroneous diagnoses. Assessments of both groups may be further hampered by the prominence of language-based assessments for assessing, which often focus on the groups' language-based similarities (e.g., difficulties with verbs). Although children with EAL and children with DLD have similar language difficulties, it appears that difficulties may be attributed to different underlying issues as will be discussed later (Mak et al., 2017).

2.4.2. Cummins' theory. EAL language acquisition may be explained by Cummins' (2008) theory. Cummins (2008) stated that language acquisition may follow two distinct trajectories including Cognitive Academic Language Proficiency (CALP) and Basic Interpersonal Communication Skills (BICS). The former refers to a child's ability to display competency in both written and verbal academic language (Cummins, 2000). CALP often represents the more complex of both language acquisition pathways, whilst BICS refers to more informal, conversational language (Cummins, 2008). CALP is often acquired later than BICS, and subsequently, children may present with more apparent language difficulties in school than in more informal contexts (Cummins, 2008). Research suggests that it could take a child approximately nine years to achieve proficiency in an additional language, with the development of CALP taking longer than

the development of BICS (Cummins, 2008; Slama, 2012). Cummins (1984) stated that by failing to make a distinction between BICS and CALP, professionals may engage in inaccurate psychological assessments of children with EAL. Furthermore, Cummins (1984) claimed that teachers and psychologists often do not make a distinction between BICS and CALP, leading to children's premature exit from additional language support. Indeed, in Ireland, children with EAL are often expected to have become proficient in English after two years of additional support (Taguma et al., 2009). Critiques of Cummins' (2008) theory have argued that it is a 'deficit theory', whereby the concept of CALP may attribute academic difficulties 'within-child' rather than to academic factors (Edelsky, 1990). However, Cummins (1996) has elaborated that the difficulties experienced by children with EAL may be attributed to socio-political factors, which impact directly on educational provision.

2.5. Cognitive Theoretical Perspectives of Language Development

As well as typological language differences between children with DLD and children who have EAL, cognitive theories on DLD and EAL may actually underpin key differences. In fact, evidence suggests that an understanding of the processes underpinning language acquisition is central to the accurate assessment of children with EAL (Ferlis & Xu, 2016). Embedded in cognitive theories of DLD is the notion that the cognitive processes of children with EAL and DLDs are governed by two distinct trajectories. Specifically, research illustrates how typically developing children with EAL may not have certain cognitive deficits that children with DLD possess (Montgomery, Magimairaj & Finney, 2010). A swath of literature has revealed that working memory (including non-verbal and verbal working memory) and processing speed deficits are often evident amongst children who have DLD (Leonard, Weismer, Miller, Francis, Tomblin, & Kail, 2007; Marton & Schwartz, 2003; Montgomery et al., 2010). Therefore, it may be anticipated that children with EAL may not present with working memory or speed of processing deficits, whereas children who have a DLD may have difficulties in these areas. Evidence also suggests that children with EAL may outperform children with DLD on related aspects of executive functioning, such as attention (Sandgren & Holmström, 2015). Interestingly, Sandgren and Holmström (2015) argued that typically developing children with EAL may actually have superior cognitive functioning in these domains in comparison to their typically developing monolingual counterparts. The evidence cited here also has a theoretical basis, as highlighted in sections 2.5.1 to 2.5.4.

2.5.1. Limited processing capacity of developmental language disorder. Firstly, inherent to our understanding of DLD are Limited Processing Capacity theories of language development (e.g., Kail, 1994; Montgomery, 2000). Limited Processing Capacity theories of DLD delineate that language difficulties may be the result of cognitive impairments or domain-general cognitive aspects of functioning (Paradis, 2010). Sandgren and Holmström (2015) argued that learning a second language may, in fact, improve upon these domain-general cognitive aspects, rendering children with EAL with more cognitive advantages than monolingual children. Although some researchers debate the notion of limited processing capacity (see Rothweiler, 2010), Kail and Salthouse (1994) have strongly argued that DLD may be explained by a limited capacity model. Leonard et al. (2007) proposed that this view of limited processing capacity is triarchic in nature. Firstly, Kail and Salthouse (1994) proposed that the computational aspect of memory is restricted… in other words, there is a limited space for storing information. Secondly, represented through the analogy of fuel expenditure, Kail and Salthouse (1994) posited that limited processing is akin to expending fuel or energy, prior to completion of a task. Finally, it was proposed that information is not processed in prompt manner, rendering information vulnerable to corrosion or decay (Kail & Salthouse, 1994). Leonard et al. (2007) proposed that the first two perspectives may represent working memory, whilst the third perspective represents processing speed. In this way, evidence suggests that processing speed and working memory may not be distinct entities; faster processing speed, for example, can result in faster rehearsal (Leonard et al., 2007). Finally, Leonard et al. (2007) argue that processes required for completing timed tasks, such as attention, have also been found to be related to working memory. In fact, a corpus of neurological evidence suggests that the brain mechanisms, associated with attention, are the same as those needed for working memory (Ellis Weismer, Plante, Jones & Tomblin, 2005; Jonies, Lacey & Nee, 2005). In their 2005 study, Jonides et al. (2005) found that the neurological components of attention were similar to those required for refreshing internal representations in working memory. Overall, it appears that cognitive deficits are at the essence of language difficulties in children with DLD and this notion is encapsulated by the recent terminological advancement.

2.5.2. Verbal working memory. As evident from the analogy presented in section 2.5.1, verbal working memory refers to an individual's ability to temporarily retain and transform information while performing mental operations (Pham & Hasson,

2014). With an expansive research base, Baddeley's (1986) model of working memory aimed to explain the concept of working memory in terms of both a phonological and visual spatial storage system. Specifically, the phonological loop briefly stores verbal information in short term memory (Baddeley, 1986). Without rehearsal, this verbal information will eventually be lost and replaced by new verbal information (Baddeley, 1986). In a similar process, the visuospatial sketchpad briefly stores visual information (Baddeley, 1986). Through the methods of information encoding and retrieval, the central executive coordinates information flow. Baddeley expanded this model in 2000 to incorporate the concept of an episodic buffer, that is, a component of working memory which is responsible for assimilating features of objects or words (i.e., 'chunking'). Empirical evidence suggests that children with DLD have particular difficulties with the processes associated with the phonological loop (Gathercole & Baddeley, 1990). Therefore, Leonard et al. (2007) argued that the notion that children with DLD are unable to retain verbal information long enough to create a phonological representation of a word, may be a plausible explanation for language difficulties. Boerma and Blom (2017) suggested that due to deficits in the phonological mechanism of working memory, children with DLD often struggle with repeating nonwords. Conversely, typically developing children with EAL usually do not have difficulties with verbal working memory mechanisms (Sandgren & Holmström, 2015; Leonard et al., 2007) nor nonword repetition (Boerma & Blom, 2015). Interestingly, nonword repetition tasks are based on Baddeley's (1986) concept of the phonological loop (Im-Bolter, Johnson & Pascual-Leone, 2006).

2.5.3. Processing speed. Leonard et al. (2007) also argued that delayed processing may result in children with DLD having difficulties in promptly processing sentences, for example. Processing speed typically refers to an individual's ability to process information with speed and with reasonable accuracy (Jacobson et al., 2011). Kail (1994) argued that children with DLD typically have slower Response Times (RTs) than typically developing children, with Miller et al. (2001) finding that children with DLD were typically 14% slower in their RTs. With regards to typically developing children with EAL, evidence suggests that these children should perform similarly to their typically developing monolingual peers on non-linguistic processing speed tasks (Sandgren & Holmström, 2015). However, Foy and Mann (2014) found that that children with EAL may not perform as well on verbal trials measuring accuracy and RT. Overall, the processing speed difficulties evident in children with a DLD are often described by

the general slowing hypothesis (Kail, 1994) and the temporal processing theory of DLD (Tallal, Miller & Fitch, 1993). Kail's (1994) general slowing hypothesis suggests that children with DLD often have difficulties with overall cognitive processing and would typically have slower reaction times across most tasks in comparison to same-aged typically developing peers. Kail (1994) proposed that this reduced processing speed would be evident across tasks rather than being a domain-specific phenomenon. In terms of the temporal processing theory of DLD, Tallal et al. (1993) argued that difficulties in processing speed may only relate to the auditory processing domain, where issues with sensory integration may be evident. However, Hill (2001) suggests that evidence now suggests that children with DLD appear to have difficulties with processing speed in general which aligns more closely with the sentiments expressed via Kail's (1994) general slowing hypothesis.

2.5.4. Cattell-Horn-Carroll theory. Interestingly, the deficits associated with DLDs appear to be aligned somewhat to those associated with Specific Learning Difficulties (SLD). For example, Smith-Spark and Fisk (2007) suggested that children with SLDs may have deficits in verbal working memory and processing speed and this has been reflected in recent advances in the assessment of SLDs in Ireland. Interestingly, such advancements in the assessment of children with SLD may be applicable to the assessment of children with DLD and is related to the Cattell-Horn-Carroll (CHC) theory of intelligence (McGrew, 1997).

Ultimately, CHC Theory (McGrew, 1997) posited that intelligence is comprised of ten broad and 70 narrow abilities and this has directly influenced what is known as the 'third option(s)' of SLD identification (Flanagan, Fiorello & Ortiz, 2010). Specifically, it appears that there is a gradual move away from individual assessments of literacy in SLD assessments towards assessments of cognitive abilities with researchers becoming confident in the predictive validity of testing underlying cognitive abilities related to SLDs. Traditional methods of SLD identification such as the ability-achievement discrepancy have been met with some scepticism (e.g., Ysseldyke, 2005), whilst Response to Intervention approaches appear to be invalid (Reynolds & Shawitz, 2009). However, grounded in CHC theory, Flanagan et al. (2010) proposed this 'third option' in SLD diagnosis focusses on objectively assessing a child's performance across a broad range of cognitive abilities, in particular those abilities typically associated with SLD.

2.6. Assessment and (Mis)diagnosis of Developmental Language Disorder

In tandem with assessments of SLD, recent literature has drawn attention to the adoption of unbiased methods for assessing DLDs in children who have EAL, such as cognitive testing. Unfortunately, however, it appears that tools used to assess children with EAL are typically biased and language-based (Cummins, 2008). Such assessments may be in the child's L1 or in the child's L2. The Irish Association of Speech and Language Therapists (IASLT, 2017) have recommended that children with EAL are tested in their first language, whilst professionals should ensure that translators are used if necessary. Paradis (2016) also argued that testing a child in their first language was a sensible and reliable approach.

Unfortunately, however, numerous researchers have highlighted difficulties in accessing translation services, tools or professionals capable of assessing children from minority ethnolinguistic backgrounds (Boerma & Blom, 2017). However, according to Vanderwood, Tung and Checca (2013), assessments provided to children with EAL in their L2 are often inaccurate and are more favourable towards monolingual children. Resendiz and Peña (2015) also stated that interpreting standardised tests with children with EAL, including those tests used by SLTs, may be hazardous. Paradis (2005) referred to a swath of evidence which suggested that professionals should exercise caution when assessing children in their L2, stating that such biased assessment methods increase the risk of mistaken or missed identity.

As has been discussed, the overlap between children with EAL and children with DLD's language profiles poses a further challenge in the assessment of children with EAL. As children with EAL and DLD appear to follow distinct cognitive trajectories, would language-reduced assessments focussing on the differences between both groups be more appropriate rather than focussing on the commonalities between them? Evidence would suggest so (e.g., Sandgren & Holmström, 2015). Although assessments of DLD in children with EAL still include language-based assessments (e.g., tests of morphology and vocabulary), emerging literature has advocated the use of less language-burdened assessments. Notwithstanding assessments of language, such as, nonsense verb assessments (e.g., Jacobson & Livert, 2010), recent research has focussed on Dynamic Assessment (Petersen, Chanthongthip, Ukrainetz, Spencer & Steeve, 2017), nonword repetition tasks (Thordardottir, 2015), digit span tests (Ziethe, Eysholdt & Doellinger, 2013), tests of processing speed (Leonard et al., 2007), language sample analysis

(Kapantzoglou, Fergadiotis & Restrepo, 2017) and tests of executive functioning (Sandgren & Holmström, 2015). However, some of these tests are presented to the child in his/her L1, rendering it difficult to find unbiased tests that can be administered to all children regardless of language background. Adding to the difficulties associated with the assessment of children with EAL is the prevalence of referrals by teachers to external services. Such unnecessary referrals may be attributed to the notion that language development of children with EAL is often unknown territory for professionals. The underlying assumptions of Cummins' (2008) theory along with Sociocultural theory (Vygotksy, 1978) are often misunderstood by teachers (Ferlis & Xu, 2016). Ferlis and Xu's (2016) assumptions in this domain are therefore critical to our understanding of the shortcoming associated with inappropriate referrals and subsequent misdiagnoses.

From an Irish perspective, a recent publication by IASLT (2017) advised that children should be diagnosed with a DLD based on a case history, formal and informal language testing, observations, Response to Intervention and an evaluation of risk factors. However, with regards to formal testing, O' Toole and Hickey (2012) raised important points regarding the difficulties encountered by EPs and SLTs in attaining appropriate assessment tools for identifying DLDs amongst Irish-speaking children in Gaeltacht areas (i.e., Irish speaking regions of Ireland). IASLT (2017) also provided recommendations for assessing children from diverse linguistic backgrounds. They recommended a lengthy assessment process, where professionals ascertain language exposure and input, adopt tools which examine underlying markers of impairment, whilst applying a Response to Intervention approach. Paradoxically, it emerged that there was an overreliance on the discrepancy model, whereby average or above average ability scores on cognitive testing were required to be discrepant from language scores (IASLT, 2017). Again, children with EAL may automatically have lower language scores and therefore may meet the criteria for a DLD.

2.7. Summary of Rationale and Aims of the Systematic Review

Research has highlighted how a misunderstanding of the processes and theories underlying second language acquisition can lead to the misidentification of DLDs amongst the EAL population (Ferlis and Xu, 2016). Noted as cases of 'missed' or 'mistaken' identities, Paradis (2005) stated that the overlap in language presentations between children with EAL and DLD is at the crux of erroneous assessments. Subsequently, research illustrates that a lack of proficiency in a second language is often

wrongly regarded as a language deficit, leading to the disproportionality of EAL learners being diagnosed with DLDs (Cummins, 2000; Ferlis & Xu, 2016). Research is ubiquitous in its support of the notion that children with EAL are overidentified as having DLD or another SEN, as a result of inappropriate assessment approaches (Artiles, Rueda, Salazar, & Higareda, 2005). Conversely, research has highlighted how children with EAL's comprehension difficulties may remain undetected as difficulties may be attributed to their EAL status rather than to a language difficulty (Bowyer-Crane, Fricke, Schaefer, Lervåg & Hulme, 2017). Paradis (2005) supported these claims, adding that professionals may adopt a 'wait and see' approach, resulting in children with EAL remaining undiagnosed for a prolonged period. However, for the most part, in light of the potential inadequacies in terms of assessment tools, a disproportionate number of children with EAL are identified as having DLD and subsequently receive special education as opposed to language support (Artiles & Ortiz, 2002; Keller-Allen, 2006). Sullivan (2011) claimed that special education is often a misdirected and ineffective remedy for improving English language proficiency. Similarly, Kim and Helphenstine (2017) asserted that interventions typically associated with SEN are often futile in helping children to acquire an additional language. In fact, special education provision may even be harmful to the learning of children who have EAL (Kim & Helphenstine, 2017). On the other hand, children with EAL who remain with undetected language difficulties may be inappropriately placed in mainstream education or they may not receive much-needed additional support (e.g., SLT) (Paradis, 2005).

Over-identification and under-identification may also be attributed to a dearth of suitable assessment tools for differentiating between typically developing English Language Learners and actual language impaired children with EAL (Bedore & Peña, 2008; Linan-Thompson & Ortiz, 2009; Paradis, 2005). Many researchers have called for more research on the topic of DLD identification amongst children with EAL (Paradis, 2010; Rutis & Xu, 2016). Accurate assessment tools are required to ensure that children's needs are evaluated precisely and without bias. In fact, Peña, Gillam and Bedore (2014) stated that the literature was ubiquitous in stating that 'accurate assessment of bilingual children is a critical practical need in the field' (p. 2208). In the DES inspectorate report (DES, 2012b), entitled 'English as an Additional Language in Primary Schools', the inspectorate stated that more effective and accurate assessment tools were required. In a study conducted by Murtagh and Francis (2012), it emerged that Irish teachers were also concerned about the potential overidentification of SEN amongst children with EAL with

explicit reference to a lack of appropriate assessment tools. IASLT (2006) also stated that the 'availability of standardised tests where norms are based on bilingual children is limited' (p. 6). They promoted the place of differential diagnosis in terms of differentiating between a lack of language proficiency and an actual language disorder. Alongside apparent concerns from the SLT and teaching communities in Ireland, it appears that Irish psychologists recognise the need for more accurate assessment tools. O'Toole and Hickey's (2012) research highlighted the difficulties faced by both EPs and SLTs when engaging in the assessment process. It was reported that such clinicians felt that their own assessment strategies were flawed; the assessments employed were relatively informal and 'unstandardised' due to the limited availability of assessment tools for linguistically diverse learners. EPs and SLTs reported that they often had to translate standardised tests for the purpose of assessments (O'Toole & Hickey, 2012), albeit Boerma and Blom (2017) stated that this may be an impractical method for assessing children from diverse language backgrounds. Overall, the National Educational Psychological Service (NEPS) have recently stated that there is a need for developing a screener tool to differentiate between the features of DLDs and EAL (NEPS, 2011).

2.7.1. Overarching aim of the study. Based on the above rationale, difficulties in the assessment of DLDs amongst children who have EAL speaks to the urgent need for a reliable and universal assessment tool that can screen for DLDs in this population. Such a tool could be used with a heterogenous group of children with EAL regardless of language background. In turn, this would serve to lessen the likelihood of subsequent misdiagnoses of DLDs amongst children who have EAL. A systematic review was deemed an appropriate method of reviewing the previous research in the area, as Schlosser (2007) has found that such reviews can increase objectivity in selecting and analysing studies for review, thus eliminating bias. In this way, criticisms associated with certain studies may not present as targeted polemics, but rather as unbiased critical appraisals of the methodologies employed.

2.7.2. Review question. In light of the rationale for the current study, the systematic review will attempt to ascertain which assessment methods may be most effective for the purpose of identifying a potential DLD amongst an EAL population.

2.8. Search Strategy

An initial literature search was conducted on the 21st of July 2017, whilst a later search was conducted on the 12th of August 2018 to ensure that the systematic review

included recent articles, as well as articles that may have adopted the term DLD. Databases for the search incorporated Academic Search Complete, British Education Index, Education Full Text (H.W. Wilson), ERIC, Education Source and PsycINFO. On the 21st of July 2017, the 'multi-field' search was limited to the following search terms: ("English as an Additional Language" or "EAL" or "English as a Second Language" or "ESL" or "English Language Learner*" or "ELL" or "bilingual") and ("Specific Language Impairment" or "SLI" or "Specific Speech and Language Impairment" or "SSLI" or "language impairment" or "language disorder") and ("assess*" or "screen*" or "diagnos*"). The literature search conducted on the 12th of August 2018 was expanded in order to incorporate the terms "DLD" and "Developmental Language Disorder", and thus included the following search ("English as an Additional Language" or "EAL" or "English as a Second Language" or "ESL" or "English Language Learner*" or "ELL" or "bilingual") and ("Specific Language Impairment" or "SLI" or "Specific Speech and Language Impairment" or "SSLI" or "language impairment" or "language disorder" or "DLD" or "Developmental Language Disorder") and ("assess*" or "screen*" or "diagnos*"). Search terms were based on the premise that variations exist in terms of the 'labels' and subsequent acronyms used to describe children with EAL and DLDs. As per the inclusionary criteria highlighted in Table 1, articles were limited to the previous ten years from the date of the initial literature search (i.e., 2007 and later). Results from the database searches yielded 566 texts. The initial 566 articles were then limited to scholarly peer-reviewed journals thus eliminating 'grey literature' to ensure a certain academic standard, resulting in 505 articles for review. Duplicates were subsequently removed resulting in 194 studies remaining for initial title screening, using the inclusion and exclusion criteria presented in Table 1 below. Along with further de-duplication, the initial title screening resulted in 118 more articles being excluded, resulting in 79 articles available for initial abstract screening. Again, the abstracts of each article were screened using the inclusion and exclusion criteria outlined in Table 1. Forty-nine articles were excluded from the review following abstract screening resulting in 30 studies being subjected to a full-article review. Eight articles met the inclusionary criteria following a full-article review and thus were eligible for the systematic review. Of the remaining articles, an ancestral search was implemented, from which no further citations appeared to meet inclusionary criteria. The nine articles are noted in Table 2. The PRISMA Flow Chart (appendix A) highlights an overview of the search strategy employed, whilst articles excluded from the systematic review following the full-article review/abstract

review and the rationale for removal are provided in appendix B. A summary of included articles is tabulated in appendix C.

Table 1.

Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion	Rationale
1. Publication Type	a) The study must have been published in a peer-reviewed journal b) Publication date must be within the last 10 years (i.e., 2007-2017/2018)	a) The study was not published in a peer-reviewed journal b) The study has been published prior to 2007	a) The study has met certain academic and quality standards b) The date of publication should be relatively recent in order to eliminate 'outdated technologies' (Treadwell, Singh, Talati, McPheeters & Reston, 2011)
2.Language	The study must be published in the English language and all tools must be in English, available in English or should be non-language based or should not be in L1 of child with EAL.	The study/tools are not available in English language/are language-based/are in L1 of child with EAL.	For readability as there are no methods for translation available. For the purpose of the study, the tools should preferably be unbiased.
3.Type of Study/Design	a) The study must incorporate original, primary data b) The study must be quantitative or include a mixed-methods approach	a) The study includes secondary sources of data (e.g., meta-analyses, reviews, editorial) b) The study or qualitative data	Primary data and original studies required for the purpose of a systematic review b) Quantitative data may provide more reliable results

4.Measure/Outcomes	a) The study must provide details on assessments or diagnostic procedures for identifying a DLD in children with EAL	a) The study does refer to assessment procedures	a) Must be relevant to the review question
5.Participants	a) Participants should only include school children at primary school level aged pre-school level	a) Post-primary students (over 13 years old) or adult sample size.	a) The sample size for the proposed research study will be primary school or pre-school pupils as these populations are most likely to receive a diagnosis of DLD
	b) Participants must primarily include a sample of children who have EAL or DLD, whilst a comparison monolingual group (i.e., control) should be incorporated, or indeed another suitable control group.	b) Studies in which participants do not have EAL, a DLD or a monolingual group.	b) The review question aims to ascertain the characteristics and subsequent assessment procedures for children who have EAL and potential DLDs.

Table 2.

References for studies included in systematic review

1) Boerma, T., & Blom, E. (2017). Assessment of bilingual children: What if testing both languages is not possible? *Journal of Communication Disorders, 66*(1), 65-76.
2) Chiat, S., & Polišenská, K. (2016). A framework for crosslinguistic nonword repetition tests: Effects of bilingualism and socioeconomic status on children's performance. *Journal of Speech, Language, and Hearing Research, 59*(5), 1179-1189.
3) Danahy, K., Windsor, J., & Kohnert, K. (2007). Counting span and the identification of primary language impairment. *International Journal of Language & Communication Disorders*, *42*(3), 349-365.
4) Komeili, M., & Marshall, C. R. (2013). Sentence repetition as a measure of morphosyntax in monolingual and bilingual children. *Clinical Linguistics & Phonetics*, *27*(2), 152-162.
5) Paradis, J., Schneider, P., & Duncan, T. S. (2013). Discriminating children with language impairment among English-language learners from diverse first-language backgrounds. *Journal of Speech, Language, and Hearing Research*, *56*(3), 971-981.
6) Peña, E. D., Gillam, R. B., & Bedore, L. M. (2014). Dynamic assessment of narrative ability in English accurately identifies language impairment in English language learners. *Journal of Speech, Language, and Hearing Research*, *57*(6), 2208-2220.
7) Pua, E. P. K., Lee, M. L. C., & Liow, S. J. R. (2017). Screening Bilingual Preschoolers for Language Difficulties: Utility of Teacher and Parent Reports. *Journal of Speech, Language, and Hearing Research, 60*(4), 950-968.
8) Ziethe, A., Eysholdt, U., & Doellinger, M. (2013). Sentence repetition and digit span: Potential markers of bilingual children with suspected SLI? *Logopedics Phoniatrics Vocology, 38*(1), 1-10.

2.9. Weight of Evidence Attributed to Each Study

The eight studies highlighted above were subsequently evaluated using quality indicators as detailed in appendix D, whilst a sample scoring procedure for Danahy et al.'s (2007) study is highlighted in appendix E. Specifically, using Gough's (2007) 'Weight of Evidence (WoE)' as an overarching framework, each study was appraised in light of their methodological quality (i.e., WoE A), the relevance of the methodology for addressing the systematic review question (i.e., WoE B), as well as the relevance of the evidence to the review question (i.e., WoE C). The weightings of all three WoE's were computed and averaged to provide an overall WoE (i.e., WoE D). Please refer to appendix

D for a more detailed overview of each WoE factor, as well as the specific quality indicators used to provide subsequent ratings (i.e., weightings of evidence). Table 3 below provides a summary of the WoE for each study, as well as an overall WoE.

Table 3.

Summary of WoE for each article

Study	**WoE A** **Methodological Quality**	**WoE B** **Methodological Relevance**	**WoE C** **Relevance to the review question**	**WoE D** **Overall Weight of Evidence**
Boerma & Blom (2017)	*High (2.45)*	*Medium (2)*	*High (3)*	*High (2.46)*
Chiat & Polišenská (2016)	*Medium (2.18)*	*Medium (2)*	*Low (1)*	*Medium (2.08)*
Danahy et al. (2007)	*Medium (2.27)*	*High (3)*	*Medium (2)*	*Medium (2.3)*
Komeili & Marshall (2013)	*Medium (2.27)*	*Low (1)*	*High (3)*	*Medium (2.09)*
Paradis et al. (2013)	*High (2.45)*	*High (3)*	*Medium (2)*	*Medium (2.15)*
Peña et al. (2014)	*High (2.54)*	*Medium (2)*	*Low (1)*	*Medium (1.87)*
Pua et al. (2017)	*High (2.64)*	*High (3)*	*High (3)*	*High (2.88)*
Ziethe et al. (2010)	*Medium (1.72)*	*Medium (2)*	*Medium (2)*	*Medium (1.77)*

2.10. Critical Appraisal

2.10.1. Participant details. An analysis of the 757 participants who took part in the various studies revealed a diverse range of demographic characteristics. The demographical information provided, or lack thereof, resulted in variations in the ratings corresponding to demographical information and sample selection on WoE A (Gersten & Edyburn, 2007; Wells et al., 2009).

2.10.1.1. Language characteristics. Of the eight studies reviewed, two studies were conducted in the US (Danahy et al., 2007; Peña et al., 2014), with another two studies taking place in the United Kingdom (Chiat & Polišenská, 2016; Komeili & Marshall, 2013). The remaining studies were carried out in Singapore (Pua et al., 2017), Germany (Ziethe et al., 2010), the Netherlands (Boerma & Blom, 2017) and Canada (Paradis et al., 2013). Therefore, none of the studies for review were conducted in an Irish context. Key information regarding the L1 and L2 of participants were provided in all eight studies. Amongst these participants, English was the second language (i.e., L2) of the participants in all studies except Boerma and Blom's (2017) study where Spanish and Turkish were the L2s of participants. Participants' first spoken language (i.e., L1) varied from Spanish (Danahy et al., 2007; Peña et al., 2014) to Farsi/Persian (Komeili & Marshall, 2013) and to Malay or Mandarin (Pua et al., 2017). Turkish and Moroccan were the first languages of participants in Boerma and Blom's (2017) study. Paradis et al.'s (2013) study focussed on a diverse range of children with EAL, where first languages included Arabic, Assyrian, Cantonese, Farsi, Hindi, Mandarin, Portuguese, Punjabi, Urdu, Somali, Spanish, and Vietnamese. Paradis et al. (2013) provided relevant rationale for including a diverse range of languages. They stated that there were limited data available regarding the testing of children from diverse language backgrounds (Paradis et al., 2013). Paradis et al.'s (2013) received higher ratings in terms of WoE A as the characteristics of the participants reflected the characteristics of a more diverse population. However, the participants in Ziethe et al.'s (2010) included children whose L1 was German, rendering this study less applicable to the current study, where English is intended to represent the first language of the monolingual control group. Nonetheless, the tools used in Ziethe et al.'s (2010) study can also be used with a heterogeneous group of children with EAL. Specifically, the L2s of participants included Turkish, Italian, Polish, Greek, Finnish, Vietnamese, and English. Such tools would therefore be relevant in an Irish context, in light of the ESRI's (2009) data which indicated that newcomer pupils come from diverse linguistic and ethnic backgrounds. Interestingly, it appears that the languages chosen in the other studies were aligned with the most dominant second languages spoken in those countries. For example, after English, Spanish is the most commonly spoken language of individuals living in the US (American Community Survey Reports, 2011), whereas in Canada, Chinese is the most prominent first language amongst immigrants (Census Canada, 2011). An Irish study may have focussed on children who have Polish as a first language, in line with 2016 Census figures. The CSO

(2017) publication provided data showing that Polish is the most common first language amongst immigrants living in Ireland. Notably, none of the eight studies employed participants from micro-ethnic linguistic backgrounds. As it can be difficult to find assessment tools or translators for children who speak minority languages (Boerma & Blom, 2017), representatives from these cultures would have otherwise enhanced each study's relevance to the review question (i.e., WoE C).

2.10.1.2. Other relevant characteristics. Participants' ages ranged from three years old to 13 years old. The age ranges of participants were reported in all studies, albeit Peña et al. (2014) reported grades (e.g., kindergarten) as a proxy for age. This negatively impacted on Peña et al.'s (2014) rating on this criterion on WoE A. Other demographical information was consistently sparse across all studies. Most studies provided limited demographical information such as socioeconomic status, with the exception of Chiat and Polišenská's (2016) study. Chiat and Polišenská's (2016) emphasised the importance of determining participants' socioeconomic status due to its influence on language development. There was also a lack of precision regarding gender descriptors and age ranges across all studies, resulting in reductions in the scores attributed to studies on WoE A and WoE B. All studies also failed to address issues regarding power in terms of sample size, with none of the eight studies offering justification for chosen sample size. Thus, there is a chance that some of the studies may have been underpowered. However, each study appeared to have similar group sizes, with sample sizes typically ranging from 12 to 25 participants per group.

2.10.2. Study design. Each of the eight studies were critically evaluated in terms of their study design and sampling techniques. Higher ratings were provided across WoE A and WoE B for sufficient detail provided regarding methodologies adopted.

2.10.2.1. Sampling procedure and participant recruitment. The sampling procedure of each study was critically appraised in line with WoE A, where it was stated that the method for selecting participants must be detailed clearly (Gersten & Edyburn, 2007). Ratings on this criterion fluctuated depending on the level of detail provided. A number of studies received high ratings as they provided sufficient details in terms of the sampling procedure employed, as well as pertinent prerequisites for eligibility for participation in the study. These prerequisites included potential confounding variables such as hearing impairments or another SEN, as well as methods for ensuring that participants met the criteria for EAL. However, it appeared that Komeili and Marshall

(2012) provided only sparse data in terms of determining the EAL status of participants, as well as giving limited information on language exposure. Other studies carried out significant prerequisite screening and testing to ensure participants were suitable for inclusion in the studies. For example, Ziethe et al. (2010) conducted tests of intelligence and other testing, where children who received scores of <85 were excluded. Interestingly, Boerma and Blom (2017) included participants who had a nonverbal intelligence of 70 or above. This is questionable as lower performances on certain assessments may have been attributed to lower nonverbal intelligence.

Regarding specific sampling procedures, only three of the studies (Chiat & Polišenská, 2016; Komeili & Marshall, 2012; Peña et al., 2014) provided sufficient information on how they initially selected participants. Komeili and Marshall (2012) incorporated a convenience sampling approach, whilst Peña et al. (2014) recruited participants from a previous longitudinal study. The latter may have resulted in an even greater selection bias, as certain characteristics are associated with individuals who typically participate in studies; therefore, the sample may not represent the 'sample of interest' (Patel, Doku & Tennakoon, 2003, p. 229). Ultimately, Mackey and Gass (2015) stated that although convenience sampling is the most commonly adopted method in second language research, a random sampling approach would ensure a more representative sample. It appears that none of the eight studies adopted this sampling approach. Shuttleworth-Edwards (2016) has previously cautioned researchers who assume that a sample is representative of the population of interest, by stating that a test which is 'generally representative… is representative of none' (p. 975). Instead they recommended researchers engage in a cautious stratification of within-group norms, a method which was not evident amongst any of the studies for review. Nonetheless, research illustrates that a purposive sampling technique may be more appropriate for selecting certain groups (Etikan, Musa & Alkassim, 2016). Therefore, the sampling approaches adopted may have been a more practical method for accessing children with DLD and children with EAL. However, Mackey and Gass (2015) stated that if a random sampling technique is not feasible, it is advisable that researchers provide a thorough account of the sampling procedure adopted. This would allow those reading the paper to decide if the results are meaningful to the population of interest. The remaining studies provided only vague information on how they initially enlisted participants and therefore this effected their ratings on WoE A.

2.10.2.2. Research design. The research design can include experimental random assignment or quasi-experimental non-random assignments (Mackey & Gass, 2015). However, given the nature of the systematic review question, it is unsurprising that all of the studies for review incorporated cross-sectional or matched-subject designs. In fact, seven of the eight studies for review included more than one group or incorporated a matched-subjects design. The use of more than one group provided a robust method for ascertaining the effectiveness of certain assessment tools in identifying DLDs, in line with the systematic review question. Danahy et al.'s (2007) study incorporated three groups including English-speaking children with a DLD, typically developing English-speaking children, and EAL children with typical language development. Peña et al. (2014) also included these three groups. The inclusion of three groups permitted the researchers to ascertain if their assessment tools could correctly identify children with DLDs, whilst determining if the tool overidentified DLDs amongst the EAL group. Both Komeili and Marshall (2012) and Paradis et al. (2013) included two groups of participants (i.e., EAL vs non-EAL children, and EAL children with a DLD and typically developing EAL, respectively). Boerma and Blom (2017) incorporated a four-group design (i.e., monolingual and EAL children with and without a DLD), whilst Ziethe et al.'s (2010) retrospective study also included these four groups. Therefore, these seven studies provided a robust method for ascertaining the presence of a DLD amongst an EAL population and hence were relevant to the systematic review question on this aspect (i.e., WoE C). Pua et al. (2017) included only one group of second language learners. Their less rigorous approach was reflected by slightly lower ratings on some aspects of WoE A, in light of the absence of a monolingual control group.

2.10.3. Assessment procedure. Following a thorough critical analysis of the assessment methods used in the eight studies, the systematic review question was clarified further. The assessment strategies were assessed in terms of their implementation, reliability and validity in determining a DLD amongst an EAL population. Studies were rated along similar threads on WoE A and WoE B.

2.10.3.1. Implementation and triangulation. Regarding the fidelity of implementation of the assessment tools, studies were evaluated using the quality criteria for WoE A and the quality criteria for WoE B. Only one of the studies provided details regarding the personnel involved in implementing the assessment (e.g., professional qualifications) (Peña et al., 2014) and thus received improved ratings on WoE A on this

criterion. Each of the studies were also critiqued in light of their use of multiple assessment tools (i.e., triangulation of assessments) on WoE B. Jahangiri, Mucciolo, Choi and Spielman (2008) recommended the use of 'triangulation of assessments' so that any potential limitations of any one assessment method may be overcome. Not inclusive of prerequisite testing, five of the eight studies for review (Danahy et al., 2007; Paradis et al., 2013; Pua et al., 2017; Ziethe et al., 2010) utilised multiple assessment methods and received higher ratings on WoE B.

2.10.3.2. Reliability and validity. McNemar's (1946) assertion that 'all measurement is befuddled by error' (p. 294) was examined in light of the methodologies adopted by the eight studies for review. The reliability of the study refers to the degree to which an assessment method provides consistent outcomes each time it is used, whilst the validity of a tool refers to the accuracy of the tool in measuring a desired outcome (e.g., DLD) (Sullivan, 2011). The reliability of assessment tools was deemed critical in answering the systematic review question. The reliability of the assessment tool was examined in accordance with WoE A and WoE C. Despite the pertinence of determining the reliability of tools, it appears that many of the studies failed to allude to any reliability methodologies (i.e., internal reliability). Four of the studies (Chiat & Polišenská, 2016; Komeili & Marshall, 2012; Paradis et al., 2013; Peña et al., 2012), however, referred to inter-rater reliability. Regardless, although the inter-rater reliability was high (90% - 98%), the researchers were not specific enough about their testing of reliability and failed to describe the percentage agreement procedure followed (e.g., kappa or Kendall Tau?). Peña et al. (2012) were more specific in stating that they used the correlation coefficient to examine inter-rater reliability, although they provided no information on validity. Pua et al. (2017) was the only study to report reliability and validity scores. Pua and colleagues (2017) conducted their own reliability analyses which Weiss, Saklofske, Holdnack and Prifitera, (2016) considered as essential in determining reliability accurately. They examined internal reliability using Cronbach's alpha, where the testing tools used were considered highly reliable (<.86). They also provided details on tests of validity, citing high construct, ecological and face validity. However, low concurrent validity was calculated. Pua et al. (2017) received higher ratings on WoE A and WoE C due to their stringent reliability and validity analyses.

2.11. Synthesis of Findings

Research illustrates that an assessment tool cannot be considered valid unless it is also deemed reliable, whilst a tool can be deemed reliable even if it is not valid (Tavakol & Dennick, 2011). It was therefore of critical importance to examine the reliability and validity of the testing tools adopted in each study in order to determine the accuracy of such methods in determining a DLD amongst an EAL population. It is notable that due to the exploratory nature of most of the studies (i.e., does a certain tool work?), most assessment tools did not undergo validity or reliability tests. Most studies did, however, carry out tests of sensitivity and specificity, or comparable analyses to ascertain the ability of the tools to identify a DLD. Nonetheless, only one of the eight studies (Pua et al., 2017) provided adequate details in terms of validity and reliability. After all, in order to ensure that the assessment is accurate in measuring a construct, the tool must have both reliability and validity (Sullivan, 2011). The systematic review question should subsequently be answered with caution, in the absence of the reports of validity and reliability. Nonetheless, all eight studies claimed that their testing strategies could accurately identify a DLD amongst the EAL population. Please see appendix C for the outcomes of each study.

2.11.1. Findings. In line with research that has stated that verbal working memory is often impaired in children who have a DLD (Montgomery et al., 2010), Danahy et al. (2007) found that a counting span task was sufficiently sensitive in detecting a DLD in children both with and without EAL. They incorporated sophisticated statistical analyses and provided effect sizes ranging from medium to large. Overall, despite Danahy et al. (2007) failing to examine if their tool was reliable, the effect sizes and robust statistical analyses (i.e., ANCOVA) corroborate in suggesting that counting span (i.e., verbal working memory task) and processing speed can be an effective initial screening tool for differentiating between children with and without a DLD, amongst an EAL population. Similarly, Ziethe et al.'s (2010) measures of verbal working memory, which included a digit span task, along with a sentence repetition task, could predict which children had a DLD, to some degree. Two other studies including Boerma and Blom's (2017) and Chiat and Polišenská (2016) measured verbal working memory performance using nonword repetition tasks, both of which could successfully detect a DLD in children. It appears that Komeili and Marshall's (2012) use of the unpublished School-Age Sentence Imitation Test-English 32 (SASIT-E32) (Marinis et al., 2011) for detecting an DLD amongst children with EAL was not as convincing. Although findings suggested

that the SASIT-E32 may be able to distinguish between EAL and DLD, the effect sizes were questionable.

Paradis et al. (2013), on the other hand, had a large sample size and provided details on effect sizes (i.e., small to large effect sizes). Their findings suggested the use of EAL norm-references for standardised tests, as well as triangulating information on first language development using parent questionnaires, could be effective. Paradis et al. (2013) used a rich range of assessment tools in their study (see appendix D), whilst Peña et al. (2014) used only one method of assessment, dynamic assessment. Findings from Peña et al.'s (2014) study suggested that dynamic assessment can be a clinically useful tool for identifying DLDs in EAL children. However, they also did not provide details on effect sizes. Pua et al.'s (2017) study received the highest overall rating (WoE D) and this was unsurprising given that they provided details on reliability, validity, as well as noting medium to large effect sizes. Like Paradis et al.'s (2013) study, Pua et al. (2017) found that teacher ratings may be an effective screening method prior to subsequent referrals to clinicians. It is notable, however, that the apparent effectiveness of teacher reports may be attributed to the lack of methodological rigour associated with the other studies. Furthermore, Pua et al.'s (2017) study incorporated only one form of assessment which is in contempt of the coveted process of triangulation (Jahangiri et al., 2008). There has also been extensive literature showing that teacher ratings are often biased and influenced by contextual factors, such as cultural background (Kozlowski, 2015). In fact, Ferlis and Xu (2016) argued that teachers may be contributing to the over diagnosis of children from EAL backgrounds. Interestingly, Boerma and Blom (2017) found that the use of parental questionnaires in combination with other measures could accurately identify a DLD. Parents may have a more acute understanding of their children's language abilities in their L1.

Table 4.

Assessment tool details

Tools	Reliability	Validity	Can potentially identify DLD (Y/N)	Provided effect size *(f)?* (Y/N)	Triangulation? (Y/N)
Counting span (Danahy et al. (2007)	Not stated	Not stated	Y	Y	Y
SASIT-E32 (Komeili & Marshall, 2012)	Not stated	Not stated	Y	N	N
Parent questionnaire and standardised tests (Paradis et al., 2013)	Not stated	Not stated	Y	Y	Y
Dynamic assessment (Pena et al., 2014)	Not stated	Not stated	Y	N	N
Teacher ratings (Pua et al. (2017)	High	High	Y	Y	N
The Questionnaire for Parents of Bilingual Children; Nonword Repetition Task; The Multilingual Assessment Instrument for Narratives (Boerma & Blom, 2017)	High	High	Y	N	Y

Crosslinguistic Nonword Repetition framework (Chiat & Polišenská, 2016)	No extensive tests conducted but good interrater reliability	No tests conducted	Y	N	N
Digit Span; Sentence Repetition Task; Subtest Imitation of Grammatical Structure (Ziethe et al., 2010)	Not stated	High	Y	N	Y

2.12. Conclusion

The current systematic review sought to determine the most effective assessment tools in determining DLDs in an EAL population. As is evident from the summary in Table 4, all studies referred to the utility of their assessment tools in differentiating between DLD and EAL. The systematic review question has thus been clarified to some degree. However, notwithstanding issues around reliability and validity, there was a dearth of information provided regarding participants, sampling techniques and research design across all studies. These shortcomings are in contempt of the American Psychological Association's (2010) recommendations that research papers should be sufficiently detailed in order to permit others to replicate the study. The reluctance of researchers to elaborate on their methodologies may be somewhat anticipated. Mackey and Gass (2015) stated that second language research is often blighted by scant details in terms of research design. Unfortunately, the lack of elaboration hampered the search for an accurate assessment tool which could differentiate between a DLD and EAL. Therefore, the systematic review question could not be answered with complete clarity. However, five of the studies reported the potential of verbal working memory in disentangling DLD from EAL, whilst the potential of processing speed measures also has a theoretical basis. The use of novel words (i.e., nonword repetition tasks) that would be unfamiliar to both children with EAL and monolingual children (Kohnert et al., 2006) are particularly promising.

Despite these findings, it is noteworthy that there may also have been some limitations inherent in the systematic review process. The quality indicators for WoE B and C were not standardised and thus may have not been entirely valid. The quality criteria indicators for WoE A were adapted from Gersten and Edyburn's (2005) quality indicators which were originally created for appraising intervention studies. Finally, it appeared that the ratings provided for each study may not necessarily have been sensitive enough to detect the more minor shortcomings of the different studies. As a result, it appears that many of the studies were awarded somewhat inflated scores which may not necessarily reflect the quality of the study.

2.12.1. Implications for practice and policy. Despite its shortcomings, the systematic review magnified innate blemishes associated with second language research, flaws which have also been highlighted in the literature (Mackey & Gass, 2015). Considering the lack of methodological rigour of the studies, along with the dearth of existing tools, it may be unsurprising that children with EAL are often over-identified as having a DLD or another SEN. There has been perennial literature on the over-identification of children with SENs amongst the EAL population (Artiles et al., 2005). It also appears that there are issues at the policy and practice level which may be extenuating the problem. The current systematic review has exposed second language research, practice and policies to some scrutiny, which have implications for the current research.

2.12.2. Implications for the current research. Reiterating Pena et al.'s (2014) assertion that the 'accurate assessment of bilingual children is a critical practical need in the field' (p. 2208), it appears that continued research in the area is required. Following a critical analysis of the studies involved in the systematic review, some limitations of the studies emerged. There was a lack of information provided on sampling procedures, recruitment of participants and demographical information. Future research needs to ensure that adequate details are provided, as well as ensuring that sampling procedures are transparent and robust. Parental questionnaires, therefore, would be essential in gathering data related to aspects such as language exposure and socioeconomic status in line with Chiat and Polišenská's (2016) recommendations. With regards to sampling methods, it appears that a purposive sampling approach may be the most appropriate method for recruiting participants with specific characteristics (Etikan et al., 2016), whilst the research should incorporate a group of children with EAL and DLD, as well as a

control group. It is essential that power analyses are conducted to ensure that the research is not associated with pitfalls associated with underpowered research (e.g., Button et al., 2013).

However, central to the criticisms of the current research reviewed was the lack of methodological rigour in terms of testing for reliability and validity of tools. Seven of the eight studies reviewed did not report reliability or validity, thus undermining the credibility of these assessment tools. Future research in the domain should also incorporate more tests of validity or reliability, if possible. Examinee homogeneity may also threaten the reliability of the assessment tool (Hale & Astolfi, 2014). As the majority of the studies reviewed focussed on only one language (e.g., Spanish speakers), it is recommended that future research focusses on a broader scope of languages. Focussing on a more diverse pool of participants may also be more reflective of the Irish population, with recent CSO (2017) figures highlighting the heterogeneity of languages spoken in Ireland. In the same vein, research highlights how psychological tests may be adversely impacted by cultural, language and social biases inherent in the test itself (Bensen, 2003; te Nijenhuis, Willigers, Dragt & van der Flier, 2016). In fact, it appears the assessment tools employed in many of the studies were rooted in language. Therefore, tools such as nonverbal tests of processing speed (Leonard et al., 2007) and nonword repetition tests may offer more scope in the context of assessing a diverse group of children.

Evidence illustrates the importance of triangulating assessment information from multiple sources in order to overcome any shortcomings associated with any one tool (Mucciolo et al., 2008; Oliver-Hoyo & Allen, 2006). Although some of the studies incorporated multiple assessment tools, these tools often lacked reliability or validity, or indeed were possibly flawed by potential sources of error themselves (e.g., cultural and language bias). Future studies should ensure that the assessment tools used are free from cultural and language bias. Alternatively, language-burdened tools should be incorporated with more unbiased assessment strategies. Finally, it appears that some of the studies for review were not necessarily rooted in psychological theory, and therefore, their relevance to educational psychology practice is questionable. The Division of Educational and Child Psychology in the United Kingdom have advised EPs to engage in 'the creative application of psychological theories and research' (Kennedy, 2006, p. 519). Future studies should ensure that the assessment tool chosen is underpinned by psychological theory. As is evident from the literature review, the cognitive markers of

DLD (e.g., verbal working memory and processing speed) have been spawned from cognitive theoretical perspectives.

Drawing from relevant literature in the area, there is an urgent need for the development of a robust, unbiased assessment tool for differentiating between children with EAL and DLDs in an Irish context. The importance of a theoretical foundation for such an assessment tool cannot be underestimated. It is also pertinent that assessment or screener tools are free from cultural and language biases, and tools should be used in conjunction with other assessment tools (i.e., triangulation). Assessments should be preceded by pre-assessment checks, including a thorough parental questionnaire to determine key demographic information. Finally, reliability and tests of validity or at least tests of sensitivity and specificity are required. Stemming from these conclusions, there is a need for unbiased assessment tools which represent the diversity of caseloads encountered by clinicians. In light of this, cognitive tests that are not language loaded may prove fruitful. Ultimately, Norbury and Sonuya-Barke (2017) argued that 'language is a core component of human capital and it is in society's interests that research continues to find the most effective methods of increasing language competencies and minimising the impacts of SLI' (p. 1067).

2.13. Aim of the Study and Research Questions

Stemming from a thorough review of the literature, the aim of the research is to individually-administer tests of processing speed and verbal working memory to typically developing monolingual children, children with DLDs and children with EAL aged between seven and nine years old. These tests will be preceded by principal screening, parental completion of questionnaires and other testing to ensure that children meet the criteria for inclusion in the current research. Specifically, the research intends to answer the following research questions:

1. Can assessments of verbal working memory and speed of processing aid in differentiating between children who have EAL and children who have DLD?
2. Will children with DLD perform significantly lower on assessments of processing speed and verbal working memory than children with EAL and monolingual children?
3. Will children with EAL and monolingual children have similar processing speed and verbal working memory scores?

4. Can processing speed and verbal working memory scores detect the presence or absence of a DLD?

It is hypothesised that assessments of verbal working memory and processing speed can distinguish between children who have EAL and children who have DLD. In line, children with DLD should score lower on these cognitive assessments, whilst children with EAL and monolingual children should have similar cognitive performance. Finally, it was predicted that processing speed and verbal working memory assessments could predict which children had a DLD.

3.0. CHAPTER THREE
METHODOLOGY

In order to address the research questions outlined in section 2.13, the following methodologies were informed both by a (post)positivist philosophical paradigm and by methodologies employed in previously reviewed research (Dollaghan & Campbell, 1998; Leonard et al., 2007). This Chapter further highlights the philosophical paradigm and related assumptions adopted by the researcher, as well as the ethical considerations of the research conducted. The study design will be detailed, and subsequent demographical descriptions of participants will be provided. The diagnostic and screening measures used in the research will be outlined, with due respect for the psychometric properties of the tools. Finally, the procedure used will be outlined in a manner to ensure replicability.

3.1. Paradigm and Philosophical Assumptions

3.1.1. Overview of scientific paradigms. Hathaway (1995) describes a scientific paradigm as a 'lens through which scientists or researchers are able to perceive and understand the problems in their field and the scientific answers to those problems' (p. 541). In this way, Hathaway (1995) outlines how a philosophical assumption extends merely beyond the longstanding 'qualitative' and 'quantitative' schism. Rather, scientific paradigms are marked by philosophical assumptions regarding the ontological (i.e., nature of reality), the epistemological (i.e., the nature of knowledge) and the subsequent methodologies applied to research (Rolfe, 2013). Rolfe (2013) outlined the epistemological foundations of quantitative paradigms including the accurate assessment of certain phenomenon, the impartial nature of the researcher, accruing knowledge from controlled experiments, generalisation of data and the interpretation of information as quantifiable (Rolfe, 2013).

3.1.2. Philosophical assumptions of research and rationale. Drawing from earlier investigative traditions, the philosophical underpinnings of the research were rooted within a positivist paradigm. From an epistemological perspective, the positivist paradigm assumes that the nature of knowledge is objective, and it is envisioned that knowledge is gained through quantitative research (Mack, 2004). The fundamental nature of the positivist paradigm dovetails with the objective stance that was required for the purpose of the research presented here. The adoption of a positivist approach was therefore necessary given the inherent biases associated with previous assessment tools and diagnostic practices associated with children with EAL. However, it is notable that

the ontological assumptions associated with the research deviated somewhat from a positivist approach, per se. In line with positivism, a realist ontology (i.e., information can be measured accurately) was adopted (Rolfe, 2013). However, a positivist ontological approach assumes that there is only one reality (Mack, 2004). The research was therefore also partly in line with a post-positivist stance. Namely, the study aimed to consider the potential of more than 'one reality' through the triangulation of assessment data and theoretical perspectives, such as those highlighted above (Taylor & Medina, 2013). Ultimately, the convergence of epistemological, ontological and methodological perspectives relates to both positivism and post-positivism. The methodologies outlined hereafter are grounded in such philosophies, whilst the limitations inherent in the approach are also acknowledged.

3.1.3. Cautionary adoption of the positivist paradigm. Despite the compatibility between the positivist paradigm and the research presented here, it is notable that there are shortcomings associated with positivism. Such limitations were acknowledged by the researcher prior to devising the methodology to ensure methodological rigour, as well as to ensure that results were communicated cautiously and ethically. Firstly, Rolfe (2013) reported that limitations may pertain to the nature of quantitative research itself, that is that we can never prove a certain theory or have absolute confidence that the results of the research are accurate. Secondly, Rolfe (2013) argued that by transforming real life information into numerical data can lead to 'reduction' (i.e., the loss of potentially salient information). It raises the question of what can be counted and what actually counts (Rolfe, 2013). Essentially, Rolfe (2013) argued that quantitative methodologies provide us 'with some extremely powerful analytic tools, but while the philosophical method tends to result in logical conclusions, it does not always guarantee the truth' (p. 26).

3.2. Design

The research itself consisted of a quasi-experimental design. There was one independent variable with three levels (i.e., children who had DLD, typically developing children who had EAL and children who were typically developing and monolingual). There were three dependent variables (i.e., total processing speed score, total percentage of correct processing speed responses and total verbal working memory score).

3.3. Participants

Fifty-six participants were initially recruited but following piloting (n = 5) and the application of exclusion criteria (n = 9), the remaining participants included 12 monolingual children with DLD, 15 children with EAL and 15 typically developing monolingual children.

3.3.1. Power analysis. Sample size was calculated using a Power Analysis via G*Power 3.1.9.2. G*Power 3 (Erdfelder, Faul, & Buchner, 1996) is a power analysis programme which can calculate sample size based on a variety of factors (Faul, Erdfelder, Lang & Buchner, 2007). In line with Cohen (1988), an a-priori power analysis was conducted in order to estimate an appropriate sample size. *N* was calculated in light of the main statistical analysis used (i.e., ANOVA), the desired power level (i.e., 0.95), a significance value of 0.05, as well as the desired effect size (i.e., > 0.40). Faul et al. (2007) highlighted how existing research has found that a priori analyses are effective in controlling for statistical power before the research is conducted. Results from the G*Power analysis indicated that approximately 20 per group should be recruited. However, due to difficulties in obtaining data from the DLD group, a smaller sample was adopted for the current research. Nonetheless, the chosen sample size was also in line with previous research (e.g., Mainela-Arnold & Evans, 2005; Marton & Schwartz, 2003; Montgomery, 2000), where sample sizes were typically small (i.e., 10-12 per group).

3.3.2. Sampling method. A purposive sampling method was used to recruit participants. Although random sampling is typically advised in second language research (Mackey & Gass, 2015), a purposive sampling technique is often deemed more practical for recruiting participants from specific groups, including cultural groups (Etikan et al., 2016). In what may also be referred to as homogenous sampling (Etikan et al., 2016), schools were therefore purposefully chosen on the basis that participants would possess some of the desired attributes required for the current research (e.g., EAL status). The principals of potential schools were contacted via post and were provided with an information sheet, the selection criteria and Board of Management consent forms. Phone contact was later made with school principals in order to determine if they were interested in participating in the study. Schools from which children with EAL were recruited were informed at both instances that the researcher could translate any relevant documents for parents and children who were unable to read English proficiently. Participating schools included six primary schools across five counties in Ireland. Please see Table 5 below for

information on which of the schools the specific groups were recruited from, as well as whether the school had Delivering Equality of Opportunity in Schools (DEIS) status. DEIS schools are schools where students are at risk of social or economic disadvantage resulting in barriers in accessing education (DES, 2005b). DEIS schools therefore receive additional funding in order to somewhat alleviate the adverse impact of economic and social disadvantage on education (DES, 2005b). DEIS schools range from the most disadvantaged (i.e., DEIS Urban Band 1) to less disadvantaged (i.e., DEIS Urban Band 2; Rural).

Table 5.

Information on participating schools and participants

School	**Groups recruited**	***n***	**Status of school**
Primary School 1	Monolingual	13	Non-DEIS
Primary School 2	DLD	2	DEIS Urban Band 2
Primary School 3	EAL	14	DEIS Urban Band 1
	Monolingual	2	
Primary School 4	DLD	7	DEIS Urban Band 1
Primary School 5	DLD	1	Non-DEIS
	EAL	1	
Primary School 6	DLD	2	Non-DEIS
		N = 42	

3.3.3. Assignment to groups. Participants were assigned to either the DLD group, the EAL group or the monolingual group based on the criteria presented in Table 6 below. It is notable that participants were assigned to groups following initial principal screening and subsequent prerequisite screening. Initial principal screening required school principals to provide the relevant documentation (i.e., consent sheets, information sheets, questionnaires, protocol in the event of difficulties) to parents of children who meet the criteria as outlined in Table 6. Please see section 3.5.1 and 3.5.2 for more details.

Table 6.

Criteria for assignment to each grouping

Children who have DLD	Typically developing children with EAL	Typically developing monolingual children
• Should be monolingual (i.e., English should be their first language). • Should not be bilingual or multilingual. • The child should have a formal diagnosis of DLD. • Should not have any co-morbid diagnoses but can have another Specific Learning Difficulty such as dyslexia. • Should have an average or above average cognitive ability as tested using the WASI-II (i.e., tested by the researcher). • Free from any vision, motor or hearing impairments.	• EAL children must have been exposed to the English language for at least 6 months and no more than 9 years (see Cummins, 2008). • EAL children must have scored in the 'A' range on any aspect of written language, expressive or receptive language (in line with the Common European Framework of Reference for Languages, CEFR) on the Primary School Language Assessment Toolkit in order to be deemed EAL. • Should not have a diagnosis of any SEN including DLD. • Free from any vision, motor or hearing impairments. • Should have an average or above cognitive ability as tested using the WASI-II (i.e., will be tested by the researcher).	• Should be monolingual (i.e., English should be their first language). • Should not be bilingual or multilingual. • Should not have a diagnosis of any SEN including DLD. • Free from any vision, motor or hearing impairments. • Should have an average or above cognitive ability as tested using the WASI-II (i.e., tested by the researcher).

3.3.3.1. Rationale for criteria. The strict assignment of participants to each grouping ensured that any potential confounder variables that may have impacted on processing speed and verbal working memory were controlled for, insofar as possible.

Specifically, bilingual/multilingual children were excluded from all groupings. For the purpose of the current study, bilingual/multilingual children were distinguished from children with EAL as having better proficiency in English. Specifically, monolingual children typically have a 'C2' level of English as opposed to an 'A' level of English, whilst children with EAL may have A or B levels of English proficiency. 'C' indicates more proficiency than 'A' according to The Common European Framework of Reference for Languages (CEFR). Therefore, children may be deemed as having varying levels of proficiency (i.e., A1 – Breakthrough, A2 – Waystage, B1 – Threshold, B2 – Vantage, C1 – Effective Operational Proficiency, C2 -Mastery) across five areas (i.e., Listening, Reading, Spoken Interaction, Spoken Production, Writing). Please see appendix F for more details on CEFR grade descriptors (The Council of Europe, 2018). As a result, data collected from a group who potentially have 'mastered' the English language would have provided confounding results. Three participants were therefore not included in the study based on the premise that they met the criteria for bilingualism. Furthermore, it was stipulated that children should have been free from any vision, motor or hearing impairments as the cognitive tests involved these senses, as well as motor responses (e.g., reaction time).

Most notably, the issue of comorbidity was controlled for in a rigorous manner. In terms of typically developing monolingual children and children with EAL, to the researcher's knowledge, these participants were free from any type of SEN or specific learning difficulty. Certain categories of SEN may have resulted in below average verbal working memory and processing speed; this would have confounded results. For example, children with SLDs, such as dyslexia, have been found to possess deficits in processing speed and verbal working memory (e.g., Smith-Spark & Fisk, 2007). As the current research sought to ascertain the underlying cognitive markers that distinguish non-DLD children (i.e., no processing speed and verbal working memory difficulties) and children with DLD (as marked by processing speed and verbal working memory difficulties), it would not have been appropriate to include children who have an SLD and who were also in the EAL or typically developing monolingual categories. In order to control for literacy difficulties, children under the 10th percentile in the pseudoword decoding task were controlled for in statistical analyses.

However, children in the DLD group who also had a diagnosis of an SLD were included in the study. Research suggests that children with DLD and SLDs have similar cognitive profiles, as has been highlighted in Chapter Two. In fact, evidence suggests that

both disorders may essentially be different labels for the same difficulties (Tallal, 2004). Miller (2013) therefore proposed that these disorders may represent a commonality as opposed to a comorbidity.

Furthermore, children were eligible to participate in the study if they had an overall cognitive ability of 85 or over. Two children received overall cognitive scores below 85 and thus no further testing was conducted with these children. A cut-off score of 85 and over was selected, as this range of scores is relative to broad average norms. This cut-off point was also chosen so as to ensure that any deficits in verbal working memory or processing speed were not attributed to an intellectual disability or general learning disability. Fairer comparisons could thus be made between the DLD group, EAL group and the monolingual group, whilst overall intelligence could be controlled for. Please see section 3.4.2 for more details on intelligence testing.

Table 7.

Participants excluded from dataset and reasons why

Number of participants	**Grouping**	**Reason why participant was not included**
3	DLD group	Child was under seven years old or older than nine years old
2	Monolingual group	Children received scores of below 85 on the WASI-II.
3	EAL group	Children were deemed bilingual
1	Monolingual group	Child previously had a diagnosis of a Speech and Language Difficulty

3.3.4. Demographical information. Participants' ages ranged from seven years one month to nine years six months, with a mean age of seven years nine months. Participants included 24 females and 18 males. There were also five children included in the pilot group. The pilot included four females and one male, with ages ranging from eight years one month to nine years one month. All children in the pilot group had English as their first language and were free from any learning or language difficulties, and thus were reflective of the monolingual group. It was reported that none of the participants included in either the pilot or actual research had received a cognitive assessment in the previous two years from the Weschler family of cognitive assessments.

3.3.4.1. Monolingual group. Of the 15 children included in the monolingual group, six were male and nine were female. Participants' ages ranged from seven years

four months to eight years eight months, with an overall mean age of seven years nine months. All eligible children were deemed free from any vision, motor, language or learning impairments as indicated by initial principal screening and parental demographical questionnaires. Literacy and cognitive testing also revealed that these children had low average and above standard scores, indicating that a Specific or nonspecific learning difficulty was unlikely. All children were from an Irish background and were fluent in English, whilst it was reported that three children spoke a second language (i.e., Irish), albeit these children were not fluent in the second language. All children spoke English at home and at school, whilst all of the participating children's parents had English as their first language. Maternal education ranged from primary level education to professional or graduate level, where 6.7% of mothers' highest level of education received was at primary level, 26.7% was at post-primary level, whilst 50% of mothers had some form of college education. In terms of paternal education, 46.7% of fathers of monolingual children had at least some college education, whilst the remainder completed primary (i.e., 6.7%%) and post-primary (i.e., 33.3%) education. Data were missing on one participant regarding level of parental education. Maternal occupations were mainly concentrated in the health and social care, education, technical services and homemaking domains. Paternal occupations were typically related to the agricultural, utilities and manufacturing domains.

3.3.4.2. English as an additional language group. Fifteen children with EAL were eligible for inclusion in the research and these children comprised of five males and 10 females. Participants' ages ranged from seven years one month to nine years six months, with an overall mean age of seven years eight months. Regarding parental levels of education, 20% of fathers had received education as far as post-primary school, whilst the remainder of participants' fathers had received at least some college education (80%). Maternal levels of education included 6.7% of mothers who received primary education, 13.3% of mothers who received post-primary education, with the remainder of parents receiving at least some college education (80%). Parental occupations were typically reported to be in the transportation, healthcare, finance, legal and construction industries, where most mothers were reported to be homemakers or working in education, healthcare or retail industries. Some parents did not report having an occupation. The majority of children in the EAL group were born in Ireland, with other children born in India (n = 1), Lithuania (n = 2) and Poland (n = 1). Again, all eligible children with EAL were reported to be free from any vision, motor, language or learning impairments, as indicated by initial

principal screening and parental demographical questionnaires. The pseudoword and cognitive tests also confirmed that the children with EAL had low average and above standard scores indicating that a Specific or nonspecific learning difficulty was unlikely. Eligible children's English language proficiency ranged from A1.2. to A2.2, indicating low levels of English proficiency. Parent questionnaires suggested that participating pupils had a variety of first and second languages including Urdu, Arabic, Tigrina, Mandarin, Indian, Malayiam, Hindi, Lithuanian, Russian, Somali, Punjabi and Polish. Although some parental reports suggested that many children spoke English as their first language, these children were distinguished from bilingual children as they still had limited proficiency in English (i.e., scored in the 'A' range). The schools also confirmed that these children indeed had English as their second language. In the absence of EAL testing being completed with a child (n = 4), schools identified these children as having EAL. All participating children have received language support and have been identified as, and registered as, 'EAL' learners officially by the schools.

3.3.4.3. Developmental language disorder group. Participants included six males and six females, with ages ranging from seven years three months to nine years seven months, with an overall mean age of eight years one month. In terms of paternal levels of education, of the parents who reported this information, 75% had received as far as post-primary education, whilst the remainder (i.e., 25%) had received some college education. Maternal education comprised of 58.3% of mothers who reached post-primary level of education, with the remainder receiving some college education (41.7%). In terms of fathers' occupations, many fathers worked in the construction, healthcare and education industries. Mothers tended to be homemakers or students, with some mothers working in education, telecommunications and technical services. Similar to the EAL group, a number of parents did not indicate their occupational status. Five children were recruited from language units, whilst seven children were recruited from mainstream primary school classes. A language unit is a special class, attached to a mainstream school, for children with DLD. Such classes typically have a smaller pupil-teacher ratio (i.e., 7:1) and intensive speech and language therapy and education is provided to these children (DES, 2005c). All children had received formal diagnoses of DLD (i.e., formerly known as Specific Language Impairment or Specific Speech and Language Disorder), according to teacher or parental reports. It was reported that one child had also received a diagnosis of dyslexia, whilst another child was reported to have hypermobility and sensory issues. As previously discussed, children with DLD and dyslexia were included

in the study due to potential overlap between the conditions. Hypermobility and sensory issues were not deemed severe enough to impact on performance on the assessments. No other child was reported to have another diagnosis and all children were free from any vision or hearing impairments.

3.4. Materials

The materials for the study included a parental questionnaire adapted from The Language and Social Background Questionnaire (LSBQ) (Anderson, Mak, Chahi & Bialystok, 2018), the pseudoword decoding subtest of the Wechsler Individual Achievement Test–Third Edition (WIAT-III) (Pearson, 2009), the Matrix Reasoning and Block Design subtests of the Wechsler Abbreviated Scale of Intelligence® - Second Edition (WASI-II) (Weschler, 2011), as well as an adapted visual search task (Leonard et al., 2007) presented via SuperLab 4.0 and the Nonword Repetition Test (NRT) (Dollaghan & Campbell, 1998). The latter two instruments were chosen as they are valid and reliable tests for examining verbal working memory and processing speed. Both instruments represent a shorter, yet valid method for measuring verbal working memory and processing speed. Therefore, unlike the cognitive assessments used in previous studies (e.g., Leonard et al., 2007), which incorporated a lengthy array of assessment tools, the highly reliable and valid nature of the assessment tools, means that the amount of time taken from each child's instructional time was significantly reduced. The instruments were also carefully chosen so as to ensure that questions or tasks were not dependent on prior experiences related to culture or language, insofar as possible.

3.4.1. Demographic questionnaires. A demographic questionnaire was provided to each parent/guardian of participating monolingual children with a DLD and typically developing monolingual children, in order to establish if the child was eligible for inclusion in the study (see appendix G for monolingual questionnaire). The researcher-designed questionnaire's central purpose, however, was to gather essential demographical data on each participant and their parents. Salient information was retrieved, including language exposure, social background, age, gender, predominant language spoken in the home etc. Both parents of monolingual children (i.e., DLD and typically developing children) and parents of children who have EAL were asked to indicate their occupation, as well as the highest level of education achieved. Parental education was used to determine Socio-economic Status (SES) in line with Anderson et al.'s (2018)

questionnaire. Parents indicated their level of education on a scale from one to five, where one indicated at least some primary education, whilst five indicated a professional degree.

3.4.1.1. The language and social background questionnaire. In order to gather demographical data and to ascertain the language exposure of children with EAL, an adapted version of the adult version of the LSBQ (Anderson et al., 2018) was provided to parents of children with EAL. According to Anderson et al. (2018), 'the LSBQ is a reliable and valid instrument for describing bilingual (EAL) experience and classifying participants' (p. 262). Anderson et al. (2018) argued that the instrument can describe individuals with respect to the complex and diverse experiences associated with learning English. The instrument can also be applied to a broad scope of languages (Anderson et al., 2018). The LSBQ was adapted in order to reframe the questions so that parents could report on language exposure, as opposed to children self-reporting answers, which was deemed inappropriate in light of their young age and reduced comprehension. The LSBQ was originally designed for use with bilingual young adults and the manual advises that the questions are asked in an interview format. However, given the time constraints associated with the current research, parental report was deemed appropriate. The questionnaire (please see appendix H) determined social background as well as demographic information; questions were similar to those in the questionnaire for monolingual participants. As well as determining SES, parental level of education was determined in light of the evidence suggesting that there are within-group differences in terms of children who have EAL (Artiles, Rueda, Salazar & Higareda, 2005). In fact, Artiles et al. (2005) highlighted how 'there is a scarcity of research on within-group diversity' in terms of children who have EAL (p. 286). Furthermore, Artiles et al. (2005) found that EAL children from lower socio-economic backgrounds were more likely to be placed in special education than EAL children from higher socio-economic backgrounds. Development of English proficiency can also be determined by parental factors such as level of education and occupation (Hakuta, Butler & Witt, 2000).

Language background questions also ascertained language(s) spoken by the child, where they learned this language (e.g., at home or at school) and at what age. Parents also reported estimates of the child's proficiency for English speaking, understanding, reading and writing on a scale from 0 to 10, where 0 indicated no proficiency and 10 indicated proficiency. Parents reported the frequency of their child's usage of each language from 0 (i.e., none) to five (i.e., all of the time). The third section of the questionnaire pertained to Community Language Use behaviour. This section determined language use during

infancy, preschool and primary school age, as well as language usage in different contexts (e.g., when speaking to certain individuals, in different situations and during different activities). The child's use of language-switching (i.e., switching from one language to another within and across contexts) was also determined. Anderson et al. (2018) suggested that determining how individuals manage, select and switch between languages between and within different contexts can provide interesting data that may also result in cognitive gains. Essentially, Anderson et al. (2018) argued that 'by demonstrating that the context in which languages are used defines the degree of bilingualism the individual possesses, and that the degree of bilingualism is associated with the extent to which cognitive consequences are found' (p. 260). Essentially, the LSBQ (Anderson et al., 2018) can provide a fruitful pathway for describing and classifying participants with EAL. However, as the original tool was developed for young adults, any data collected via the LSBQ was used merely as demographical information. Nonetheless, the use of the LSBQ (Anderson et al., 2018) ensured that the researcher did not assume that the experiences and proficiencies of each participant with EAL was the same.

3.4.2. Nonverbal Intelligence. Nonverbal intelligence was measured using the Block Design and Matrix Reasoning subtests of the WASI-II (Weschler, 2011). The WASI-II is an individually-administered abbreviated test of intelligence that can be used with individuals ranging in age from six years old to 90 years old. The WASI-II represents a revision of the WASI (Weschler, 1999) and has subsequently become a more user-friendly instrument which possesses enhanced psychometric properties (Weschler, 2011). The WASI-II can be used for research purposes and is particularly useful when testing time is limited (McCrimmon & Smith, 2012). The WASI-II (Weschler, 2011) comprises four subtests, including Block Design, Vocabulary, Matrix Reasoning and Similarities. The Block Design and Matrix Reasoning subtests are both highly correlated with 'g' or 'general intelligence' (see Canivez, Konold, Collins & Wilson, 2009) and represented a fairer, less language-based method for assessing intelligence. Although research indicates that Block Design is a visual spatial factor (e.g., Weiss, Keith, Zhu & Chen, 2013), Irby and Floyd (2013) suggested that the Block Design and Matrix Reasoning subtests of the Weschler intelligence tests can provide a measure of Fluid Reasoning. Fluid intelligence is less dependent on prior experience and prior knowledge than crystallised intelligence (Cattell, 1971) and therefore may provide less culturally-biased results. These tests were also less time-consuming than more 'comprehensive' measures of intelligence (Canivez et al., 2009) and took approximately 10-15 minutes to complete.

3.4.2.1. Block design and matrix reasoning subtests. All procedures and instructions for administering the Block Design and Matrix Reasoning subtests were in line with those suggested in the Test Manual of the WASI-II (Weschler, 2011). The researcher administered both subtests to all participants and it was ensured that non-verbal cues accompanied instructions. The Block Design subtest is composed of a maximum of 13 items and measures participants' abilities to analyse and synthesise abstract visual stimuli. Basal and ceiling levels applied to this subtest, where the subtest was terminated upon the participant scoring two consecutive scores of zero. Participants were required to re-construct a model using red and white blocks by looking at a model created by the researcher and/or by looking at a picture in the Stimulus Book (Weschler, 2011). The reconstruction of the models became increasingly difficult as the subtest progressed, with participants constructing models with two blocks, four blocks and finally with eight blocks, depending on whether the ceiling or "stop point" was reached. Participants completed the reconstruction of the model within a specified timeframe and scores were subsequently calculated for each item depending on the complexity of the question. Possible scores for items one to four were either zero, one or two, whilst for items five to 13, participants could receive scores of zero, four, five, six or seven depending on the time it took them to complete the item. Participants were timed using a stopwatch on the researcher's phone and timing began as soon as instructions were provided for each item. Timing ceased when the participant said 'finished' or when the participant had clearly stopped building the model.

The Matrix Reasoning subtest included 30 items and measured fluid intelligence, broad visual intelligence, classification and spatial ability, knowledge of part–whole relationships, simultaneous processing, and perceptual organisation (Weschler, 2011). Participants were shown pictures in the Stimulus Book which displayed an incomplete matrix. Participants subsequently chose one picture from an array of response options that could complete the matrix. Again, basal and ceiling rules applied, where the subtest was ended when participants scored three consecutive scores of zero, or alternatively, when the Stop Point was reached. A score of zero indicated an incorrect answer, whilst a score of one indicated a correct answer. Please see the WASI-II (Weschler, 2011) for more details on the administration and scoring of the Block Design and Matrix Reasoning subtests.

3.4.2.2. Norming, reliability and validity. For the current research, in order to control for the possibility of 'practice effects' on the WASI-II, parents were asked to report if their child had undergone a cognitive assessment in the previous two years, and if so, which test was used. None of the participants had previously completed the WASI-II and therefore this test could be used for the purpose of ascertaining nonverbal intelligence.

The WASI-II was normed on a US sample of 2,300 individuals aged between six and 90 years old, who were subsequently divided into 23 age groups (Weschler, 2011). Each age group was comprised of 100 participants (Weschler, 2011), whilst it is estimated that there were approximately 33 participants per age group in the six years old to 16 years 11 months bracket (Irby & Floyd, 2013). Average reliability coefficients for the instrument were previously measured using Fisher's *z* transformation, where the reliability coefficients for the Block Design and Matrix Reasoning subtests were .89 and .87 respectively (Weschler, 2011). The average reliability coefficient for the overall perceptual reasoning (i.e., combined scores of Block Design and Matrix Reasoning) score was .92 (Weschler, 2011). Corrected split-half reliability coefficients were .90 and above, whilst the test-retest reliability coefficients for perceptual reasoning ranged from .86 to .87 (Irby & Floyd, 2013). As detailed validity analyses presented in the test manual were limited, Irby and Floyd (2013) alluded to discriminant validity evidence which suggested correlations between the WASI-II and other tests of intelligence. Finally, 'g' loadings were not reported in the test manual. However, Irby and Floyd (2013) stated that the four subtests, including Block Design and Matrix Reasoning were included in light of their correlations with 'g'. Furthermore, Weiss et al. (2013) presented the g-loadings of Block Design (.660) and Matrix Reasoning (.660) based on a four-factor model of the Wechsler Intelligence Scale for Children -Fourth Edition (WISC-IV), a test from which the WASI-II is in part derived (Weschler, 2011), whilst an accumulation of evidence suggests associations between 'g' and Matrix Reasoning and Block Design on various Weschler tests (Canivez, 2014; Vernon, 1983). Therefore, it may be interpreted that Block Design and Matrix Reasoning represent a robust measurement of 'g'.

3.4.2.3. Scoring. As has been aforementioned, all participants required a nonverbal IQ, as represented using the Perceptual Reasoning Index (PRI), of 85 or higher. Raw scores from the Block Design and Matrix Reasoning subtests were calculated and converted to *T* scores, which were subsequently translated to composite scores. A PRI

score was subsequently calculated for each child. PRI standard or composite scores can range from 46 to 160, where 100 represents the mean of scores, with a standard deviation of 15 (Irby & Floyd, 2013). For the current research, confidence intervals were not accounted for and the participants' estimated true scores were used as indicators of general ability.

3.4.3. Literacy assessment. All participants' literacy attainments were individually measured by the researcher using the pseudoword probe sheet from the WIAT-III (Weschler, 2009). According to Weschler (2009), the WIAT-III is a standardised achievement test that can provide both norm-referenced and criterion-referenced scores for children aged between four years old to 19 years 11 months. The WIAT-III is composed of 16 subtests which constitute seven composite measures of achievement including basic reading, total reading, reading comprehension and fluency, written expression, oral language, mathematics and maths fluency (Weschler, 2009). The WIAT-III can be used to identify students' strengths and needs in these areas and can also be used in the diagnosis of an SLD. The instrument is also suitable for research purposes (McCrimmon & Climie, 2011). Children with SLDs have been found to also have deficits in processing speed and verbal working memory (Smith-Spark & Fisk, 2007). Therefore, all children were screened using the pseudoword probe sheet in order to control for potential literacy difficulties that may otherwise be attributed to an SLD.

Although the pseudowords were derived from English-consistent morphemes (McCrimmon & Climie, 2011), pseudowords as opposed to 'real' words were used so as to present a fairer chance to children who had EAL. For example, with regards to language tasks, Kohnert, Windsor and Yim (2006) argued that pseudowords (i.e., nonsense words) are not dependent on the participants' experiences and thus 'de-emphasise the role of prior knowledge' (p. 19). Essentially, these may be less biased as they are 'equally unfamiliar to participants (such as nonsense words that do not exist in the test language)' (as cited in Kohnert et al., 2006, p. 20). Siegel (2008) found no performance differences in terms of EAL and typically developing monolingual children when pseudoword decoding was used to measure morphological awareness.

The Pseudoword Decoding subtest required participants to read a list of nonsense words of increasing difficulty from a probe sheet (Weschler, 2009). Although the WIAT-III Pseudoword Decoding subtest has certain 'start points', all participants started from the beginning of the probe sheet regardless of age. The word reading component of the testing took approximately two minutes.

3.4.3.1. Reliability and validity. Split-half reliability tests indicated that all subtests on the WIAT-III, including Pseudoword Decoding, possessed very good to excellent internal consistency with reliability coefficients falling between .83 and .97 (McCrimmon & Climie, 2009). The test-retest reliability was also good, whilst interrater reliability was very high (Weschler, 2009).

3.4.3.2. Scoring. Participants received a score of zero if they read the word incorrectly and a score of one if they read the word correctly. Only the accuracy of the word reading was recorded and thus speed of reading was not taken into account. Basal and ceiling rules applied to the Pseudoword Decoding subtest, where the subtest was terminated if participants incorrectly named four consecutive pseudowords. Incorrect responses were recorded phonetically on a record sheet. Pronunciation difficulties (e.g., associated with first language or a speech production difficulty) were also considered and noted on the record sheet. Raw scores were calculated as a standard score (M = 100) for each participant and used as a proxy for each participants' overall literacy score.

3.4.4. Processing speed. A test of processing speed, which in part also measures attention, adapted from Leonard et al.'s (2007) study was run using SuperLab 4.5 (Cedrus Corporation, 2011).

3.4.4.1. Visual search task. The processing task was presented on a Packard Bell Easy Note TV laptop with a screen size of 15.6 inches. The same laptop was used with each participant so as to ensure consistent response time recording across testing. Each visual stimulus was approximately 3 x 4 or 3 x 3 centimetres (cm) and each stimulus was presented horizontally in the centre of the screen. There was approximately 1.5 cm punctuating each of the five stimuli, whilst a wider gap of approximately 3 cm remained between the target and other five stimuli. However, measurements varied to some degree throughout the trials. The target stimulus was presented at the left side of the screen, whilst the other five stimuli were presented in a row to the right of the target. All stimuli were black and were presented against a white background. The processing speed experiment was presented using SuperLab 4.5, as a series of blocks, trials and events. These included initial instructions, two model trials, follow-up instructions, two practice trials, final instructions, followed by 36 trials of the experiment across six conditions. SuperLab is a psychology experimental package and has been used as a method of presenting experimental stimuli with child participants (e.g., Hirata et al., 2015). The reliability of SuperLab for recording response times using the keyboard involves a standard deviation of 0.333 milliseconds (Cedrus Corporation, 2011). Participants'

response times were recorded on SuperLab 4.5 in milliseconds (ms) based on keyboard input. Reaction time was operationalised as the time elapsed between the onset of the stimuli until the keyboard response. The SuperLab programme was designed to ensure that participants selected one of two keys (i.e., to indicate correct or incorrect answer) before immediate onset of the subsequent trial. Participants' responses were also automatically recorded. The SuperLab 4.5 output file was saved according to the participant's code (e.g., DLD 1) and later exported to Microsoft Excel, where participants' average response times and the average percentage of trials correct were recorded.

Specifically, children completed an adapted version of one of the nonlinguistic speed tasks (i.e., Visual Search Task as presented in Figure 1) used by Leonard et al. (2007). The visual stimuli used in the Visual Search Task were originally developed by Kail, Pellegrino, and Carter (1980) and had previously been used by Miller, Kail, Leonard and Tomblin (2001). The task was considered a nonlinguisitic cognitive task, as verbal information was not required for a correct response (Leonard et al., 2007). Specifically, visual search tasks involve the recording of response times based on motor responses for detecting certain visual stimuli. Participants had to search for a target amongst a varying number of distractors. For this task, nonsense figures were used as is evident in Figure 1. Participants were shown a target (i.e., nonsense visual) and then were advised to scan a five-figure array of other nonsense images. The participant responded to whether or not a stimulus was present by either striking a red key (i.e., target not present) or a green key (i.e., target present). The red key (i.e., the 'j' key) was marked by a red circular sticker, whilst the green key (i.e., the 'g' key) was marked by a green circular sticker. Participants were instructed to indicate their response as quickly as possible without making mistakes. Instructions for this task were delivered to participants using nonverbal cues, as well as written cues presented on the researcher's laptop. The researcher modelled the completion of two trials and indicated the search process (e.g., scanning left to right) using nonverbal cues. Participants then completed six practice trials. For the actual task, six conditions were used. According to Leonard et al. (2007), 'these corresponded to the five positions from left to right, and the case when a match was not present' (p. 413). Participants completed six trials per condition. In total, participants therefore completed 36 trials. In between each task, participants were encouraged to rest their preferred hand below the keys that were marked by the red or green dots.

The task differed somewhat from Leonard et al.'s (2007) and Miller et al.'s (2001) tasks, as the nonsense symbols were grouped by similarity (i.e., spatial arrangements of the one symbol per trial). The task was slightly adapted in order to increase the difficulty of the tasks, in order to potentially increase the discriminatory abilities of the task in distinguishing between those with higher and lower processing speed skills. In other words, the tool may possess increased sensitivity in detecting the presence or absence of a DLD.

Figure 1. Visual search task. This figure represents one of the visual search tasks used to ascertain processing speed.

3.4.4.2. Reliability and validity. Visual Search tasks can assess a number of cognitive abilities such as attention (Duncan & Humphreys, 1989). Research is also ubiquitous in its use of visual search tasks for determining processing speed (Leonard et al., 2007; Miller et al., 2001).

3.4.4.3. Scoring. A log transformation (i.e., using the Box-Cox formula) was conducted. Mean response times in each condition were recorded for each participant in ms from onset of stimulus to keyboard press. The accuracy of their responses was also recorded as a percentage following an arcsine transformation. Please refer to the Data Analysis chapter (sections 4.1.1. and 4.2.2.) for more information on these procedures.

3.4.5. Verbal working memory. The NRT (Dollaghan & Campbell, 1998) was used to assess verbal working memory using non-words or nonsense words. In the NRT task, the researcher played a recording provided by Dollaghan and Campbell (1998) of 16 nonsense words of increasing length and asked the child to repeat it back immediately. The instructions and nonwords were pronounced in a neutral American female accent. Please see appendix I for the phonetic transcriptions (Dollaghan & Campbell, 1998) of the 16 non-words that were used in the task. Recordings were only played once from the researcher's laptop. Pilot testing ensured that the recordings were heard by all participants.

3.4.5.1. Scoring. The researcher phonetically transcribed the sounds as each child repeated them back. Participants' responses were scored in line with Dollaghan and Campbell's (1998) procedure, whereby the nonwords were scored phoneme by phoneme. The number of phonemes repeated correctly were then divided by the total number of target phonemes. This number was then multiplied by 100 to get an overall score, or a Total Percentage of Phonemes Correct (TOTPPC). Individual percentages were also calculated for nonwords containing one syllable, two syllables, three syllables and four syllables. Participants were not penalised if they had articulation difficulties or pronunciation difficulties, with due regard for difficulties that may have been associated with EAL or DLD status. Phoneme additions were not penalised, although phoneme substitutions or omissions were penalised in line with Dollaghan and Campbell's (1998) procedure.

3.4.5.2. Reliability, validity and suitability of the Nonword Repetition Test. The NRT has been used extensively in research with children in order to ascertain an estimate of their verbal working memory (e.g., Leonard et al., 2007). Derived from Baddeley's (1986) notion of the phonological loop (Im-Bolter et al., 2006), evidence suggests that poorer performance on nonword repetition tasks often means that children have reduced verbal working memory (Gathercole, Willis, Baddeley & Emslie, 1994). Unsurprisingly, an accumulation of research therefore suggests that verbal working memory and nonword repetition tasks are valid tools which can be used as clinical markers for DLD in children (Baddeley, 1993; Dollaghan & Campbell, 1998).

The overall scores attributed by the researcher to the monolingual and DLD group are also in line with Dollaghan and Campbell's (1998). In the current study, the monolingual group had an average of 83.54% on the TOTPPC, whilst Dollaghan and Campbell's (1998) study revealed an overall average of 84%. This indicates that the researcher reliably scored each participant's performance on the NRT. Following a review of previous studies, Coady and Evans (2008) stated that the NRT had good face validity, sensitivity and accuracy, whilst Gathercole et al. (1994) argued that nonword repetition tasks were very suitable for young children. However, it is notable that the reliability and validity of the NRT is based on monolingual samples. However, like the pseudoword reading task, nonwords are not dependent on the participants' experiences, and again, 'de-emphasise the role of prior knowledge' (p. 19). Leonard et al. (2007) stated that the words 'do not follow English metrical stress patterns, and none of the syllables

that constitute the nonsense words correspond to actual English words' (p. 414). Furthermore, Chiat and Polišenská (2016) suggested that the nonwords used on the NRT are not real morphemes and thus have little phonotactic probability (i.e., the occurrence of certain sounds in sequences). As a result, Chiat and Polišenská (2016) argued that tests like the NRT ensure that the role of prior knowledge is insignificant and therefore children with EAL and those who have a smaller vocabulary are not disadvantaged.

3.5. Procedure

The procedure for the study was partly in line with that of Leonard et al. (2007), whilst the procedure adopted by Dollaghan and Campbell (1998) was also adhered to closely. The study was preceded by pilot testing and this pilot included five typically developing monolingual participants who represented the range of ages of children of the overall study (see section 3.3.4). The purpose of the pilot study was to ensure that the software and technological components of the research were running correctly, as well as to ensure that participants could understand tasks and instructions. Volume checks were also completed for the NRT.

The subsequent procedure followed two stages; a screening stage and an assessment stage. In total, the testing phases (i.e., both at the screening stage and the processing speed and VWM assessment stage), took a total of 25 to 40 minutes to administer depending on the cognitive ability, age, behaviour and test-taking ability of the participant. The assessments were individually-administered by the researcher in a quiet room in the schools. The researcher had been trained in test administration. The assessments were administered to the child in the same order subsequent to obtaining child assent.

3.5.1. Stage 1: Screening. The screening stage included initial screening by the participating schools, parental completion of the demographic questionnaires, as well as prerequisite testing. Again, initial principal screening involved principals only providing the relevant documentation to parents of children who meet the criteria as outlined in Table 6. This was followed by parental completion of the LSBQ (Anderson et al. 2018) or demographic questionnaire (i.e., for monolingual participants). Participants were subsequently excluded at this stage if parental questionnaires indicated that the participant did not meet the criteria as per Table 6. Prerequisite testing involved the individual administration of the WASI-II and WIAT-III, where the latter occurred immediately following completion of the WASI-II. However, children who did not receive a score of

85 or over on the WASI-II did not complete the WIAT-III. Participants proceeded to Stage 2 regardless of results on the WIAT-II, as literacy difficulties were controlled for in later analyses.

3.5.2. Stage 2: Assessment procedure. Following Stage 1, children who met the criteria as per Table 6 and who received a PRI standard score of 85 and over on the WASI-II proceeded to Stage 2, which occurred immediately after administration of the WIAT-III. Stage 2 incorporated the tests of processing speed and verbal working memory as described in sections 3.4.4 and 3.4.5. Participants were instructed to sit in front of the laptop, whilst the Visual Search task was run. This was followed by the NRT, where participants were asked to listen carefully as the instructions and then nonsense words were played via the researcher's laptop. Participants were thanked for their involvement in the research and accompanied back to their classroom.

3.6. Ethics

3.6.1. Approval. The research and methodologies employed were approved by the Doctorate in Educational and Child Psychology (DECPsy) Research Ethics Committee in Mary Immaculate College, Limerick. The research was approved on the 4th of May 2018 and approval was granted until October 2020.

3.6.2. Ethical considerations. The research was replete with ethical considerations as the study involved the psychological testing of children on an individual basis. The researcher subsequently prepared an ethics application for submission to the DECPsy Research Ethics Committee. The application was devised in accordance with the Psychological Society of Ireland's (PSI, 2010) 'Code of Professional Ethics'. Therefore, any ethical considerations presented here are presented with a corresponding numerical citation in order to indicate which section of the PSI (2010) document is being referenced.

3.6.2.1. Informed consent (1.3). A prominent ethical consideration pertained to the fact that approximately one-third of parents and children did not have English as their first language. According to the British Psychological Society's (2010), 'language should be clear and accessible to people with limited literacy, using short words and sentences, written in the active voice, and avoiding the use of technical terms' (p. 19) (1.3.4). Therefore, information was provided in a concise and accessible language. Furthermore, the schools where participants' parents who had EAL were contacted prior to the study. If parents/guardians were identified by the principal as being unable to read English,

consent forms and information sheets were offered in their home language and this would be provided by a certified translation service (i.e., 'Certified Translation Services Ireland'). However, the principals of the participating schools felt that participating parents would be able to read the relevant information without translation. The implications of this will be discussed in the section 5.3.2.

3.6.2.2. Child protection procedures. As the researcher was working one on one with participants in a room in the school, child protection procedures were adhered to closely. In line with best practice in child protection, the researcher received Garda Clearance both through Mary Immaculate College and through the Teaching Council and had completed 'Children First' training. It was ensured that each room the researcher was working in had a glass-panelled door and each participant was seated closer to the door, so that his/her exit from the room was not impeded. The researcher also ensured that there was passive surveillance by a staff member in the school.

3.6.2.3. Right to withdraw (1.3.5.). It is notable that the researcher was on Career Break from one of the schools in which she collected data. Accessing data from this school was essential in light of the high percentage of children who had EAL in the school, as well as the diversity of languages spoken by the children and their families. Furthermore, the researcher also collected data from a school in which she worked in, as part of her role as a Trainee Educational Psychologist. Again, access to this school was essential in light of the fact that it contained a language unit and thus would permit the researcher to collect data from a number of pupils who have DLD. In order to alleviate any concerns that pupils, schools or parents/guardians might have had, it was emphasised that participation was entirely voluntary, and that they could withdraw from the study at any time without penalisation. With regards to pupils, the right to withdraw was referred to in both the information sheet and in the informed assent sheet. This was in line with Nolen and Putten's (2007) discussion on 'insider research', specifically that 'researchers revise consent and assent documents to repeatedly clarify that there is no penalty for refusing to participate' (p. 405). Furthermore, Nolen and Putten (2007) recommended that all researchers intending to conduct research in their own schools should receive formal ethical training, which the researcher had been trained in. However, given the little involvement that the researcher had in the schools in the period leading up to data collection, the potential of a power relationship or coercive atmosphere was unlikely. According to Mercer (2006), benefits of conducting research in a school in which the researcher is employed/works in include access, familiarity, researcher credibility,

knowledge of school culture and organisation and rapport. Finally, the objective and philosophical nature of the research (i.e., quantitative and positivist in nature) ensured that any ethical concerns around researcher bias (Nolen & Putten, 2007) were unlikely.

3.6.2.4. Openness (4.3.). If children received scores that indicated the presence of a language impairment, or indeed if they received scores which placed them in the lowest cognitive percentiles, a protocol was followed as evidenced in appendix J, in line with PSI Code 1.3.15. All parents/guardians had the right to request their child's cognitive test scores and a separate consent form (see appendix K) was provided to parents who made contact with schools for their child's results. A number of parents were contacted and informed that their children had received lower scores on verbal working memory (*n* = 9), processing speed (*n* = 7), literacy (*n* = 3) and on perceptual reasoning (*n* = 1), where some of these children received lower scores on multiple tests. Four parents/guardians requested access to their child's results and were provided with these results using the template in appendix L.

Ultimately, as the risks associated with a child being misdiagnosed with a DLD, and subsequently being inappropriately placed in special education, may be more harmful for a child's development, it is envisioned that the benefits of this research far outweigh the risks (2.3.3). In line with national guidelines, 'every effort was made to ensure that positive change for children is an outcome of the research' (p. 5). This notion will be further expanded upon in section 6.4, where recommendations for future research include the potential mandatory dissemination of research in which vulnerable participants have been involved.

3.7. Conclusion

The methodologies adopted for the study therefore were moulded by these ethical considerations, whilst also upholding (post)positivist values as highlighted previously. Built upon previous research (Dollaghan & Campbell, 1998; Leonard et al., 2007), the procedures and measures were also designed to ensure that any shortcomings associated with any particular assessment tool or procedure was addressed. Some limitations are also inherent in the methodological approaches adopted. Thus, a thorough analysis of the strengths and limitations of the methodologies will be discussed in Chapter Five (section 5.3). In the interim, it is notable that the methodologies adopted for the study directly influenced subsequent data analyses.

4.0. CHAPTER FOUR
DATA ANALYSIS

Having defined the research questions in previous chapters, Chapter Four presents a thorough overview of the statistical analyses used to address these research questions. In line with the post-positivist philosophy of the research project, the data analysis will be quantitative in nature, enabling the researcher to subsequently address the original research questions. Following prolonged research, all of the statistical analyses are accompanied with a scientific justification, whilst also ensuring relevance to the original research questions and the aims of the research project. All analyses were conducted using the Statistical Package for the Social Sciences Version 25 (SPSS 25.0). In order to address the research questions, it was firstly necessary to follow data preparation procedures and subsequent preliminary analyses to ensure that data were interpretable and accurate. Tests of normality were also completed to ascertain if parametric tests were suitable for the purpose of addressing research questions. These preliminary procedures allowed for the creation of the independent variable with three levels (i.e., children who had DLD, typically developing children who had EAL and children who were typically developing and monolingual) and three main dependent variables (i.e., total processing speed score, total percentage correct processing speed responses and total verbal working memory score). A series of ANOVAs and post-hoc tests were then conducted to ascertain if verbal working memory and processing speed could distinguish between the EAL, monolingual and DLD groups. ANOVAs have previously been employed in similar research (e.g., Miller et al., 2001) to distinguish between groups on these measures. Tests of specificity and sensitivity were then conducted to ascertain the validity of the verbal working memory and processing speed tests in identifying a DLD using Receiver Operating Curve (ROC) analysis. Again, this procedure has been adopted in similar studies previously (e.g., Laloi et al., 2017). Finally, the numeric outcomes of these analyses will be translated into tangible conclusions, in preparation for the theoretical and clinical interpretations, which will ensue in Chapter Five.

4.1. Data Preparation and Preliminary Analyses

Swift (2006) recognised that data preparation and preliminary analyses often pre-empt the main analyses and therefore are critical components of data analysis. The process of data preparation includes transforming ‘raw data’ into interpretable data, as well the ‘tidying up and recategorisation’ of data (Swift, 2006, p. 154). The preparation

stage of analysis therefore initially involved data coding, data entry and the replacement of missing values (e.g., due to completion of different questionnaires by different groups). All data were then subjected to a clerical check, in order to reduce chances of error, and a number of variables were recoded to represent different categories of age ranges and score ranges. All data were initially structured in 'wide format', with the exception of processing speed scores. Following data preparation, the distributions of scores for Processing Speed (i.e., speed and accuracy) and Verbal Working Memory were tested to ascertain if they met the assumptions of normality.

4.1.1. Log transformation for processing speed. As processing speed scores were considered 'repeated measures' scores, processing speed data (i.e., response times) were restructured from 'wide format' into 'long format'. This restructuring was necessary in order to conduct a 'Box-Cox' Log Transformation. Evidence suggests that Reaction Time data (i.e., data obtained from processing speed task) are often best interpreted using a 'Log Transformation', in line with the Box-Cox procedure (Box & Cox, 1982; Whelan, 2008). Reaction Time data are typically not normally distributed and are often positively skewed (van Zandt, 2002). Such data usually have a number of outliers (Ratcliff, 1993; Whelan, 2008). In fact, Whelan (2008) argued that Reaction Time distributions often rise rapidly on the left, whilst they have a long positively skewed tail on the right, similar to the data presented in Figure 2. A log transformation includes transforming raw data to logged data and then back to its original format (e.g., in ms) using the exponential log function. This process attempted to make the data more normal and less skewed, allowing for further analysis of Processing Speed scores. The aging literature argues that transforming raw scores to log scores can increase the power of an analysis to detect differences between groups (Doksum & Wong, 1983; Rasmussen & Dunlap, 1991).

In order to create a dependent variable for Processing Speed, it was thus essential to complete a log transformation on the Processing Speed/Reaction Time data. Firstly, descriptive statistics revealed that the Processing Speed data, as measured using Reaction Time data, were not normally distributed, as indicated by a p value of 0.01 on the 'Kolmogrov-Smirnov' test. As well as considering the significant value on the Kolmogrov-Smirnov test, the Q-Q Plot (see Figure 2 below) revealed that data were positively skewed (i.e., data were leptokurtic, where the Skewness value was 2.411), as is typical in Reaction Time data (Whelan, 2008). Furthermore, data were highly peaked (i.e., kurtosis is 11.483) and a number of extreme scores (i.e., outliers) were evident.

Following the implementation of the log transformation, data were aggregated in order to obtain an average of correct response times, or mean log Reaction Times, for each participant. In line with Whelan's (2008) suggestions, Reaction Times under 200 ms were eliminated, as these may not have represented a 'thoughtful response' from the participant. An upper cut-off point was not established as the Visual Search/Processing Speed task also measured attention. As is evident in Figure 3, the log transformation process essentially ensured that the data were more normal and interpretable.

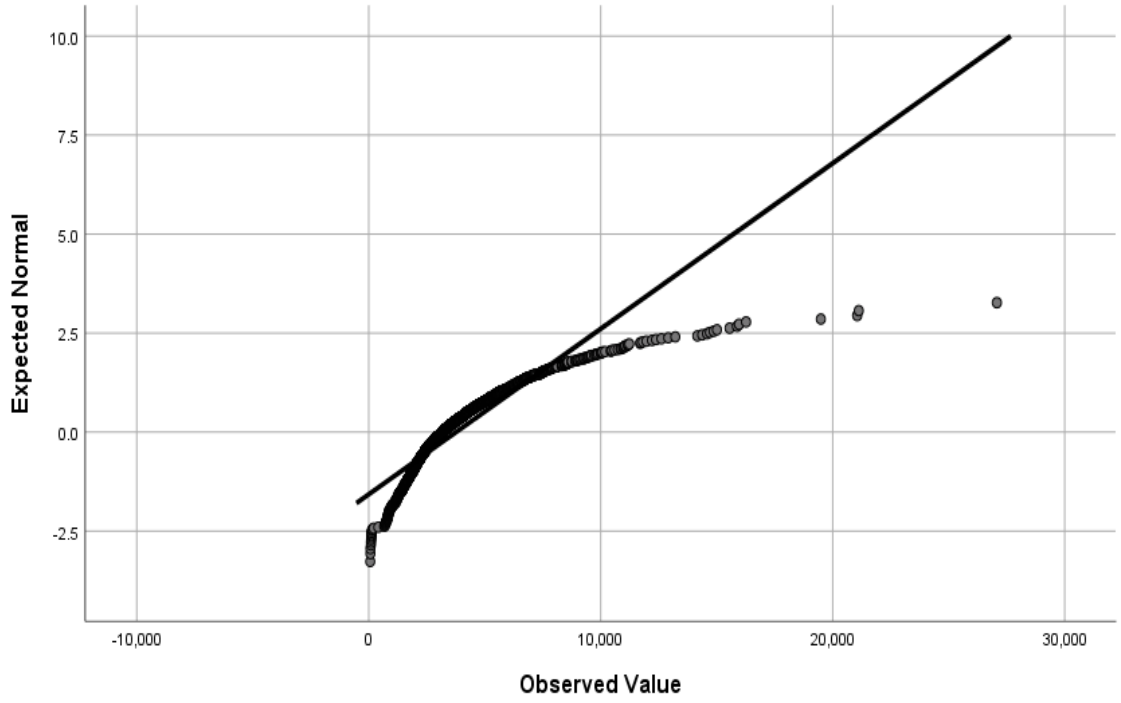

Figure 2. Q-Q Plot showing distribution of Processing Speed/Reaction Time scores. This figure shows that data were not normally distributed.

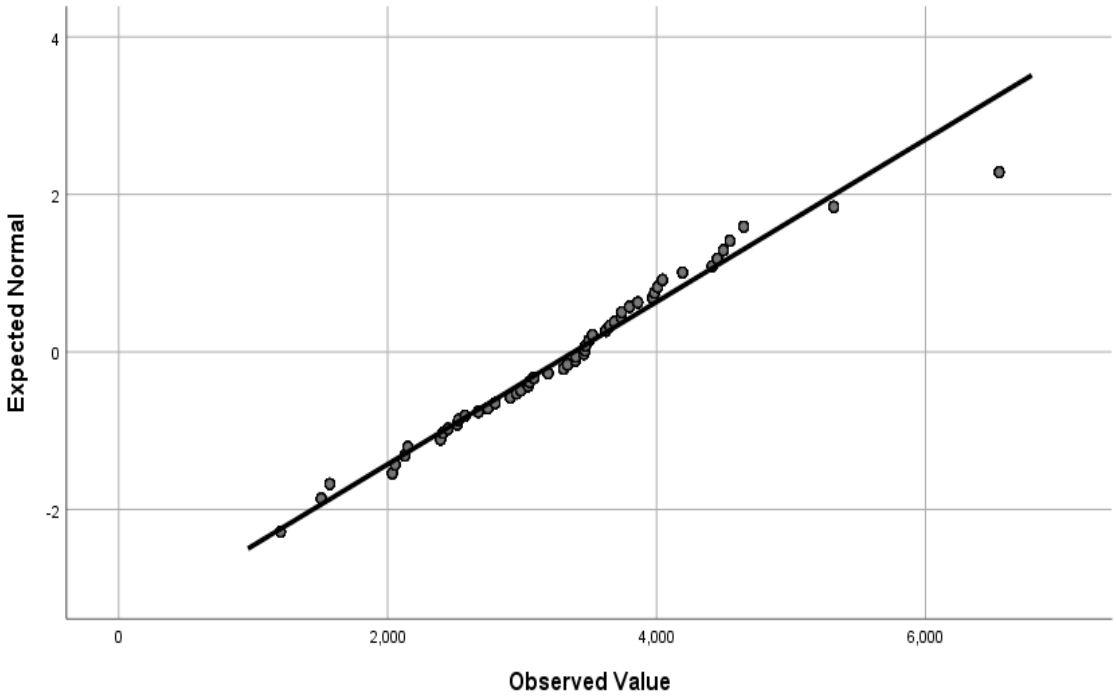

Figure 3. Q-Q Plot showing distribution of Processing Speed/Reaction Time scores following the Log Transformation process. This figure shows that data were more normally distributed following the transformation.

4.1.2. Processing speed accuracy. After log transforming the processing speed scores, an arcsine transformation was employed for error rate data. This allowed for the accurate calculation of non-normal accuracy data. Evidence suggests that an arcsine transformation can be used to normalise data and reduce variance of percentage data (Sokal & Rohlf, 1981). Descriptive statistics showed that the proportion of correct response times on the Processing Speed task were not normal. The Kolmogrov-Smirnov test showed that the distribution of accuracy data was statistically different from a normal distribution, where $p = 0.03$. In light of these findings, it was necessary to manually calculate the percentages of correct response times for each participant. These percentage scores were divided by 100 in order to establish the proportion of correct responses for each participant. This proportion score could then be normalised by multiplying the arcsine of the square root of the proportion correct, by two, through SPSS (Sokal & Rohlf, 1995). The arcsine transformed average accuracy scores were then suitable for parametric analyses, where converted error rate data or accuracy data were reflected as percentages.

4.1.3. Verbal working memory data. Verbal working memory data, as measured as TOTPPC, were analysed to investigate if scores were normally distributed. Unlike the processing speed and processing speed accuracy scores, the TOTPPC scores

were normally distributed (i.e., Kolmogrov-Smirnov *p* value = 0.56), meaning that parametric analyses were suitable. Please see Figure 4 for distribution of scores. An analysis of the distribution of the percentage of phonemes correct for the two syllable, three syllable and four syllable words revealed statistically significant Kolmogrov-Smirnov scores. However, an examination of the Q-Q plots generated for each of these scores showed that data appeared normally distributed. Finally, the distribution of the accuracy scores for the recollection of one syllable words were highly peaked, which is anticipated as the majority of participants recalled the one syllable words accurately. Non-parametric analyses were hence necessary for one syllable words data.

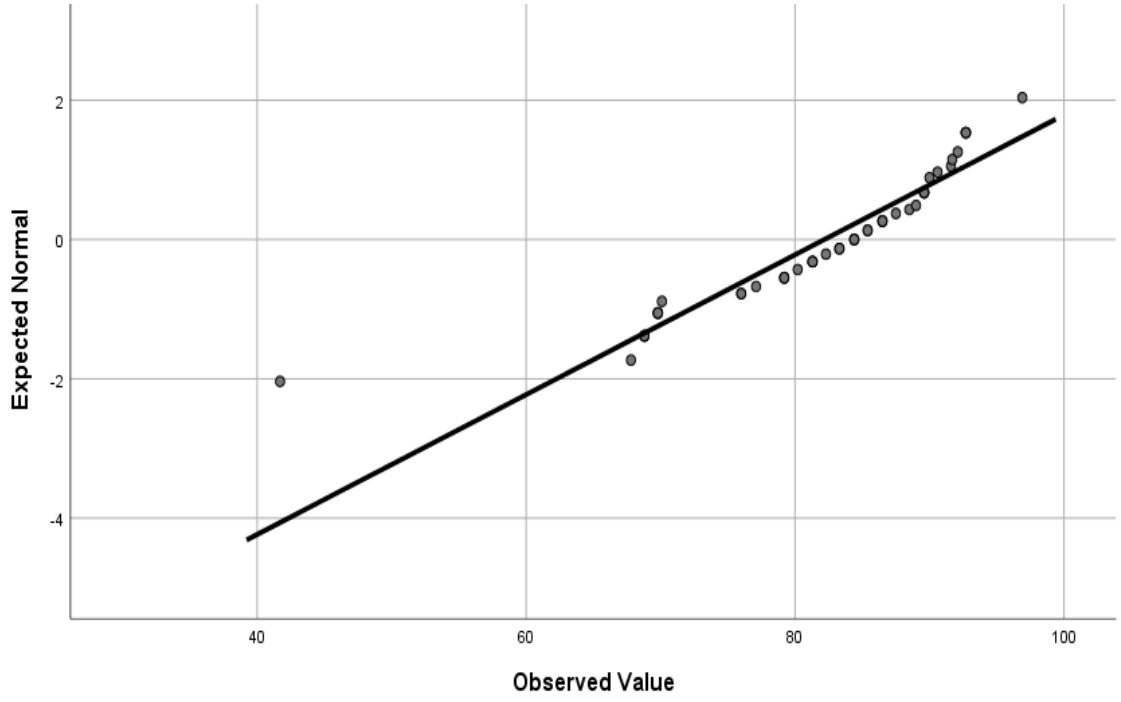

Figure 4. Q-Q Plot showing distribution of Total Percentage of Phonemes Correct scores. This figure provides further evidence that data were normally distributed.

4.1.4. Descriptive statistics. Following transformation procedures, all data were subsequently restructured to ensure that they were interpretable in 'wide format'. Demographical data were examined to determine if differences were evident between groups across different demographical variables. The pilot group were excluded for the purpose of these analyses. This procedure informed subsequent analyses to ascertain if certain variables needed to be controlled for (e.g., literacy scores). More details on

demographical information for each group, as collated via parental questionnaires, are presented in the previous chapter (see section 3.3).

4.1.4.1. Gender. Although more females than males participated in the research, a series of independent samples *t*-tests revealed that there were no differences in the mean performance of males and females across perceptual reasoning, t (40) = 1.022, p = .313, literacy, t (40) = -1.327 p = .192, Verbal Working Memory, t (40) = -.099, p = .922, Processing Speed, t (40) = -.203, p = .840, and Processing Speed accuracy, t (40) = -.771, p = .445 scores. Participants' scores therefore did not differ by gender.

4.1.4.2. Age. Participants' ages were recoded from numerical data to categorical data, where ages were assigned to one of five age categories. As is evident from Table 8 below, there were no significant differences in the performance of age groups across any of the age ranges. A one-way ANOVA also showed that the average age of each group did not differ significantly.

Table 8.

ANOVAs showing that there were no age differences in terms of performance for all participants.

Dependent variable	**Sum of Squares**	**df**	**Mean Square**	***F***	**Signifiance Value**
Perceptual Reasoning (measured using WASI-II)	219.74	4, 41	59.94	.564	.817
Literacy (measured using pseudoword decoding)	1228.89	4, 41	307.25	1.406	.251
Verbal Working Memory (measured using as the TOTPPC from the NRT)	591.03	4, 41	147.758	1.446	.238
Processing Speed (measured using Visual Search task)	1166122.71	4, 41	291530.676	.235	.917
Processing Speed accuracy (measured using Visual Search Task)	.839	4, 41	.210	.807	.528

4.1.4.3. Literacy and perceptual reasoning scores. An ANCOVA, as opposed to an ANOVA, was originally planned for the analysis of data. As was indicated in Chapter Two and Three, low verbal working memory and processing speed scores may otherwise be attributed to a child having lower overall general intelligence or an SLD. Therefore, controlling for general intelligence (i.e., perceptual reasoning) would involve subtracting the effects of general intelligence on verbal working memory and processing speed (Vogt, 1999). There were significant differences in the literacy scores at the $p < 0.01$ level between the DLD (M = 82.83, SD = 10.86), EAL (M = 109.2, SD = 11.01) and monolingual groups (M = 104.47, SD = 9.32), F (2, 39) = 23.64, $p < 0.01$. Post-hoc tests (i.e., Tukey test) showed that children with DLD performed significantly lower than their EAL ($p < .001$) and monolingual peers ($p <. 001$) on the literacy task (i.e., pseudoword decoding task. However, Field (2009) argued that controlling for a particular variable in order to find a 'true effect' can sometimes be difficult; often a covariate and a dependent variable cannot be truly independent of one another. As Tallal (2004) has suggested, DLD and literacy difficulties may essentially be different labels for the same difficulty. As a result, literacy could not be controlled for through an ANCOVA,

In terms of general intelligence, a one-way ANOVA showed that there were no differences in the mean PRI scores between the monolingual (M = 98.73, SD = 10.04), EAL (M = 100.4, SD = 14.72) and DLD groups (M = 92.17, SD = 7..4), F (2, 39), = 245.1, p = .161. Results from prerequisite tests also showed that this data did not meet the assumptions of an ANCOVA and thus it was not considered appropriate. Specifically, a number of scatter plots indicated that the relationship between perceptual reasoning and the three dependent variables (i.e., Verbal Working Memory, Processing Speed and Processing Speed) were not linear, thus violating the assumptions of an ANCOVA (Field, 2009). Please see Table 9 for mean scores for perceptual reasoning and pseudoword decoding.

Table 9.

Literacy and Perceptual Reasoning Scores

Group	**Literacy**	**Perceptual reasoning**
Overall mean of three groups (N = 42)	99.98	97.45
Monolingual (n = 15)	104.47	98.73
DLD (n = 12)	82.83	92.17
EAL (n = 15)	109.2	100.4

4.1.4.4. Parental occupation. As has been discussed previously, development of English proficiency can also be influenced by parental factors such as level of education and occupation, whist SES can also impact on the test-taking of different groups (Alfano et al., 2016; Hakuta et al., 2000). McLoyd (1998) also argued that parental level of education is often used to determine SES. Therefore, two one-way ANOVAs (i.e., one for maternal level of education and one for paternal level of education) were conducted in order to ascertain if there were differences in the performance of children from different socioeconomic backgrounds on the dependent variables (i.e., verbal working memory, processing speed and processing speed accuracy). Results indicated that there were not significant differences in the performances of children on the three dependent variables across the five levels of education. However, it is interesting to note that maternal level of education had a significant impact on children's scores on the pseudoword test, F (4, 36) = 695.87, p = .011, η^2 = .55 (large effect size, Cohen, 1988). Children whose mothers had a graduate or professional degree (M = 114.2, SD = 11.74) scored significantly higher than children whose mothers had received post-primary education, as their highest level of education (M = 93.85, SD = 12.33), p = .008, and mothers who had received some degree/diploma (M = 94.76, SD = 11.55), p = .033. As pseudoword decoding was not considered a dependent variable, level of maternal education was not controlled for in future analyses.

4.2. Verbal Working Memory Differences Between Groups

A series of ANOVAs were employed to determine differences between groups for the percentage of one syllable phonemes recalled correctly, two syllable phonemes, three syllable phonemes, four syllable phonemes and TOTPPC. In order to reduce the likelihood of a Type 1 error or a false positive finding (i.e., due to running a number of one-way ANOVAs), a more conservative post-hoc comparison test was used, the Tukey Honestly Significant Difference (HSD) Test. Field (2009) argued that employing correction tests such as the Bonferroni Correction Test, where the alpha or p value is divided by the number of comparisons, can often result in increased probability of obtaining a Type II error (i.e., likelihood that a significant result is rejected erroneously). Although it is often considered a conservative test, the Tukey HSD test is quite powerful and controls for a Type 1 error when comparing a large number of means (Field, 2009).

A one-way ANOVA was firstly conducted to ascertain if there were significant differences in verbal working memory performance on the NRT between the

monolingual, EAL and DLD groups. In terms of TOTPPC, there were significant differences between the three groups, F (2, 39) = 16.397, p < .001, η^2 = .457 (medium effect size, Cohen, 1988). Post-hoc comparisons using the Tukey HSD test showed that there were significant differences between the DLD group (M = 71.03, SD = 10.78) and the EAL group (M = 87.92, SD = 4.97) (p < .001), as well as the DLD and monolingual group (M = 83.54, SD = 9.32) (p = 0.01). There were no significant differences between the EAL and the monolingual group (p = .285). Therefore, the EAL and monolingual groups' scores on overall verbal working memory did not differ significantly from one another. However, the DLD group scored significantly lower than the EAL and monolingual groups for overall verbal working memory. Please see bar chart in Figure five showing the means of Total Phonemes Correct for each group. Table 10 shows the mean scores across the three dependent variables for each group.

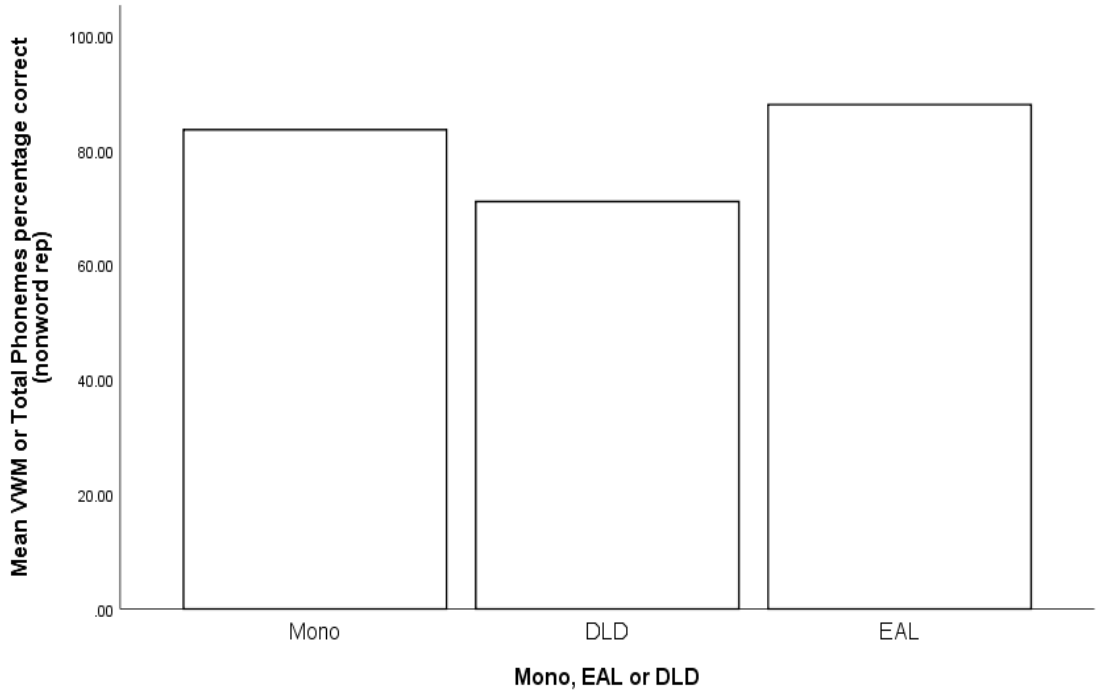

Figure 5. Bar-Chart showing mean scores for each group for Total Percentage of Phonemes Correct scores.

Table 10.

Mean scores across dependent variables

Group		VWM	Processing speed	Accuracy for processing speed in %
Mono	Mean	83.54%	3187.61ms	78.89%
DLD	Mean	71.03%	3601.95ms	61.34%
EAL	Mean	87.92%	3161.74ms	67.62%
Total	Mean	81.53%	3296.75ms	69.85%

Results also indicated that there was a length effect, where significant differences between groups became more apparent with increased demand on working memory (i.e., with increased syllables to be recalled). As participants' scores for the one syllable words were not normally distributed, a non-parametric test was used to compare the one syllable percentage correct ranks between groups. A Kruskal-Wallis test, using the Exact test which is recommended when sample sizes are small (Field, 2006), showed that there were not significant differences in the mean ranks between the three groups, in terms of the Percentage Correct of One Syllable Words, H (2) = 3.67, p = .162. A one-way ANOVA showed that there were significant differences between the three groups in terms of Percentage Correct of Two Syllable Words, F (2, 39) = 4.495, p = .018, η^2 = 0.187 (i.e., small effect, Cohen, 1988), for the Percentage Correct of Three Syllable Words, F (2, 39) = 7.399, p = .002, η^2 = 0.275 (i.e., small effect, Cohen, 1988) and for the Percentage Correct of Four Syllable Words, F (2, 39) = 12.55, p < .001, η^2 = 0.392 (i.e., medium effect size, Cohen, 1988). Tukey HSD comparison tests showed that participants with DLD performed significantly lower than the EAL and monolingual groups regarding Percentage Correct of Two, Three and Four Syllable Words. Please refer to Table 12 for the mean percentages of each group for TOTPPC, one syllable percentage correct, two syllables percentage correct, three syllables percentage correct and the percentage correct for four syllable words.

Table 11.

Results from post-hoc comparisons using the Tukey HSD

Dependent Variable	Group	Comparison group	Significance, where p < 0.05
VWM or Total Phonemes Percentage correct	Monolingual	DLD	.010
		EAL	.285
	DLD	Monolingual	.010
		EAL	.000
	EAL	Monolingual	.285
		DLD	.000
Percentage correct (2 syllables)	Monolingual	DLD	.026
		EAL	.987
	DLD	Monolingual	.026
		EAL	.037
	EAL	Monolingual	.987
		DLD	.037
Percentage correct (3 syllables)	Monolingual	DLD	.017
		EAL	.661
	DLD	Monolingual	.017
		EAL	.002
	EAL	Monolingual	.661
		DLD	.002
Percentage correct (4 syllables)	Monolingual	DLD	.002
		EAL	.435
	DLD	Monolingual	.002
		EAL	.000
	EAL	Monolingual	.435
		DLD	.000

Table 12.

Mean verbal working memory scores as measured using the Nonword Repetition Test

Number of syllables	Monolingual group mean	EAL group mean	DLD group mean
Total phonemes correct %	83.54%	87.92%	73.21%
One syllable words %	96.11%	98.67%	92.18%
Two syllable words %	95%	94.67%	88.61%
Three syllable words %	86.42%	90.26%	66.96%
Four syllable words %	72.59%	78.89%	49.38%

4.3. Processing Speed and Processing Speed Accuracy Between Groups

A series of one-way ANOVAs were conducted to establish if there were significant differences in the performance of the DLD, EAL and monolingual group in terms of processing speed. Using the exponentially logged mean Reaction Time score, the means of each group were compared. Results indicated that there were not significant differences in the mean Reaction Time scores, as measured in ms, of the three groups, F (2, 39) = .674, p = .515. The DLD group (M = 3601.9, SD = 1389.85) scored lower on the Processing Speed task than the monolingual (M = 3187.61, SD = 965.16) and EAL groups (M = 3161.74, SD = 890.89), but not significantly so, as is evident in Table 12. The accuracy of participants' responses on the processing speed (visual search) task were approaching significance, F (2, 39) = 3.23, p = .05. However, the eta squared statistic (η^2 = 0.116) was small (Cohen, 1988), which means that it is unlikely that accuracy can distinguish between the three groups. Although the DLD group's overall accuracy scores (M = 61.34, SD = 15.14) were also lower than the EAL (M = 67.62, SD = 26.57) and monolingual groups (M = 78.89, SD = 17.12), the difference did not reach significance (p = 0.41).

4.4. Sensitivity, Specificity and Likelihood Ratios

As well as analysing data through the comparison of means, the assessment tools were also evaluated in terms of sensitivity, specificity and likelihood ratios. 'Sensitivity' may be described as the capacity of a test to detect the presence of a diagnostic condition or a positive result (e.g., DLD), whilst 'specificity' refers to the ability of the test to detect the absence of a certain condition or a negative result (Glaros & Kline, 1988). Sensitivity is the proportion of individuals who score below a certain point, known as the 'cutting point' and specificity relates to those individuals who score above a certain cutting point (Glaros & Kline, 1988). Tests of specificity and sensitivity have been used in previous research in order to ascertain if certain cognitive factors could identify a DLD (Laloi et al., 2017). In line with Laloi et al.'s (2017) approach, ROC curves were used to establish the cut-off points at which sensitivity and specificity were most optimal. In other words, children who have a DLD would have scores below the cut-off score and children without a DLD should have a score the same as, or better than, the cut-off score (Laloi et al., 2017). Likelihood ratios indicate how much an assessment tool can increase the probability that a tool can predict the presence (positive likelihood ratio) or absence

(negative likelihood ratio) of a DLD. According to McGee (2002), likelihood ratios are one of the most respected methods for expressing diagnostic accuracy.

4.4.1. Verbal working memory. A ROC Curve was generated to establish cut-off scores for the Percentage of Total Phonemes Correct measure. As is evident from the ROC Curve (see Figure 6), verbal working memory appears to be effective in detecting the presence or absence of a DLD, with an Area Under the Curve (AUC) score of .926, $p < 0.01$. The AUC is denoted as a value which expresses the accuracy of the tool, ranging from 0.0. (i.e., no predictive value) to 1.0 (i.e., perfect predictor), where scores above .70 are considered to have a strong effect (Rice & Harris, 2005). The cut-off point was established using the co-ordinates of the curve, where the sensitivity and specificity were given equal value. It was established that a cut-off score of 79.7% would be an appropriate value as this would provide more or less equal weighting to both the specificity and sensitivity of the tool. Hence, this score would suggest that participants who scored below 79.7% would have a DLD, whilst those who scored above this score would not have a DLD.

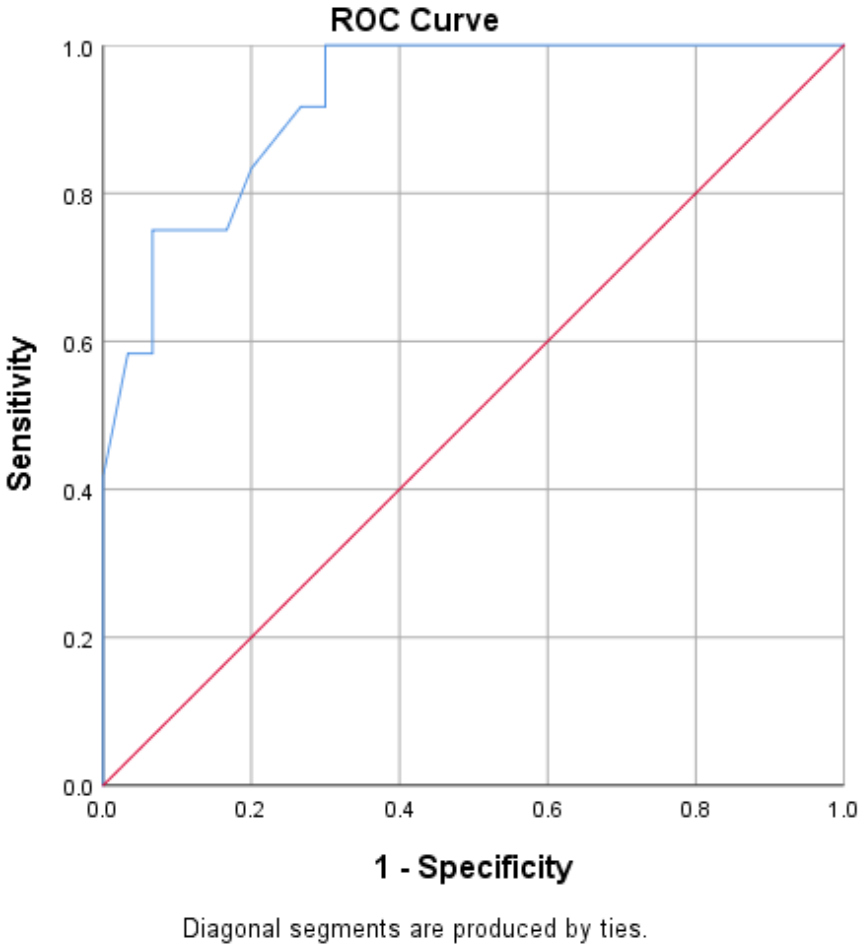

Figure 6. ROC Curve showing the sensitivity and specificity of the Verbal Working Memory measure.

Participants who scored below 79.7% were therefore coded as indicating the presence of a DLD, whilst those who scored above 79.7% were coded as indicating the absence of a DLD. A separate variable was also formulated where participants were coded as '1' if this indication was correct and '2' if it was incorrect. Thus, if the participant had a DLD and results from the verbal working memory measure confirmed this, this would be known as a 'true positive'. Where participants did not have a DLD and results from the measure confirmed this, this was regarded as a 'true negative' score. Conversely, participants who had a DLD but the assessment tool indicated that they did not, this would be considered a 'false positive'. In a situation where participants who did not have a DLD, but were assessed as having the condition, this was regarded as a 'false negative' score. Please see Table 13 for a crosstabulation highlighting the prevalence of true positive, true negative, false positive and false negative scores on the Verbal Working Memory measure.

Table 13.

Crosstabulation of presence or absence of a DLD compared measure outcome

	DLD present	DLD absent
Verbal Working Memory measure positive for DLD	*n* = 9 (true positive)	*n* = 5 (false positive)
Verbal Working Memory measure negative for DLD	*n* = 3 (false negative)	*n* = 25 (true negative)

Sensitivity was measured by dividing True Positive by True Positive and False Negative. Specificity was calculated by dividing True Negative by True Negative and False Positive. From these calculations, it emerged that the sensitivity of the verbal working memory tool (i.e., Nonword Repetition Test) for the three groups was 75.5%, meaning that over 75% of participants were correctly identified as having a DLD. Evidence suggests that the sensitivity of an assessment tool should be at least 70% (Glascoe, 2005; VanDerHeyden, 2011). The specificity of the assessment tool was 83.3%, meaning that it accurately identified the absence of a DLD in 83.3% of participants. Interestingly, Glascoe (2005) argued that specificity should be approximately 80% 'to minimize overreferrals' (p. 174). The positive likelihood ratio was 4.5 and the negative likelihood ratio was 0.3. Using McGee's (2002) bedside estimates, the assessment

increased the likelihood of accurately detecting a DLD by 25% and decreased the likelihood of misdiagnosing a DLD by 25%. In terms of the EAL group, the verbal working memory measure could successfully predict the absence of a DLD in all children with EAL (i.e., 100% specificity for the EAL group).

4.4.2. Processing speed. The ROC Curve, shown in Figure 7, indicated that processing speed was not an accurate measure for assessing the presence or absence of a DLD. The AUC was .575, where p = .452. An analysis of the co-ordinates of the ROC Curve analysis indicated that Processing Speed, as measured in mean Reaction Time, possessed only approximately 40% sensitivity and 45% specificity, which indicate poor diagnostic accuracy.

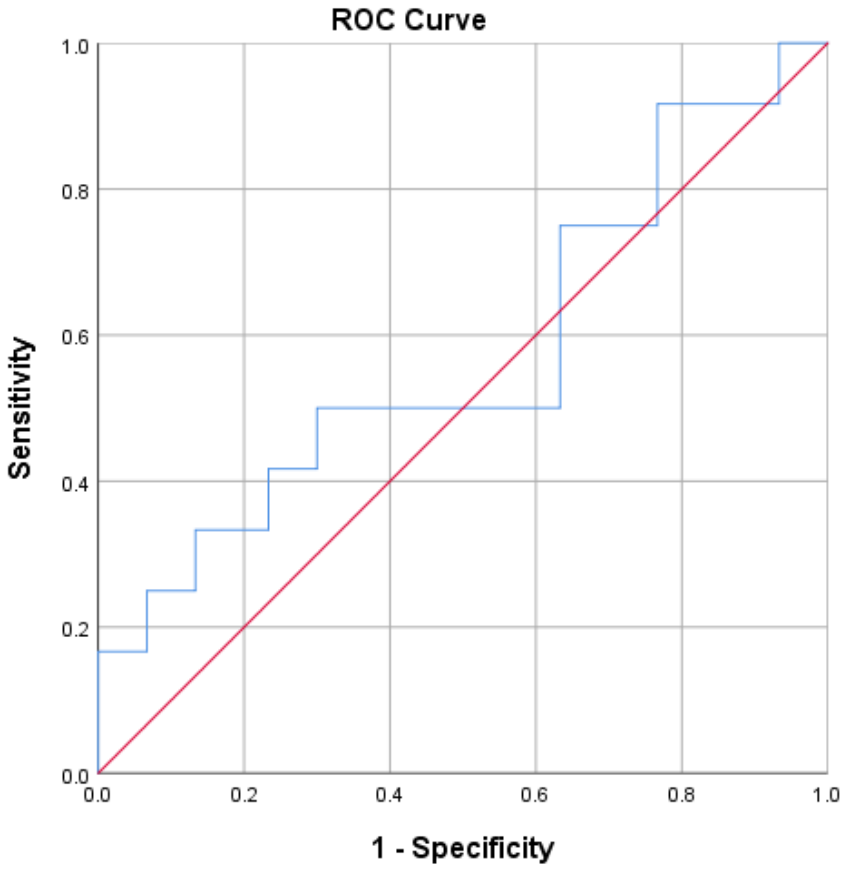

Figure 7. ROC Curve showing the sensitivity and specificity of the Processing Speed measure.

4.5. Conclusion

Following preliminary data preparation and analyses, results from a number of one-way ANOVAs and post-hoc testing indicated that verbal working memory can distinguish children with EAL from children with DLD. This was as predicted, whilst the hypothesis that children with EAL and monolingual children would have similar verbal

working memory scores was also confirmed. In terms of sensitivity and specificity, results revealed that the NRT is somewhat effective in detecting the presence or absence of a DLD. Interestingly, the task could detect the absence of a DLD correctly for all members of the EAL group. Results for the processing speed measure were not as promising. Although children with EAL and children who were monolingual had very similar Reaction Time scores, which were higher than the DLD group, this did not reach the significance level. This is in line with Miller et al.'s (2001) findings where children with DLD had generally slower processing speed but this was not the case for all children with DLD. In terms of accuracy, monolingual children performed better than the DLD group but there were no differences between the EAL and DLD group. However, this had a very small effect. Results are discussed in the following chapter in the context of research, practice and policy, with due regard for the strengths and limitations associated with the statistical approaches adopted.

5.0. CHAPTER FIVE
DISCUSSION

This penultimate chapter intends to address the findings outlined above, in light of the original research questions. Each research question will be addressed individually and will be accompanied by potential explanations for findings based on theoretical viewpoints and previous literature. Following the presentation of findings and related literature, the implications of the research will be provided, with specific emphasis on the theoretical, clinical and educational implications of results. Notably, the implications for Irish policy directives, as they pertain to educational and clinical practice, will be clearly defined and defended. As all research has scope for improvement, the strengths and limitations of the research will be discussed and this will culminate with suggestions for future research in the area.

5.1. Findings

Proponents of language-reduced assessment tools for assessing children with EAL argue that tests of verbal working memory and processing speed can distinguish between EAL and DLD (e.g., Laloi et al., 2017; Marton & Schwartz, 2003; Montgomery et al., 2010; Sandgren & Holmström, 2015;). Arising from this evidence, the use of processing speed and verbal working memory measures for this purpose were intuitively and empirically appealing. With this is mind, it was predicted that verbal working memory and processing speed could distinguish between children with EAL and children with DLD. It was hypothesised that children with DLD would perform significantly lower on tests of verbal working memory and processing speed than their EAL and monolingual counterparts. In a similar vein, children with EAL and monolingual children should have had similar processing speed and verbal working memory scores. Finally, it was hypothesised that processing speed and verbal working memory scores could detect the presence or absence of a DLD. Drawing from the literature, this section seeks to explain whether or not these hypotheses were partially or completely confirmed.

5.1.1. Verbal working memory measure. As outlined in Chapter Four, having conducted thorough data analyses, it emerged that the measure of verbal working memory (i.e., a nonword repetition task) could successfully distinguish between the EAL, monolingual and DLD groups. Specifically, children with EAL performed similarly to monolingual children, whilst children who had a DLD performed significantly lower than both groups in terms of verbal working memory. Therefore, in line with initial

hypotheses, children with EAL had similar verbal working memory performances to children who were monolingual, whereas, as predicted, children who had DLD scored lower. As well as examining the differences between the EAL, monolingual and DLD groups, it was also necessary to assess the specificity and sensitivity of the verbal working memory tool to establish if the NRT could successfully predict the presence or absence of a DLD. It emerged that the task could predict the presence or absence of a DLD, with some accuracy.

Overall, the results presented above were unsurprising considering the literature reviewed in Chapter Two. For example, findings were anticipated in light of the limited processing capacity theoretical model of DLD (e.g., Kail, 1994; Montgomery, 2000), where it is argued that language impairments may be attributed to limited space for storing information, and thus, certain cognitive impairments related to verbal working memory and processing speed, are evident. More specifically, children with DLD may have obtained lower performance scores on verbal working memory due to the restricted computational aspect of memory, as well as time-mediated decay of information (Kail & Salthouse, 1994). Baddeley's (1986) model of working memory also explains why children with DLD may have received lower scores than children with EAL and children who were monolingual. Research illustrates how children with DLD often have impaired functioning of the phonological loop (Boerma & Blom, 2017; Gathercole & Baddeley, 1990), rendering them unable to retain verbal information long enough to repeat the word (Leonard et al., 2007). Boerma and Blom (2017) argued that typically developing children with EAL do not have difficulties with nonword repetition, as these verbal working memory mechanisms are usually not impaired (Leonard et al., 2007; Sandgren & Holmström, 2015). Neurocognitive evidence also suggests that children with a DLD differ from their peers in terms of brain activity in the precentral sulcus, an area which may be responsible for working memory (Ellis Weismer, Plante, Jones & Tomblin, 2005).

5.1.1.1. Length effect. Baddeley's (1986) theory of working memory, as well as the limited processing theories of DLD are further supported by the finding that a 'length effect' was also observed in the NRT. That is, with increased syllables in nonwords, the difficulties experienced by the DLD group became particularly apparent. Thus, whilst children with DLD performed comparably well to the monolingual and EAL groups when the nonwords were shorter, their performance decreased as the words became more cumbersome. Baddeley's Working Memory Model (1986) may indeed be a plausible

explanation for this finding. As described previously, the phonological loop briefly stores verbal information in working memory, so for example, nonwords (Baddeley, 1986), whilst the episodic buffer is often deemed responsible for 'chunking' (e.g., binding letters of nonwords). Theories aimed at explaining the word-length phenomenon have been longstanding, such as Miller's (1956) limited capacity model, where it was posited that individuals have the ability to remember information in approximately seven chunks, plus or minus two. Interestingly, the concept of limited capacity is also in tandem with Kail and Salthouse's (1994) proposition that DLD may be explained by a limited processing model, where information may be subjected to decay if not processed promptly. Although, Neath and Nairne (1995) contradicted the latter sentiments, Baddeley (2000) contradicts Neath and Nairnes' (1995) prose. Drawing from information related to the phonological loop and episodic buffer, Baddeley (2000) argued that individuals typically find it easier to recall short words than longer words due to the burdensome task of having to rehearse and recall polysyllabic words. Unlike Neath and Narines (1995), Baddeley (2000) argued that rehearsing and recalling many syllables would naturally result in a time-based decay of this information. Ultimately, Baddeley (2000) argued that the word-length effect may be attributed to time-based decay of information and to the limited capacity of a phonemically-based store, again which is related to the limited capacity model of DLD. Therefore, it is unsurprising that children with DLD's verbal working memory performance became progressively reduced as the words became more complex.

5.1.1.2. Potential English as an additional language advantage? As well as a length effect for the verbal working memory task, it was noted that children with EAL scored slightly higher than the monolingual group, albeit differences were not outstanding. Nonetheless, there is an argument that children with EAL often have superior verbal working memory to children who are monolingual, which may explain why the children with EAL scored slightly higher than monolingual children on this occasion. For example, Sandgren and Holmström (2015) argued that learning a second language may prove cognitively advantageous to children with EAL. In fact, the research base is expansive in this regard (Adesope, Lavin, Thompson & Ungerleider, 2010; Warmington, Kandru-Pothineni & Hitch, 2018). Interestingly, Sangren and Holm (2015) reported that children with EAL often have superior cognitive performance in terms of executive functioning and verbal working memory than monolingual children, in particular when tasks become increasingly demanding. This is in stark contrast to children with DLD, where increased complexity (i.e., longer nonwords) resulted in reduced performance

relative to the children with DLD and EAL. Perhaps if the nonwords presented to the EAL and monolingual groups further increased in complexity, an EAL cognitive advantage may have been more evident. In terms of visual working memory, Blom, Küntay, Messer, Verhagen and Leseman (2014) found that such advantages remain even when considering children's SES. Blom et al. (2014) provided convincing evidence that children who are from a lower SES backgrounds often have reduced executive functioning perhaps due to a less cognitively-stimulating environment. However, Blom et al. (2014) argued that learning a second language can actually counteract the negative effects of such.

It is thus necessary to delve deeper into this concept and ask how exactly do children with EAL have an apparent verbal working memory advantage? The extant research addressing this question is somewhat scarce. Although emerging research suggests that having two languages may not wholly guarantee an 'EAL advantage' (Engel de Abreu, 2011), Yang (2017) offers compelling evidence that a working memory advantage may come from the need to hold and decode incoming L2 information, which would place increased demand on working memory (Yang, 2017). Similarly, enhanced executive functioning and working memory may be attributed to a requirement to engage in attentional inhibition of either the child's L1 or L2 depending on the language context or requirements (Zhang, 2018). Nonetheless, the notion that learning another language may lead to enhanced cognitive performance on working memory tasks is debateable. It must be asked, does the process of learning a second language enhance cognitive skills, or do these skills determine which children will be enabled to learn a second language in the first place? Cox et al. (2016) compared this dilemma to a notoriously difficult quandary – 'which came first, the chicken or the egg?' (p. 300).

5.1.1.3. Effectiveness of verbal working memory. Overall, it appears that, in particular, a nonword repetition task with words of increased length may successfully predict the presence or absence of a DLD in an EAL population. In line, children with DLD performed lower than children with EAL and monolingual children. Although children with EAL surpassed their monolingual colleagues to some degree, this did not reach significance. However, an argument remains that there may be some cognitive advantages in terms of working memory for children with EAL.

5.1.2. Processing speed measure. Although it appears that verbal working memory may successfully distinguish between the EAL and DLD groups, the processing

speed measure offered less promising results. Overall, the null hypothesis was accepted, meaning that processing speed did not distinguish between children with EAL and DLD, nor could the tool predict the presence or absence of a DLD. Subsequently, results from data analysis showed that there were no significant differences in the processing speed of the EAL, monolingual and DLD groups. However, the DLD group did score lower than both groups but these differences were not statistically significant. Although unrelated to the initial hypotheses, it also emerged that processing speed accuracy may not be robust enough to distinguish between the EAL and DLD groups.

Considering the abundance of research, which suggested that processing speed could be a useful marker for differentiating between EAL and DLD, the findings were unexpected. For example, several authors have illustrated how children with DLD typically have slower Reaction Times and processing speed than children who do not have a DLD (Johnston & Weismer, 1983; Kail, 1994; Leonard et al., 2007; Miller et al., 2001; Montgomery & Windsor, 2007). In fact, the evidence was so convincing that one of the key theories related to DLD, the general slowing hypothesis, is based on the premise that children with DLD have reduced processing capacities in comparison to children without a DLD (Kail, 1994).

Furthermore, Leonard et al. (2007) had initially argued that processing speed and working memory are not distinct from one another, but that faster processing speed can relate to the faster rehearsal and better retention of information in working memory. Yet, the current research found that although effects were evident for verbal working memory, the processing speed assessment was comparably ineffective. It is notable, however, that Gillam and Ellis Weismer (1997) have found that processing speed and working memory may be more independent from one another than had initially been presumed (as cited in Leonard et al., 2007). Notably, Leonard et al. (2007) subsequently found that processing speed and verbal working memory should be regarded as distinct entities. The findings arising from the current research support these assertions. However, this still does not provide a plausible explanation as to why children with DLD did not have slower processing speed than the EAL and monolingual groups, despite the abundance of research to the contrary.

Some researchers have reported findings where processing speed was not a particularly useful clinical marker for DLD. For example, Lahey, Edwards and Munson (2001) disputed the idea that processing speed differed depending on severity of the DLD.

There remains, however, a scarcity of research which wholly contradicts the notion children with DLD have reduced processing speed in comparison to typically developing children with EAL and DLD. Although there is a possibility that the processing speed and DLD literature may be subject to publication bias, it is perhaps more conceivable that there were flaws inherent in the assessment tool employed. In turn, the tool may not have tapped into the distinct processing speed domains, where the deficits associated with DLD may lie. Although Kail's (1994) general slowing hypothesis is the preeminent theory pertaining to processing speed deficits in children with DLD, Tallal et al. (1993) proposed that DLD may be governed by specific processing speed deficits, namely, auditory processing. Research has also illustrated how DLDs may be governed by domain-specific pathways, rather than underlying general deficits (Van der Lely, 2005).

Leonard et al. (2007) have also suggested that variability of results across studies may be attributed to the fact that different assessment tools may have examined different processing speed processes. Leonard et al. (2007) argued that this is reflective of the research on cognitive ageing, where reduced processing speed may be more apparent in certain domains than others. As a result of these differing domains of processing, Leonard et al. (2007) stated that linguistic and nonlinguistic processing are distinguishable from one another, and accordingly, they adopted both linguistic and nonlinguistic tasks for their study. However, for the current research, it was not possible to adopt a more linguistic measure of processing speed, as language-neutral assessment tools were chosen in light of the EAL population. Perhaps, more inventive tools, where linguistic and non-linguistic processing were measured may have provided very different results, where it may have been likely that children with DLD would have performed lower than children with EAL and the monolingual group. It is also interesting to note that Leonard et al. (2007) felt that their 'inclusion of a sizable number of children with language impairments with age-appropriate nonverbal intelligence scores could have worked against finding that nonlinguistic/nonverbal processing contributed to our models' (p. 421). However, as nonverbal intelligence scores were comparably similar across the three groups, this may provide an unlikely explanation for insignificant processing speed results.

5.1.2.1. English as an additional language advantage? Furthermore, unlike the verbal working memory measure, children with EAL did not surpass their monolingual counterparts in terms of processing speed. Similarly to potential verbal working memory advantages, a wealth of research has suggested that children with EAL should have

superior executive functioning on tasks which require controlled attention, such as on the processing speed task (Bialystok, 2007; Hilchey & Klein, 2011). However, Namazi and Thordardottir (2010) argued that the 'bilingual advantage' may only pertain to working memory, which may explain why no particular advantage was evident on the processing speed task. Furthermore, evidence suggests that increased language proficiency can result in increased cognitive gains (Mishra, Hilchey, Singh, & Klein, 2012). The children with EAL who participated in the current study had comparably low levels of English proficiency, as measured using the Council of Europe's Common European Framework of Reference for Languages. Such children with EAL may differ somewhat to perhaps a bilingual learner, per se. Therefore, the cognitive gains may not have been particularly apparent from this group. Interestingly, Warmington et al. (2018) have recently clarified that there are specific cognitive domains which may benefit from learning more than one language. They found that although there was an advantage for working memory and novel-word learning (i.e., both involved in nonword task), as well as response inhibition, there was no such advantage in terms of selective attention (i.e., measured in processing speed task). Zhang (2018) also argued that many of the tasks that measure executive functioning may be too simple to reveal the full extent of children with EAL's cognitive gains, meaning that the processing speed task used in the present research may have been over simplistic.

5.1.2.2. Effectiveness of processing speed task? To review, it is evident, therefore, that the visual search task employed in the current research was ineffective in answering the research questions previously posed. However, this does not imply that processing speed cannot distinguish between children with EAL and children with a DLD and should be a disavowed practice. Rather, the wealth of research is somewhat indisputable in defence of the notion that processing speed can provide a powerful marker for DLD. As a result, it may be concluded that the assessment tool used for the current research may not have been robust enough to detect processing speed differences. The implications of such will be discussed in terms of the limitations of the research and directions for future research (see section 5.3).

5.1.3. Conclusion. The findings presented here aimed to address the research questions set out at the beginning of the research paper. The most compelling results revealed that verbal working memory, namely, the NRT may distinguish EAL from DLD. In contrast, the visual search task used to measure processing speed may not have been

robust enough to detect true differences in processing speed between the EAL, monolingual and DLD groups. With these factors in mind, a better-designed measure of processing speed may offer more fruitful results. A more thorough discussion will be offered regarding the implications of these findings at a research, practice and policy level in the following sections (see section 5.2), whilst the strengths and shortcomings of the assessment tools employed will also warrant discussion (section 5.3).

5.2. Implications of Research Findings

Having discussed the research findings with references to theoretical frameworks and to the wider literature, it is necessary to expand on such frameworks through a discussion on the theoretical implications of the findings. Theoretical interpretations will be translated into both educational and clinical implications of the current research and related literature emphasising the potential impact of research findings on practice. Such a discussion will subsequently uncover the shortcomings of current Irish policy provision for children with EAL and recommendations for changes in policy directives will subsequently be made. It will be argued that, as well as an obvious ethical obligation to ensure policy advancements are made in line with our diversifying population, the economic advantages associated with policy changes will also be argued. Essentially symbolic of Ricento and Hornberger's (1996) 'onion metaphor', which states that language planning policy has multiple layers, the implications of the findings will span across theoretical, research, policy and practice spheres.

5.2.1. Theoretical and research implications and reflections. The findings from the current research have unveiled some theoretical and research implications, including implications for a revised theoretical understanding of CHC theory as it pertains to the diagnosis of DLD in an EAL population. Other theoretical perspectives pertaining to children with EAL and DLD will also be reflected upon in light of research findings. However, in the absence of a larger-scale study, these recommendations and reflections will be tentative in nature.

5.2.1.1. Cummins' theory. It appears fitting to firstly discuss the findings of the research in the context of Cummins' (2008) BICS and CALP theory, as it is one of the most prominent theories related to EAL language acquisition. Cummins (2008) has previously suggested that most assessment tools are biased towards children who have EA, and therefore may be inaccurate measures of their performance (Cummins, 1984). The current findings suggesting that verbal working memory may be an appropriate

measure for children with DLD, may serve to address some of Cummins' concerns. The direct implications of these findings in the context of BICS and CALP (Cummins, 2008) are discussed in more detail in sections 5.2.2.1, 5.2.2.2 and 5.2.3.4.1, in terms of clinical and educational implications.

5.2.1.2. Cognitive theories. The evidence suggesting that children with DLD may have reduced cognitive abilities in verbal working memory and processing speed formed the basis for the current research (e.g., Leonard et al., 2007; Marton & Schwartz, 2003; Montgomery et al., 2010). Such evidence appears to arise from limited processing capacity theories of DLD (Paradis, 2010). Research also illustrated how children with EAL may even have superior abilities in these cognitive domains as compared to typically developing monolingual children, as learning another language can strengthen these underlying cognitive processes (Sandgren & Holmström, 2015). The results found here provide supporting evidence, to some degree, that verbal working memory can serve as a clinical marker for DLD amongst children with EAL. Children with EAL also outperformed their monolingual counterparts on the verbal working memory measure but not significantly so. However, the findings from the research provide countering evidence that processing speed measures possess the desired success.

In line with Baddeley's (1986) working memory model, it appeared as though children with DLD were unable to retain verbal information for long enough to create a phonological representation of the nonwords. Leonard et al. (2007) argued that such difficulties may result in the language difficulties that are evident in children with DLD. Boerma and Blom (2017) suggested that due to deficits in the phonological mechanism of working memory, children with DLD often struggle with repeating nonwords, whereas children who do not have language difficulties, including children with EAL, did not appear to have any difficulties with verbal working memory. In terms of the specific mechanisms that may impact on verbal working memory, the findings that there was a length effect provide further evidence that children with DLD have specific difficulties associated with the phonological loop (Gathercole & Baddeley, 1990).

5.2.1.2.1. Recommendation 1: Processing speed. It is recommended that further research is conducted to ascertain if processing speed, is indeed, as powerful of an indicator of DLD than was original perceived.

5.2.1.2.2. Recommendation 2: EAL advantage. More research may also be required to investigate if children with EAL have an advantage in terms of cognitive performance, in comparison to typically developing monolingual children.

5.2.1.3. Cattell-Horn-Carroll theory. As has been previously discussed, CHC theory has been previously used to inform assessment procedures for children with SLDs, whereby SLD diagnosis is determined by performance across a range of cognitive and academic abilities (Flanagan, Ortiz & Alfonso, 2013). The findings that verbal working memory may underly language difficulties in DLD may support the application of CHC-inspired assessment methods for children with EAL and DLD. Therefore, as the findings presented in Chapter Four suggest nonword repetition tasks may be invaluable when ruling in or ruling out a DLD in children with EAL. Interestingly, such findings lend themselves to CHC theory and a Pattern of Strengths and Weaknesses (PSW) approach. CHC theory and the PSW approach are closely aligned (Miciak, Fletcher, Stuebing, Vaughn & Tolar, 2014). In line with cognitive frameworks of DLD, a PSW approach dictates that children with learning difficulties may be identified by certain patterns of cognitive strengths and weaknesses (Hale et al., 2010). Miciak et al. (2014) refer to particular methodologies for implementing the PSW approach. These include the Concordance/Discordance Method (C/DM; Hale & Fiorello, 2004), the Cross-Battery Assessment Method (XBA; Flanagan et al., 2013) and the Discrepancy/Consistency Method (Naglieri, 1999). All of these methods have some key features, namely, data are collected from a number of sources, data are analysed to ascertain if patterns emerge, as well as the importance of supporting literature and professional judgements in decision-making (Miciak et al., 2014).

Based on CHC theory, Flanagan et al.'s (2013) XBA approach appears particularly applicable to the current research. Firstly, Flanagan et al. (2013) promoted the use of nonverbal tests when applying the XBA method but only in the context of other assessment methods. In line, verbal working memory scores should be considered as only a singular component of a more robust, holistic assessment. Specifically, the XBA method dictates that there should be a deficit in an academic (i.e., language) and cognitive component (i.e., verbal working memory), where theoretically, there is causality between the academic and cognitive components (Miciak et al., 2014). As has been highlighted throughout Chapter Two, evidence strongly suggests that cognitive deficits may underlie the language difficulties experienced by children with DLD (e.g., Leonard et al., 2007;

Marton & Schwartz, 2003; Montgomery et al., 2010). The XBA approach also contends that the child should have an otherwise typical cognitive profile (i.e., in this case, average nonverbal intelligence), whilst Flanagan et al. (2013) also advise that clinicians should consider other 'exclusionary clauses' (i.e., cultural, language and cultural factors) in determining the presence of a difficulty. Looking through the lens of the current research, these exclusionary clauses may refer to the bilingual factors, which are further highlighted upon in section 5.2.3.5. As referred to in section 3.4.1.1, Artiles et al. (2005) are also proponents of examining within-group differences in children with EAL.

5.2.1.3.1. Recommendation 3: Cross battery research for children with DLD. Although emerging research exists in support of an XBA method for assessing children with an SLD, more research may be required to investigate if the method is suitable for assessing children with EAL for a possible DLD. Such research should also consider within-group variability (i.e., bilingual factors/exclusionary clauses) amongst groups with EAL.

5.2.1.3.2. Recommendation 4: Alternative assessment methods. Indeed, it may also be fruitful for researchers to continue to explore alternative methods for assessing children with EAL for a DLD.

Indeed, further recommendations for future research will be made at the conclusion of this chapter in light of some of the limitations inherent in the study. Nonetheless, the findings of this research, as well as the review of the literature reveals that theoretical viewpoints in terms of DLD and EAL may require substantial revision in order to ensure fairer assessments for such populations.

5.2.2. Educational implications. The theoretical implications of the findings of the research also have direct consequents for schools. Specifically, arising from the findings presented here, recommendations will be made in terms of Initial Teacher Education (ITE) and Continued Professional Development for existing teachers, with an emphasis on the importance of understanding some of the key theories on EAL language acquisition. The fallacies of standardised testing and the potentially hazardous consequences of teacher over-referrals also warrant discussion, as do the implications of school placements for children with EAL and DLD.

5.2.2.1. Initial teacher education and continued professional development. Given the potential deleterious impact of misdiagnosing a child with EAL with a DLD,

raising teachers' awareness of theories related to second language acquisition may be the ultimate safeguard for ensuring a reduction of missed or mistaken diagnoses of DLD. As has been aforementioned, Ferlis and Xu (2016) argued that theories such as Cummins' (2008) BICS and CALP Theory, as well as Sociocultural theory (Vygotksy, 1978) are often misunderstood by teachers, leading to erroneous educational provision for this population. In fact, the training of teachers was highlighted as an area for potential improvement in the aforementioned OECD (2009) report. It was argued that 'there is little in the way of provision of continuing professional development in age-specific teaching and assessment methods' of children with EAL in Irish schools (Taguma et al., 2009, p. 41). With regards to ITE, Murtagh and Francis (2012) posited that exposure to EAL theory in conjunction with school placements in more diverse schools may prove fruitful, and indeed may address Ferlis and Xu's (2016) concerns around teachers' theoretical knowledge.

An illustration of the lack of exposure to EAL theories includes the potential consequences of teachers' misunderstanding of Cummins' (2008) BICS and CALP theory. As has been previously described, Cummins (2008) argued that EAL development can relate to a child's abilities to display both written and verbal academic language (i.e., CALP) or a child's ability to engage in more informal or conversational language (i.e., BICS), where CALP is often developed much later than BICS. Naturally, as a child's CALP is more commonly evident in academic settings, often children with EAL may present as having more underdeveloped language skills than is reflective of their BICS. Furthermore, in line with Cummins' (2008) theory, research illustrates how it may take a child with EAL approximately nine years to achieve proficiency in a second language (Cummins, 2008; Slama, 2012). During this time, which may span the entirety of a child's primary school education, it may appear as though a child with EAL may have difficulties with language, when, in fact, he or she is still in the process of learning academic English. Difficulties with academic language may also prevent a child with EAL accessing all areas of the curriculum, which may further reaffirm a teacher's suspicions that a child with EAL has an SEN (Rosamond, Bhatti, Sharieff & Wilson, 2003).

As well as the central tenets of Cummins' (2008) theory, children with EAL may also present with characteristics which may result in teachers mistakenly believing that he or she has DLD. For example, children with EAL often undergo a 'silent period' when they first move to a country, where their first language is suddenly in contradiction to the

societal language (Rosamond et al., 2003). This silent period may last as long as six months and is often a cause for concern for teachers (Rosamond et al., 2003). Again, it is recommended that teachers should monitor this transitional period in case the silent period is actually masking a communicative disorder. However, the silent period is usually a normal phase of additional language development, a phase which teachers may be unfamiliar with in the absence of exposure to EAL theories.

5.2.2.1.1. Recommendation 5: Initial teacher education and continued professional development. It is recommended that Irish primary school teachers are provided with continued professional development in the area of assessment, intervention and development of children with EAL. Education in relevant theories (e.g., Cummins, 2008) should also infiltrate ITE and Continued Professional Development. In doing so, teachers could become more adept at recognising if a child's development is deviating from typical EAL language development.

5.2.2.2. Teacher assessment. As well as the consequences of a misunderstanding of EAL language development, which can lead to erroneous onward referrals or missed cases of a DLD, there may also be an increase in referrals as a result of testing. In fact, by failing to understand the distinction between BICS and CALP, Cummins (1984) stated that many professionals may engage in inaccurate assessments of children with EAL. Vanderwood et al. (2013) argued that often standardised assessments are inaccurate measures of the actual abilities of children with EAL. Furthermore, in relation to CALPS, as assessments typically focus on academic language, then children with EAL are likely to receive lower scores than their monolingual counterparts on most academic assessments. This may not be an indication of a lack of ability, but rather a lack of academic language. Rosamond et al. (2003) raised some interesting points around the use of assessments which are not in line with the child's first language and they advised 'extreme caution' when adopting standardised assessments (p. 12).

It is also notable that as well as biases being inherent in assessment tools, biases and prejudices are often also engrained in the practitioner (Paniagua, 2013). Rhodes, Ochoa and Ortiz (2005) argued that many schools and teachers may also display systemic school bias, whereby referral procedures are often negatively impacted as a result of practitioners' perceptions of children with EAL. As a result, children with EAL are often victims of unnecessary referrals, which can lead to inaccurate diagnoses (Ferlis & Xu, 2016).

5.2.2.2.1. Recommendation 6: Educational assessment. Teachers should be made more aware of the fallacies of testing, in particular standardised testing, in order to reduce the possibility that children with EAL are unfairly assessed. It is advisable that teachers are therefore wary of adopting standardised assessment techniques with children who have EAL. However, some forms of summative assessment may be necessary to ascertain L2 language proficiency, such as the 'Primary School Assessment Kit' (Integrate Ireland Language and Training, 2007). This will aid in the monitoring of the child's Response to Intervention, an assessment method which will be discussed in more detail in section 5.2.3.4. Teachers should also consider adopting formative assessment techniques. For example, it may be fruitful to engage in observations of children with EAL on the school yard or in a more social context to ascertain the BICS aspect of language development.

In light of the evidence which suggests that teachers themselves may hold some biases, Rhodes et al. (2005) devised a questionnaire for teachers to determine whether or not a child with EAL required further assessments from external agencies. This should reduce, to some degree, the potential of inappropriate school placement, or referrals and subsequent missed or misdiagnoses. Rhodes et al. (2005) also argued that teacher training may also result in more culturally responsive educational provision, where such training may reduce the disproportionality of children with EAL in special education.

5.2.2.3. Educational instruction. However, in light of the difficulties associated with teacher assessment, as well as the possibility that teachers misunderstand the fundamental tenets of EAL language development, onward referrals to external agencies may still occur. Subsequently, there is a possibility that these children may be then misdiagnosed as having a DLD, depending on the approach of the receiver of the referral (Ferlis & Xu, 2016). At the heart of the current paper is the sentiment that there is an overrepresentation of children with EAL in special education and evidence suggests that such instruction is not appropriate for children with EAL (Artiles & Ortiz, 2002; Keller-Allen, 2006; Sullivan, 2011). Rosamond et al. (2003) also argued that whether or not a child is receiving the appropriate EAL support provision can greatly influence whether a child is enabled to access the curriculum. Therefore, if a child receives inappropriate support, such as SEN support (i.e., additional support hours provided by a Special Education Teacher, DES, 2017), this may further hamper their efforts to develop the additional language. Adding to the possibility that children with EAL may receive SEN support is the revision of the Irish model of SEN (Circular 0013/2017) (DES, 2017),

where ‘language support teachers’ or ‘EAL teachers’ are now regarded as ‘Special Education Teachers’. Again, this may add to confusion around the type of instruction that a child with EAL should receive. Finally, and albeit anecdotal, the researcher observed that over 50% of the children in the language classes visited, comprised of children with EAL, which undoubtedly is above the relative average frequency of monolingual children with DLD. In fact, some language classes approached reported that 100% of the children in their classes had EAL. Again, language classes may not be the most appropriate setting for children who have EAL.

5.2.2.3.1. Recommendation 7: Educational placement and resources. It is recommended that ‘Special Education Teachers’ make a distinction between children with EAL, who require specialised, evidence-based language support and children who have an SEN. In fact, the term ‘Special Education Teacher’ may need to be reviewed (see section 5.2.4.3.). In order to measure a child with EAL’s responsiveness to intervention, it is essential that appropriate language support interventions are provided, rather than generalised special education or specialised language classes. It is notable, however, that sometimes, an SEN such as a DLD, may be hindering a child’s development of an additional language (Rosamond et al., 2003). As Paradis (2005) explained, there is a possibility that having EAL may mask underlying difficulties, which may be attributed to a DLD. In such cases, practitioners should follow the revised SEN Circular 0013/2017 (DES, 2017), whilst also being mindful that such children may still require EAL support (Rosamond et al., 2003). Schools should also be cautious when considering if a language class is the most appropriate setting for a child with EAL, where specialised language support may be more suitable.

5.2.3. Clinical implications. As well as educational implications, the research findings have implications for clinicians, namely how EPs and SLTs engage in assessments of children with EAL. The findings from the current research (i.e., that verbal working memory can distinguish between EAL and DLD) can, in fact, translate into clinical actions. However, as Flanagan, Ortiz and Alfonso (2013) noted, language-reduced tests should not be used as a ‘singular approach’ to testing children with EAL (p. 301). Therefore, recommendations for the assessment of children with DLD in an EAL population will be made, in light of a more holistic PSW/CHC approach. As well as cognitive and PSW approach to testing, a discussion will also ensue on the importance of monitoring children’s Response to Intervention. In line with Kohnert’s (2010)

terminologies, recommendations, therefore include between-child (i.e., cognitive assessments between monolingual and EAL children) and within-child assessments (i.e., Response to Intervention and background information). A cautionary framework or synopsis, expressed in Figure 8, will then be proposed for the assessment of children with EAL. The aim of such is to potentially reduce the number of false positive diagnoses amongst children with EAL.

5.2.3.1. Patterns of strengths and weaknesses assessment. As has been explained previously, based on CHC theory and the PSW approach, XBA assessments may be suitable for the purpose of assessing children with EAL and DLD. From a practical level, this method permits clinicians to analyse strengths and weaknesses to ascertain if there are certain patterns that may indicate a difficulty. In order to interpret patterns, clinicians should reflect on the following (Flanagan et al., 2013):

1. Is the language difficulty evident across different sources of data?

2. Does the literature support the connection between the language difficulty and the cognitive difficulty?

3. Are there data (e.g., exclusionary clauses/bilingual factors) that would suggest that there may be another underlying cause of the language difficulty?

4. Is other information required before making a diagnosis?

5.2.3.1.1. Recommendation 8: Pattern of strengths and weaknesses assessment. Clinicians should consider the use of the XBA method (Flanagan et al., 2013) when assessing for a DLD in children with EAL. The recommendations below, as well as the flowchart in Figure 8, may offer more guidance on how to comply with this approach. The flowchart does not strictly adhere to the XBA principles, as it is advised that clinicians should be hesitant in adopting the method in the absence of specific supporting evidence.

5.2.3.1.2. Recommendation 9: Assessment-informed intervention. Although a discussion on specific interventions for children with DLD goes beyond the scope of the current research, the use of a PSW approach may have some implications for intervention. According to Leonard et al. (2007), the difficulties experienced by children with DLD typically exist in nonlinguistic or cognitive domains, as can be assessed using an XBA method. Depending on the results of the assessments, interventions could therefore be

informed by more general or broad-based approaches, resulting in an increase in the child's overall development. Leonard et al. (2007) also argued that children with DLD typically have difficulties with language and thus language interventions may also be beneficial. Finally, Montgomery et al. (2010) suggested that interventions aimed at improving working memory may also aid in remediating language difficulties by enhancing the cognitive components that may underpin same.

5.2.3.2. Language assessment. The current research does not endeavour to engage in a thorough discussion on the language assessment of children with EAL, as this goes beyond the professional competencies of a Trainee EP. However, the research in the domain warrants some discussion. It is notable that Weismer and Evans (2002) have argued that cognitive assessment tools may offer more accurate results than standardised measures of DLD. For example, Rosamond et al. (2003) argued that standardised assessment tools, in general, may not be based on EAL norms. Interestingly, they argued that even the prominent British Picture Vocabulary Scale (Dunn, Dunn, Styles & Sewell, 2009), which includes a measure for children with EAL, should be interpreted with caution. Specifically, such a scale makes an assumption that within-group variability does not occur amongst children with EAL. As is outlined in the section 5.2.3.5, clinicians should be wary of assuming that all children with EAL are a homogeneous group, when there are many factors that may impact on language and cognitive development.

5.2.3.2.1. Recommendation 10: Language assessment. Clinicians should adopt standardised language assessments for children with EAL with caution (Rosamond et al., 2003). Such assessments should be used in collaboration with more unbiased assessments, such as the cognitive assessment approach highlighted in 'Recommendation 8' (section 5.2.3.1.1.). Clinicians should also be cautious when adopting EAL-specific assessments and should be mindful of within-group variability. It is also necessary to consider the bias of assessment tools in the context of the CHC Culture-Language Interpretive Matrix (C-LIM) and assessment tools may be chosen accordingly (Flanagan et al., 2013). Essentially, the CHC C-LIM ascertains the validity of scores obtained from testing in light of the cultural and language biases potentially inherent in the tool. Tools can then be rated as having 'low', 'moderate' or 'high' cultural and language loadings, where those rated as 'low' are more appropriate for use with children with EAL (Flanagan et al., 2013). Indeed, psycho-educational assessment tools, in general, even if considered to be 'language-reduced' should be evaluated using the CHC C-LIM.

5.2.3.3. Use of translators. Adding to the issue of testing a diverse group of children with EAL, is the evidence which suggests that the use of translators may also not be considered best practice. The use of translators or translation services are often considered an alternative to English-based standardised assessments and are sometimes regarded as unbiased methods of assessment. However, variability in terms of dialects of various languages may impact on the impartiality of translators (Rosamond et al., 2003). In fact, even when the translator and child come from the same area, the vocabulary used by the translator may differ as a result of different language backgrounds or home learning environments. Furthermore, given the diversity of languages spoken by children with EAL in Ireland (CSO, 2017), the enduring difficulties associated with recruiting translators remain. Rosamond et al. (2003) argued that services may subsequently seek out any individual who can speak a certain language regardless of whether or not these individuals have specific training and knowledge of the education systems in Ireland.

5.2.3.3.1. Recommendation 11: Translators. Whilst Rosamond et al. (2003) stated that translators may be effective, in line with their recommendations, it is advised that services conduct thorough background checks on the translator to ensure that they are suitably qualified. Where possible, the background of the translator should align to that of the child being assessed. If suitable translators are not available, services may seek alternative methods for assessment, such as the use of nonlinguistic assessment tools. Services should also be mindful that translating tests may not always be possible for children from microlinguistic backgrounds. For example, many languages do not have a written form and different dialects can exist of the same language (Rosamond et al., 2003).

5.2.3.4. Response to intervention. As a result of these difficulties, clinicians have sought to uncover alternative approaches to assessing children with EAL. One such approach includes the 'Response to Intervention' method. Interestingly, Phipps and Beaujean (2016) advocated the use of a Response to Intervention in conjunction with a PSW approach. In fact, Phipps and Beaujean (2016) argued that combining Response to Intervention and PSW approaches may lead to a more comprehensive assessment process. Although the evidence for children with EAL in this regard is lacking, proponents of the Response to Intervention model argued that it can be effective in SLD diagnosis, for example (Bradley, Danielson & Hallahan, 2002). With regards to SLD identification, Vaughn and Fuchs (2003) argued that the model may reduce bias in identification. In fact,

historically, Grigorenko (2009) suggested that the concept of Response to Intervention was initially developed to directly address the issues with the overidentification of special needs amongst children from ethnic minorities. In order for the Response to Intervention approach to be applied correctly, evidence-based interventions, with carefully constructed monitoring procedures would be required (Grigorenko, 2009). It is notable, however, that Grigorenko (2009) argued that Response to Intervention should be 'viewed as one possible, but not the only' in the quest for 'the balance between the overidentification of those children who are not, in fact, eligible for special educational services and the underidentification of those children who do indeed need such services' (p. 117). Unfortunately, it appears that clinicians are typically undertrained in the implementation of Response to Intervention (Grigorenko, 2009).

5.2.3.4.1. Recommendation 12: Response to intervention and tiered approach. It is recommended that clinicians aid in the implementation, or promote, the use of a Response to Intervention approach, being mindful that a child with EAL may require up to nine years to become fluent in another language (Cummins, 2008). In line, clinicians may support schools in implementing and monitoring evidence-based interventions (Ehren, 2007). This may be of particular relevance to SLTs, who may in the future be assigned to Irish schools, and who may wish to aid in the implementation of tiered approaches to intervention, in line with international best practice (see McCartney, 2018).

5.2.3.5. Background assessment/exclusionary factors. Nonetheless, children's Response to Intervention may also be impeded by issues such as having a lower SES and other background factors, for example (Grigorenko, 2009). As a result, Grigorenko (2009) argued that Response to Intervention should also be used alongside cognitive testing and other background information. This is in line with the XBA method (Flanagan et al., 2013). Therefore, the use of parental questionnaires, such as the LSBQ, may be very useful for gathering important information on aspects such as language exposure, parental education and SES, which all may result in variations in how children learn language (Chiat and Polišenská, 2016; Kohnert, 2010). As has been discussed previously, Kohnert (2010) eloquently argued that certain 'bilingual factors' can impact on language acquisition, such as the 'age and context of acquisition along with the social value and related opportunities to develop each language affect absolute as well as relative levels of proficiency in each of the bilingual child's languages' (p. 461). Indeed, for all children, the home learning environment can greatly impact on academic outcomes (Melhuish,

Phan, Sylva, Sammons, Siraj-Blatchford & Taggart, 2008). As well as sociodemographic considerations, in light of the findings that a DLD may be underpinned by a cognitive difficulty (i.e., in verbal working memory), it is plausible that DLD has a genetic component (Montgomery et al., 2010). Ultimately, clinicians should be aware that various 'bilingual' and other factors result in variability in the language presentation of children with EAL.

5.2.3.5.1. Recommendation 13: Background assessment. It is advisable that clinicians gather considerable data on the 'bilingual factors' including age, context of acquisition, social value attributed to language or dialect, genetics, language proficiency in all languages, parental education etc. The parental questionnaire presented in appendix G may form the basis for many of these questions.

5.2.3.6. Synopsis of clinical assessment. Overall, due to the flaws associated with each approach, clinicians should ensure the triangulation of data, namely data obtained through cognitive and language assessments, parental questionnaires and Response to Intervention. The use of translators and standardised assessment tools should also be adopted with caution and the latter should be considered in the context of the CHC C-LIM (Flanagan et al., 2013). The flowchart presented below in Figure 8 aims to encapsulate all of these approaches. Please note, the flowchart does not serve to be prescriptive, but rather a potential guide for EPs and SLTs, when determining if a child with EAL has a DLD of not. All procedures are evidence-informed and based on the XBA Method.

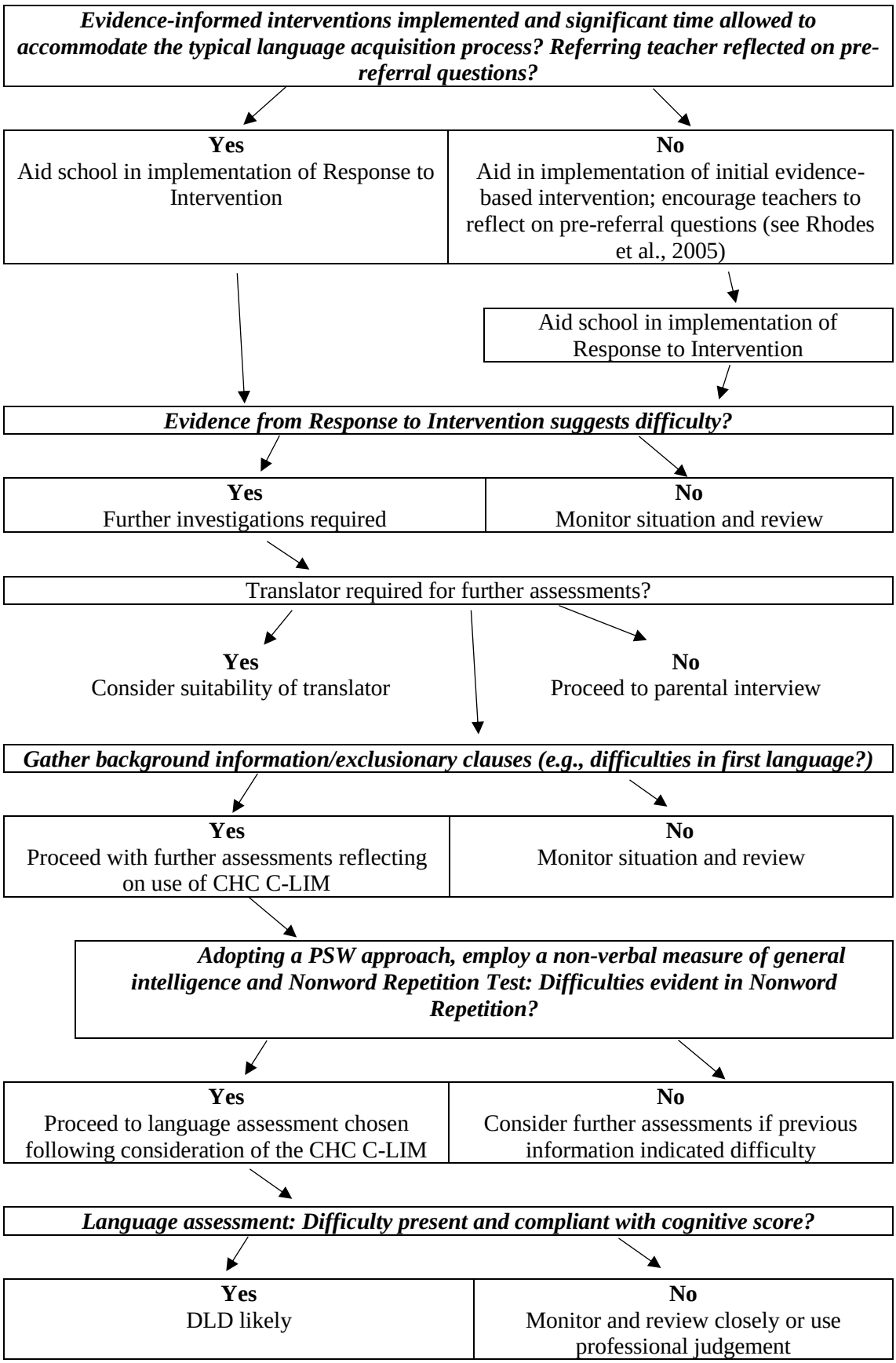

Figure 8. Flowchart which may facilitate in the decision-making process whether language difficulties are due to 'differences' or a 'disorder'.

5.2.4. Policy and economic implications. Of course, it may not be possible for teachers or clinicians to comply with the aforementioned recommendations in the absence of supporting policies. This section provides an overview of policies in an Irish and international context. From an economic perspective, it is important to appreciate the financial value of having an increasingly diversifying population. In particular, the new model of SEN (Circular 0013/2017) (DES, 2017) has direct implications for educational provision for children with EAL in Ireland, whilst the topic of Irish exemptions will also be explored.

5.2.4.1. Economic benefits. Firstly, it is important to note, that asides from a clear ethical duty, governance agendas are often influenced by potential future economic gains. In fact, evidence suggests that, depending on the societal value placed on having a second language, bilingualism can result in more economic growth for a particular society than individuals who are monolingual (Ruiz de Zarobe, Sierra & Gallardo del Puerto, 2011). For example, having more than one language can result in increased globalisation/international trade, albeit this is dependent on the value placed on the particular language (Ruiz de Zarobe et al., 2011). As a result of the potential economic advantages of having a diverse population, Ruiz de Zarobe et al. (2011) argued that areas that had a high proportion of Spanish-speakers (e.g., Miami, Florida) invested heavily in bilingual education, presumably to ensure proficiency in two languages rather than risk potential language attrition. Kim (2013) has also argued that there is a strong correlation between having more than one language and economic growth in English-dominant countries such as Canada. On the other hand, if a society does not place value on learning more than one language, then they may be unable to compete with economies who have dual-language citizens (Ruiz de Zarobe et al., 2011).

5.2.4.1.1. Recommendation 14: Economic benefits. It is advisable that policymakers conduct a cost-benefit analysis to assess current policies as they pertain to EAL service provision. In turn, this may incentivise further investment in EAL education and service provision.

5.2.4.2. General policy implications. As has been previously discussed, there are a number of strengths and shortcomings associated with Irish policies (e.g., see OECD report, Taguma et al., 2009) as they pertain to children with EAL. Ultimately, it appears that Ireland is overdue a comprehensive policy focussing on the educational provision for children with EAL. In particular, guidelines on the assessment of children with EAL is

somewhat inundated with rhetoric, without robust guidelines to implement same. As a result, schools in Ireland are under no legal obligation to measure the language proficiency of children with EAL, despite research indicating the importance of categorising and assessing children with EAL (Hutchinson, 2018). Furthermore, policies on EAL provision and requirements for specialist training also appears to be lacking (Murtagh & Francis, 2012), similar to that of the United Kingdom (Hutchinson, 2018).

5.2.4.2.1. Recommendation 15: Irish policy. Hutchinson (2018) contended that EAL policy in the United Kingdom should follow that of other English-speaking jurisdictions such as Australia and the US. As the US and Australia have longstanding experiences of catering for the needs of children with EAL, it is recommended that Irish EAL policies also follow such procedures. Specifically, Irish policies on EAL should mandate the testing of all children with EAL using language proficiency toolkits, so that a child's language proficiency can be measured using the Council of Europe's Common European Framework of Reference for Languages. In line, children with EAL's Response to Intervention can be measured. This may also indicate if a child will require more than two years of additional language instruction, which is likely, in line with Cummins' (2008) theory. Assessments may also facilitate the categorisation of children with EAL, which may lead to more tailored interventions. Hutchinson's (2018) proposed key terms for categorisations, namely, 'New to English, Early Acquisition, Developing Competence, Competent, or Fluent'. Such categorisations could be streamlined, to some degree, with the language milestones or 'Oral Language Progression Continua' of the new Primary Language Curriculum in Ireland (DES, 2015).

5.2.4.3. Irish policy: new model of SEN. Perhaps the most influential policy advancement, in terms of children with EAL, is the emergence of Circular 0013/2017 (DES, 2017). As has been discussed, under the revised allocation of support model, the deployment of additional support is now at the discretion of Irish schools. Schools have been advised to consider the results of school standardised tests to determine those who require such support (DES, 2017). Again, children with EAL's scores on standardised tests may underestimate their actual abilities (Resendiz & Peña, 2015). Therefore, children with EAL may be wrongly attributed as having a literacy or numeracy difficulty, when, in fact, they may just require language support. Adding to the shortcomings of the new model (Circular 0013/2017) is that additional support for children with EAL is now referred to as 'Special Education' and is provided by 'Special Education Teachers'. Previously, teachers who provided support to children with EAL were known as

'Language Support Teachers' (DES, 2005a). Referring to such teachers as Special Education Teachers may pose the risk that children with EAL are considered as having an SEN, such as DLD, or that they may receive additional support alongside children who have an identified or diagnosed SEN. Again, research strongly indicates that special education is ineffective in improving language acquisition in children with EAL (Artiles & Ortiz, 2002; Keller-Allen, 2006; Sullivan, 2011). As a result, children with EAL may appear to be irresponsive to interventions in school, when in reality, they are just receiving ineffective support. It is also worrying that children with EAL are not guaranteed additional support under Circular 0013/2017 (DES, 2017). Overall, the new model of SEN may actually be placing children with EAL at further risk of being misidentified as having an SEN, such as DLD, or indeed an SEN may be missed if children receive no support at all.

5.2.4.3.1. Recommendation 16: new model of SEN. It is recommended that the DES Circular 0013/2017 (DES, 2017) is revised in order to cater for the needs of children with EAL. With this in mind, it is advised that additional support or SEN support is provided by 'Language Support Teachers' as opposed to 'Special Education Teachers' in line with the now defunct SEN policy (02/05). Such teachers should be provided with appropriate continued professional development training, informed by evidence-driven interventions for improving the language acquisition process. Finally, Circular 0013/2017 (DES, 2017) should remind teachers that standardised testing may not be the best indicator of the needs of children with EAL. In fact, all children who have EAL, whose scores and profiles indicate that they are 'New to English' or they are at the 'Early Acquisition' or 'Developing Competence' stages, should be provided with Language Support directed at that level. SEN support should not serve to replace this language support, but that is not to say that both types of support cannot co-exist in cases where children with EAL also have a co-occurring SEN.

5.2.4.4. Reflection on recent paper on Irish exemptions. Another recent policy development has emerged in 2018. Specifically, a research paper was published by the DES (2018) which sought to review the existing Irish Exemption Policy (DES, 1996). With regards to children with EAL, Irish Exemptions are automatically granted to students who receive EAL support or children who have spent a considerable period of time not living in Ireland. However, the new research paper (DES, 2018) has reported that school principals expressed the need for a revision of the Irish Exemption policy. One argument made by school principals in support of a new policy pertained to children

whose parents speak English as a second language. Specifically, it was suggested that children whose parents do not speak English should also be offered exemptions from Irish. This may serve to further isolate children with EAL from partaking in school activities that they should otherwise be able to engage in. In fact, some of these children may technically not have EAL, and as the current research suggested, children with EAL may have cognitive advantages that may indeed improve their abilities to acquire more languages. Although the research paper (DES, 2018) recognised these cognitive advantages in terms of very young children with EAL, the findings with regards to school principals' sentiments are worrying. Nonetheless, the policymakers' (DES, 2018) recognition of potential exclusion of children with EAL suggests some progress.

5.3. Limitations of Research and Pathways for Future Research

As has been highlighted throughout the research paper, the current research has a number of strengths, whereby all methods and measures adopted have been carefully selected in light of the literature. However, like all research, the methodologies and measures are accompanied by some caveats. The limitations inherent in the current research may include issues around the validity and reliability of tools, as well as limitations associated with sample size. These are issues which were also uncovered in the literature evaluated in the systematic review. Finally, some shortcomings associated with the statistical and methodological techniques will also be referred to. As well as the aforementioned recommendations (i.e., recommendations 1, 2, 3), further directions for future research will be borne out of this discussion.

5.3.1. Shortcomings of tools. The main limitation of the current research is that although tests of sensitivity and specificity were conducted on assessment tools, robust tests of reliability and validity were not completed due to the limited time available to conduct research. For example, tests of reliability such as test retest reliability, which establishes the coefficient of stability over time (Dunsmuir et al., 2015), and tests of internal validity would have been desirable. Future researchers should consider adopting more robust methods for determining the reliability and validity of tools for assessing children with EAL for a potential DLD. In terms of validity, it is also possible that the assessment tools did not measure verbal working memory and processing speed specifically. For example, it is possible that children with DLD had difficulties sustaining attention, which may have resulted in a decrease in their ability to recall nonwords, as their complexity increased, for example (Im-Bolter et al., 2006). After all, Jonides et al.

(2005) argued that the neurological components of attention were similar to those required for refreshing internal representations in working memory. Foy and Mann (2014) reviewed the literature pertaining to bilingualism and attentional control in an attempt to explain why children with EAL may have cognitive advantages in comparison to their monolingual peers. It appeared that children with EAL are required to frequently inhibit responses (i.e., inhibit a certain language) and 'rapidly select and control attentional resources' (Foy & Mann, 2014, p. 718), meaning that children with EAL may have had an attentional advantage rather than a verbal working memory advantage over children with DLD.

In particular, as has previously been argued, the processing speed measure may have been overly simplistic and subsequently, it may not have detected true differences between the EAL, DLD and monolingual groups (Zhang, 2018). Equally, as has been discussed in terms of an 'EAL advantage', if nonwords became more complex, then a cognitive advantage may have been more evident. As a result, future research should carefully consider which assessment tools are robust and sensitive enough to measure true differences between groups.

The use of a nonword repetition task may have had other limitations. Although children with EAL's performance was on par with the monolingual group, Kohnert (2010) expressed some concerns around the use of such as task with children with EAL. It was argued that although nonwords do not possess any real meaning, they are phonotactically derived from English, which may result in a degree of bias against children whose first language differs from English (Kohnert, 2010). As well as this potential issue, the researcher also phonetically transcribed participants' responses on the NRT, where future researchers should be more inclined to record participants' responses using a recording device. Nonetheless, the researchers' transcriptions appeared to be accurate given that participants' responses were in line with previous research (i.e., Dollaghan & Campbell, 1998).

5.3.2. Methodological and statistical techniques. According to Reinharz (1983), 'methods and methodology are not simply techniques and rationales for the conduct of research. Rather they must be understood in relation to specific historical, cultural, ideological and other contexts.' Although methodological considerations were afforded to most of these contextual aspects, some of the historical and cultural aspects may not have been wholly considered. For example, in terms of statistical techniques, it

is possible that the analyses did not take into account the full variability of children with EAL. Therefore, statistical techniques may not have been utilised to full effect, nor did they acknowledge the variability or within-group differences that may have occurred in the group with EAL. Evidence suggests that those from lower SES or minority ethnolinguistic backgrounds (i.e., where the L1 is not considered a 'high status' language) may have had different language presentations or cognitive profiles to other children with EAL (Han, Brebner & McAllister, 2016). As the parents who consented to the study did not require translators, it may be inferred that these parents also have had higher levels of English. Therefore, it is also likely that differences existed between children depending on the language proficiency and education levels of their parents. However, none of these factors were accounted for in analyses due to the LSBQ being unstandardised for children. Future research should endeavour to develop inventive methods for analysing within-group differences, with due respect for the variability in languages, dialects and backgrounds that may exist.

Statistical analyses focussing on within-group differences was not possible due to another limitation associated with the current research, namely, the limited sample size. A criticism of the studies analysed for the systematic review, Button et al. (2013) argued that small sample sizes can undermine the reliability of studies. Smaller sample sizes, in general, are evident when working with children who have a DLD (e.g., Mainela-Arnold & Evans, 2005; Marton & Schwartz, 2003; Montgomery, 2000). Nonetheless, efforts were made to recruit more participants so that there would be 20 participants per group, in line with the power analysis. However, it became increasingly difficult to recruit participants for the DLD group, as is often the case with clinical subgroups. The researcher's efforts were also hampered by the limited timescale for collecting data. Despite these recruitment challenges, future researchers should not be disheartened and should endeavour to meet the expectations set out by their initial power analysis.

Despite the many justifications cited for the use of the transformation techniques (i.e., log transformation and arcsine transformation), there are also critics of the approach. Wilson et al. (2013) argued that the arcsine transformation may have become a somewhat archaic approach. Where once a coveted approach in the 1970s, they stated that arcsine transformations can alter the significance value of findings (Wilson et al., 2013). The researcher therefore deliberated over the use of an arcsine transformation but found convincing and longstanding evidence in support of the method (Sokal & Rohlf, 1981).

Similar scepticism exists around the use of log transformations, with Lo and Andrews (2015) arguing that linear mixed-effect modelling may be more appropriate. Future statisticians may therefore wish to ascertain the most appropriate methods for normalising Reaction Time data, whilst also being mindful that the use on log transformations have much empirical support.

5.4. Discussion Summary

Overall, despite these limitations, the researcher ensured that all methodologies, measures and statistical methods were supported by empirically-sound literature. However, future research may consider these flaws as opportunities to replicate similar studies on a larger and more sophisticated scale than the current study, whilst also considering the specific research recommendations made earlier in the Chapter. As well as discussing pathways for future research, the Discussion Chapter extensively reviewed the findings of the research in relation to the pre-existing literature. These findings then subsequently added to the existing literature, in an attempt to develop theory, practice and Irish policy, as they pertain to children with EAL and children with DLD. A total of sixteen specific recommendations, derived from research findings and preceding discussions, were made in order to target policymakers, researchers, teachers and clinicians alike. A visual representation of a potential PSW-inspired assessment method for clinician's was also included in an attempt to encapsulate various recommendations made at a practice level.

6.0. CHAPTER SIX
CONCLUSION

In the closing chapter, a shortened narrative based on the initial rationale for the current study will be highlighted, followed by a summary of how each research question was addressed, with reference to relevant findings. The recommendations arising from these findings will then be summarised for ease of reference, which will subsequently culminate in a discussion on how the research findings will be disseminated. Concluding, yet cautionary, remarks will subsequently be made regarding the assessment of children with EAL.

6.1. Summary of Rationale and Literature Review

The rationale for the current research was based on the premise that there are currently difficulties in detecting the presence or absence of DLD in an EAL population (Artiles & Ortiz, 2002). As a result, increasing numbers of children with EAL are being misdiagnosed with a language disorder (Paradis, 2005). The difficulties in assessing children with EAL are multifaceted. Firstly, in a broader sense, children with DLD often present with similar language profiles to children with DLD (Weismer & Kaushanskaya, 2010). In fact, the language profiles of both groups are remarkable, resulting in a potential over-identification of DLD amongst children with EAL (Crago & Paradis, 2003; Windsor & Kohnert, 2004). Raul and Ahyea (2017) stated that, as a result, there are difficulties in disentangling a difficulty associated with learning a new language from having an actual language disorder. O'Toole and Hickey (2012) also argued that there was a lack of appropriate assessment tools and professionals did not wholly understand theories related to the language acquisition process, leading to further misdiagnoses. Adding to these difficulties are the findings that children with EAL have diverse language backgrounds (ESRI, 2009), rendering it more difficult to assess children in their first language, which is considered 'best practice' (Boerma & Blom, 2017).

Indeed, as is clear from the figures presented in Chapter One, the population of Ireland is rapidly diversifying (CSO, 2017). As a result, the consequences of inappropriate assessment tools may be far-reaching. Such ill-consequences may include children with EAL receiving inappropriate school instruction either through designated language units or from a Special Education Teacher. Evidence suggests that such educational interventions may not be helpful for children with EAL (Sullivan, 2011).

Holtzman (1982) argued that at the heart of such is that 'opportunities for academic success may be restricted… where a child's educational progress may falter due to lowered or inappropriate expectations and goals' (p. 11). Conversely, inappropriate assessment tools and a lack of understanding of theories related to language development may also lead to cases of 'missed identities', where a child's EAL status may mask an underlying difficulty (Paradis, 2005).

A systematic review of the literature was subsequently conducted to ascertain if there were any appropriate assessment tools which could distinguish between language disorder and language difference. It emerged that a solution to the difficulties in assessing children with EAL for a DLD may be to adopt language-reduced assessment tools, which may result in fairer assessment methods. A thorough review of the literature revealed that children with DLD often have reduced cognitive functioning in terms of verbal working memory and processing speed, whilst children with EAL should not experience such cognitive difficulties (Laloi et al., 2017; Marton & Schwartz, 2003; Montgomery et al., 2010; Sandgren & Holmström, 2015). As a result, non-verbal assessment tools, which measure these cognitive markers, may be appropriate for such purposes as to distinguish EAL from DLD (Laloi et al., 2017). Theoretically speaking, there are several theories which underpinned the assumption that verbal working memory and processing speed could and should be used to distinguish between EAL and DLD. For example, theoretical perspectives such as those of Carroll's (1993) CHC theory, Cummins' (2008) BICS and CALP theory, as well as limited processing capacity theories of language development (e.g., Kail, 1994; Montgomery, 2000) and working memory models (Baddeley, 1986), were discussed in light of the assessment of children with EAL for a potential DLD.

6.2. Review of Research Questions and Related Findings

As a result of the strong theoretical underpinnings and rationale for the current research, the aim of the research was to ascertain if tests of verbal working memory and processing speed could distinguish between children with EAL and children who had a DLD. The following research questions were subsequently formulated:

- Can assessments of verbal working memory and speed of processing aid in differentiating between children who have EAL and children who have DLD?
- Will children with DLD perform significantly lower on assessments of processing speed and verbal working memory than children with EAL and monolingual children?

- Will children with EAL and monolingual children have similar processing speed and verbal working memory scores?
- Can processing speed and verbal working memory scores detect the presence or absence of a DLD?

To address these research questions, following an initial pilot study (n = 5), participants included children aged between seven and nine years old who were assigned to either the monolingual (n = 15), EAL (n = 15) or DLD (n = 12) groups. Following initial screening and completion of parental questionnaires, participants completed a literacy assessment (i.e., pseudoword decoding) and a nonverbal intelligence test (i.e., WASI-II). They subsequently completed Visual Search (i.e., processing speed) and Nonword Repetition (i.e., verbal working memory) tasks. In keeping with the post-positivist philosophical stance of the current research, data were prepared for data analysis using log and arcsine transformation techniques. Using a series of one-way ANOVAs and tests of sensitivity and specificity, it appeared that assessments of verbal working memory using non-words may discriminate between children who have EAL and children who have DLD, whereas tests of processing speed did not hold such promise. The findings were discussed in the context of empirical literature, whilst limitations of the statistical and methodological were also acknowledged, paving the way for future research.

6.3. Summary of Recommendations

The findings from the current research and related literature reviews resulted in the generation of sixteen recommendations for research, policy and practice. A summary of the recommendations can be found in Table 14, with a more in-depth rationale for recommendations provided in the previous chapter (section 5.2.).

Table 14.

Recommendations for policy, practice and research

1. It is recommended that further research is conducted to ascertain if processing speed, is indeed, as powerful of an indicator of DLD than was original perceived.
2. More research is required to investigate if children with EAL have an advantage in terms of cognitive performance in comparison to typically developing monolingual children.
3. More research may be required to investigate if an XBA method is appropriate for assessing children with EAL for a possible DLD.
4. Researchers should continue to explore alternative methods for assessing children with EAL for a DLD.
5. Teachers should receive training on appropriate intervention and assessment strategies, as well as training on EAL language development.
6. Teachers should be made more aware of the fallacies of testing, in particular standardised testing, in order to reduce the possibility that children with EAL are unfairly assessed.
7. It is recommended that 'Special Education Teachers' make a distinction between children with EAL, who require specialised, evidence-based language support and children who have an SEN.
8. Interventions for children with DLD may include broad-based approaches, as well as specific interventions aimed at improving working memory.
9. Clinicians should adopt standardised language assessments for children with EAL with caution. Such assessments should be used in collaboration with more unbiased assessments and should be evaluated using the CHC C-LIM.
10. It is advised that services conduct thorough background checks on translators to ensure that they are suitably qualified. Services should also be mindful that translating tests may not always be possible for children from microlinguistic backgrounds.
11. Clinicians should aid in the implementation, or promote, the use of a Response to Intervention approach in schools. This may hold particularly relevance to SLTs, who may in the future be assigned to Irish schools.
12. It is advisable that clinicians gather considerable data on 'bilingual factors' including age, context of acquisition, social value attributed to language or dialect, genetics, language proficiency in all languages spoken, parental education etc.
13. It is advisable that policymakers conduct a cost-benefit analysis to assess current policies as they pertain to EAL service provision. In turn, this may incentivise further investment in EAL education and service provision.
14. Irish policies on EAL should mandate the testing of all children with EAL using language proficiency toolkits, thus facilitating appropriate categorisation.
15. It is recommended that the DES Circular 0013/2017 (DES, 2017) is revised in order to cater for the needs of children with EAL. It is advised that additional support or SEN support is provided by 'Language Support Teachers' as opposed to 'Special Education Teachers' in line with the now defunct SEN policy (02/05).

16. Clinicians could implement an XBA method (i.e., type of PSW method) when assessing for DLD in children with EAL. This should be implemented cautiously whilst awaiting further empirical support.

However, it is notable that the above recommendations and the findings of the current research are irrelevant if practitioners, researchers and policymakers are unaware that they exist. Therefore, dissemination of the recommendations remains the pivotal aim of the current research.

6.4. Dissemination of Research

In line with the PSI (2010) Code of Ethics, research activities should provide more benefit than risk to those involved. How can benefits be accrued for the population with whom the research was carried out, if research is not disseminated? Dissemination of research should thus be considered an ethical and professional duty. The assessments completed by participants undoubtedly resulted in some element of stress or anxiety on the part of the child, in particular for those children who may be considered vulnerable (i.e., DLD group). As a result, the efforts made by such children should be acknowledged and reflected through the dissemination of research, which may eventually result in increased benefit for these populations. Therefore, any research completed in university or commercial settings should be accompanied by increased accountability on the part of the researcher, regardless of whether or not the research yielded promising or disappointing results. In relation to pharmacological and medical research, Edwards (2015) argued that 'it should be emphasised that researchers have an ethical obligation to at least attempt to disseminate their research findings' (p. 465). The same level of accountability should be considered in the educational psychology domain.

As a result, conscious efforts will be made to disseminate research findings through multiple platforms. The theoretical underpinnings of dissemination are rooted in McGuire's (2001) framework, where there is a focus on five different components of dissemination; the source, channel, message, audience, and setting of dissemination. Therefore, the central thesis that verbal working memory may distinguish between children with DLD and EAL, can be communicated both orally and in written format, in research journals and at professional conferences. The audience will therefore initially include those from academic backgrounds, as well as practitioners. Please see appendix M for empirical paper, which will be submitted to the 'International Journal of Bilingual Education and Bilingualism' journal, whilst a number of other journals have been

earmarked. An article written specifically for teachers may also be included in the 'Irish Teacher's Journal', a journal which is typically sent to every primary school in Ireland. 'Knowledge translation' will therefore occur promptly (i.e., through presentation) and in detail (i.e., through publication) (Edwards, 2015, p. 465) to ensure that research is translated into practice. Eventually, it is anticipated that any published materials are sent to policymakers or those who may have a direct influence on policy directives in an Irish context.

6.5. Concluding Remarks

The central message of the current research is that the language difficulties associated with having EAL should not be equated with the language difficulties associated with having a DLD. Unfortunately, as Artiles and Trent (1994) noted in the early nineties, 'disability and cultural difference' are too often 'implicitly equated' (p. 424). Nonetheless, clinicians should ensure that they are cautious when adopting costly assessment methods, which may, in fact, place children with EAL at a disadvantage – 'caveat emptor'. By uncritically adopting standardised assessment methods, they may unwittingly be placing a child with EAL at an immediate disadvantage, as a result of 'mistaken' or 'missed' identities (Paradis, 2005, p. 173). Although distinguishing between EAL and DLD is undoubtedly a complex task, due to the overlap of language profiles and the prominence of language-loaded assessment tools, there are cognitive differences between the two groups which can be exploited when assessing children with EAL for a DLD. The results, from the current research, indicate that verbal working memory, namely the NRT, may offer an unbiased method for assessing children with EAL. In closing, in a landmark court case in the US in 1954, 'Brown versus the Board of Education', it was remarked that 'in these days, it is doubtful that any child may reasonably be expected to succeed in life if he is denied the opportunity of an education. Such an opportunity… is a right which must be made available on equal terms to all' (as cited in Rhodes et al., 2005, p. 42). Although more robust research is required to support findings, the results presented here offer hope that language-reduced assessment tools used in the context of an XBA assessment approach, may serve to lessen equality gaps. However, it is firstly incumbent on policymakers, teachers and clinicians, in particular, to ensure that education is provided on equal terms to all children.

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Yang, E. (2017). Bilinguals' working memory (wm) advantage and their dual language practices. *Brain sciences, 7*(7), 86.

Yew, S. G. K., & O' Kearney, R. (2013). Emotional and behavioural outcomes later in childhood and adolescence for children with specific language impairments: meta-analyses of controlled prospective studies. *Journal of Child Psychology and Psychiatry, 54*(5), 516-524.

Ysseldyke, J. E. (2005). Assessment and decision making for students with learning disabilities. What if this is as good as it gets? *Learning Disability Quarterly, 28*, 125 – 128.

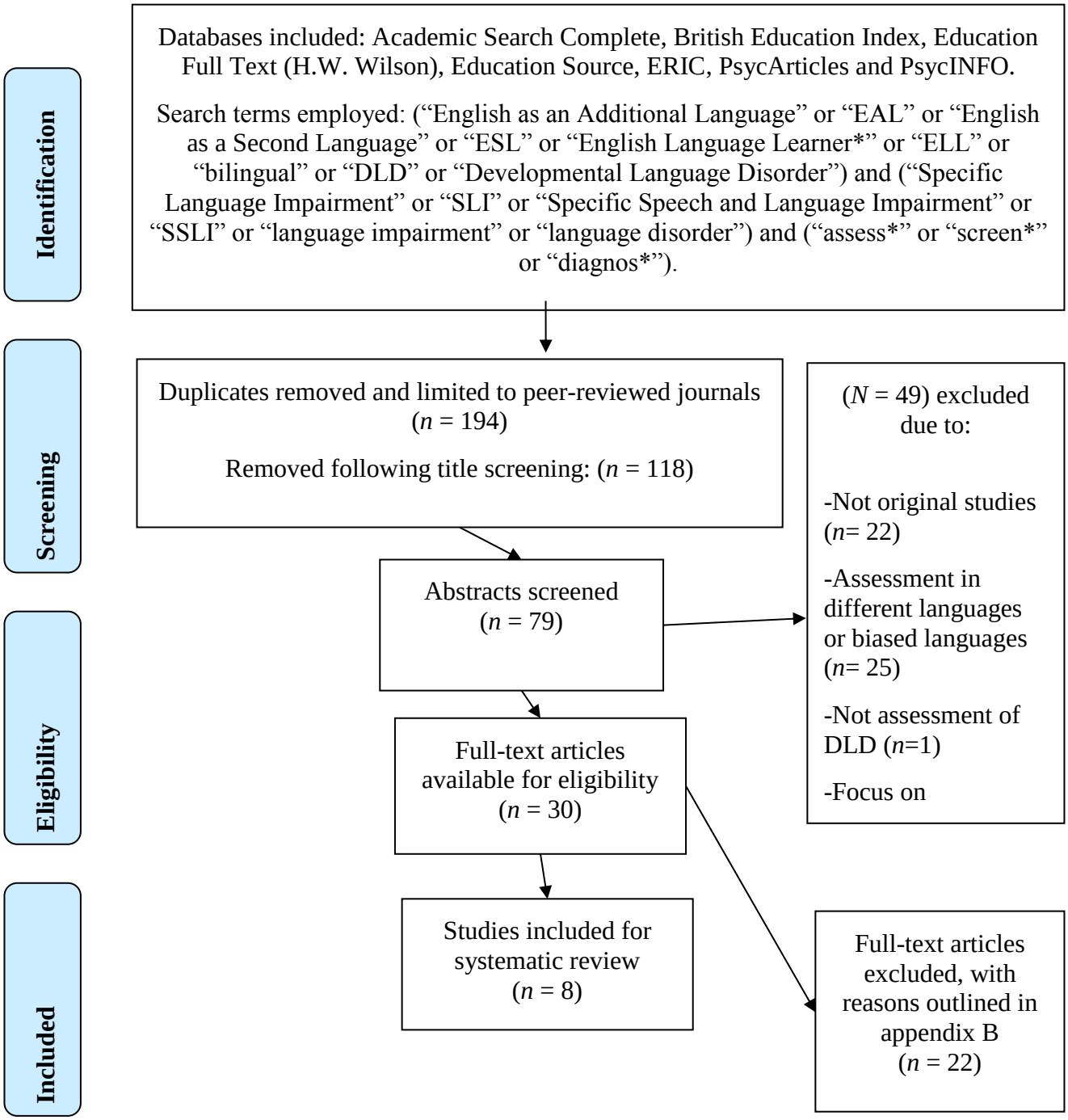
Zhang, M. (2018). An overview of the bilingual advantage: history, mechanisms, and consequences. *Western Undergraduate Psychology Journal, 6*(1), 1-9.

Ziethe, A., Eysholdt, U., & Doellinger, M. (2013). Sentence repetition and digit span: Potential markers of bilingual children with suspected SLI? *Logopedics Phoniatrics Vocology*, *38*(1),1-10.

Zurer-Pearson, B. (2010). We can no longer afford a monolingual norm. *Applied Psycholinguistics*, *31*(2), 339-343.

APPENDICES

Appendix A: PRISMA (2009) Flow Diagram Outlining Literature Search



Adapted from: Moher, D., Liberati, A., Tetzlaff, J., & Altman D.G., The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: *The PRISMA Statement. PLoS Med 6*(7): e1000097. doi:10.1371/journal.pmed1000097

Appendix B: Excluded Articles and Reasons for Exclusion

Excluded following full-text

Studies	Reasons for exclusion
Boerma, T., Chiat, S., Leseman, P., Timmermeister, M., Wijnen, F., & Blom, E. (2015). A quasi-universal nonword repetition task as a diagnostic tool for bilingual children learning Dutch as a second language. *Journal of Speech, Language, and Hearing Research*, *58*(6), 1747-1760.	Exclusion criteria 2 – assessment for Dutch speakers
Boerma, T., Leseman, P., Timmermeister, M., Wijnen, F., & Blom, E. (2016). Narrative abilities of monolingual and bilingual children with and without language impairment: Implications for clinical practice. *International Journal of Language & Communication Disorders*, *51*(6), 626-638.	Exclusion criteria 2 – assessment in more than one language
Cleave, P. L., Girolametto, L. E., Chen, X., & Johnson, C. J. (2010). Narrative abilities in monolingual and dual language learning children with specific language impairment. *Journal of Communication Disorders*, *43*(6), 511-522.	Exclusion criteria 5 – participants did not have English as an additional language, rather they had English as their dominant language
Engel de Abreu, P. M., Cruz-Santos, A., & Puglisi, M. L. (2014). Specific language impairment in language-minority children from low-income families. *International Journal of Language & Communication Disorders*, *49*(6), 736-747.	Exclusion criteria 2 – assessment in more than one language
Guiberson, M., Rodríguez, B. L., & Zajacova, A. (2015). Accuracy of telehealth-administered measures to screen language in Spanish-speaking preschoolers. *Telemedicine and E-health*, *21*(9), 714-720.	Exclusion criteria 2 – assessment in Spanish
Hasson, N., Camilleri, B., Jones, C., Smith, J., & Dodd, B. (2013). Discriminating disorder from difference using dynamic assessment with bilingual children. *Child Language Teaching and Therapy*, *29*(1), 57-75.	Exclusion criteria 3 – used primarily qualitative data

Jacobson, P., & Livert, D. (2010). English past tense use as a clinical marker in older bilingual children with language impairment. *Clinical Linguistics & Phonetics, 24*(2), 101-121.	Exclusion criteria 5 – only incorporated two groups of children with EAL and thus did not have a monolingual control group
Kapantzoglou, M., Fergadiotis, G., & Restrepo, M. A. (2017). Language sample analysis and elicitation technique effects in bilingual children with and without language impairment. *Journal of Speech, Language, and Hearing Research, 60*(10), 2852-2864.	Exclusion criteria 2 – assessment offered in Spanish
Kapantzoglou, M., Restrepo, M. A., & Thompson, M. S. (2012). Dynamic assessment of word learning skills: Identifying language impairment in bilingual children. *Language, Speech, and Hearing Services in Schools, 43*(1), 81-96.	Exclusion criteria 2 – assessment in more than one language
Kohnert, K., & Danahy, K. (2007). Young L2 learners' performance on a novel morpheme task. *Clinical Linguistics & Phonetics, 21*(7), 557-569.	Exclusion criteria 2 – assessment partly in Spanish
Kraemer, R., & Fabiano-Smith, L. (2017). Language assessment of Latino English learning children: A records abstraction study. *Journal of Latinos and Education, 16*(4), 349-358.	Exclusion criteria 3 – did not have original data
Naudé, E., Louw, B., & Weideman, A. (2007). First steps toward developing tools for language assessment in multilingual urban pre-schoolers. *Southern African Linguistics and Applied Language Studies, 25*(4), 519-538.	Exclusion criteria 3 – –although quantitative methods were employed, they were sparse in nature and thus would have been difficult to evaluate for the current systematic review
Ooi, C. C. W., & Wong, A. M. Y. (2012). Assessing bilingual Chinese–English young children in Malaysia using language sample measures. *International Journal of Speech-language Pathology, 14*(6), 499-508.	Exclusion criteria 2 – involved code-switching to Malay

Paradis, J., Emmerzael, K., & Duncan, T. S. (2010). Assessment of English language learners: Using parent report on first language development. *Journal of Communication Disorders*, *43*(6), 474-497.	Exclusion criteria 5 - did not directly compare children with EAL from children who were monolingual
Patterson, J. L., Rodríguez, B. L., & Dale, P. S. (2013). Response to dynamic language tasks among typically developing Latino preschool children with bilingual experience. *American Journal of Speech-Language Pathology*, *22*(1), 103-112.	Exclusion criteria 2 – assessment in more than one language
Peña, E. D., Gillam, R. B., Bedore, L. M., & Bohman, T. M. (2011). Risk for poor performance on a language screening measure for bilingual preschoolers and kindergarteners. *American Journal of Speech-Language Pathology*, *20*(4), 302-314.	Exclusion criteria 2 – assessment in more than one language
Petersen, D. B., Chanthongthip, H., Ukrainetz, T. A., Spencer, T. D., & Steeve, R. W. (2017). Dynamic assessment of narratives: efficient, accurate identification of language impairment in bilingual students. *Journal of Speech, Language, and Hearing Research, 60*(4), 983-998.	Exclusion criteria 2 – assessment in more than one language
Resendiz, M. & Peña, E. (2015). Dynamic assessment with English language learners. *Journal of the Texas Educational Diagnosticians' Association*, *44*(1), 15-17.	Exclusion criteria 3 – refers to a case study
Verhoeven, L., Steenge, J., van Weerdenburg, M., & van Balkom, H. (2011). Assessment of second language proficiency in bilingual children with specific language impairment: A clinical perspective. *Research in Developmental Disabilities*, *32*(5), 1798-1807.	Exclusion criteria 2 – assessment in more than one language
Westman, M., Korkman, M., Mickos, A., & Byring, R. (2008). Language profiles of monolingual and bilingual Finnish preschool children at risk for language impairment. *International Journal of Language & Communication Disorders, 43*(6), 699-711.	Exclusion criteria 2 – assessments all in L1 (i.e., Swedish) of child with EAL

Excluded following initial abstract screening

Studies	Reasons for exclusion
Ahadi, H., Nilipour, R., Rovshan, B., Ashayeri, H., & Jalaie, S. (2014). The perception and expression of verb morphology in bilinguals with specific language impairment. *Audiology, 23*(1), 62-69.	Exclusion criteria 2 – assessment contained more than one language
Anaya, J. B., Peña, E. D., & Bedore, L. M. (2018). Conceptual scoring and classification accuracy of vocabulary testing in bilingual children. *Language, Speech, and Hearing Services in Schools, 49*(1), 85-97.	Exclusion criteria 2 – assessment contained more than one language
Armon-Lotem, S., & Meir, N. (2016). Diagnostic accuracy of repetition tasks for the identification of specific language impairment (SLI) in bilingual children: evidence from Russian and Hebrew. *International Journal of Language & Communication Disorders, 51*(6), 715-731.	Exclusion criteria 2 – assessment contained more than one language
Bedore, L. M., & Pena, E. D. (2008). Assessment of bilingual children for identification of language impairment: Current findings and implications for practice. *International Journal of Bilingual Education and Bilingualism, 11*(1), 1-29.	Exclusion criteria 3 – did not have original data
Bedore, L. M., Peña, E. D., Anaya, J. B., Nieto, R., Lugo-Neris, M. J., & Baron, A. (2018). Understanding disorder within variation: Production of English grammatical forms by English language learners. *Language, Speech, and Hearing Services in Schools*, *49*(2), 277-291.	Exclusion criteria 2 – assessment in Spanish
Bedore, L. M., Pena, E. D., Gillam, R. B., & Ho, T. H. (2010). Language sample measures and language ability in Spanish-English bilingual kindergarteners. *Journal of Communication Disorders, 43*(6), 498-510.	Exclusion criteria 2 – assessment partly in Spanish

Chondrogianni, V., & John, N. (2018). Tense and plural formation in Welsh–English bilingual children with and without language impairment. *International Journal of Language & Communication Disorders*, *53*(3), 495-514.	Exclusion criteria 2 – assessment partly in Welsh.
Dollaghan, C. A., & Horner, E. A. (2011). Bilingual language assessment: A meta-analysis of diagnostic accuracy. *Journal of Speech, Language, and Hearing Research*, *54*(4), 1077-1088.	Exclusion criteria 3 – did not have original data
Dos Santos, C., & Ferré, S. (2018). A nonword repetition task to assess bilingual children's phonology. *Language Acquisition*, *25*(1), 58-71.	Exclusion criteria 2 – assessment partly in French
Ebert, K. D., & Kohnert, K. (2016). Language learning impairment in sequential bilingual children. *Language Teaching*, *49*(3), 301-338.	Exclusion criteria 3 – did not have original data
Ebert, K. D., & Pham, G. (2017). Synthesizing information from language samples and standardized tests in school-age bilingual assessment. *Language, Speech, and Hearing Services In Schools*, *48*(1), 42-55.	Exclusion criteria 2 – assessments in Spanish
Gathercole, V. C. M. (2010). Interface or face to face? The profiles and contours of bilinguals and specific language impairment. *Applied Psycholinguistics*, *31*(2), 282-293.	Exclusion criteria 3 – did not have original data
Gibson, T. A., Peña, E. D., & Bedore, L. M. (2014). The receptive–expressive gap in bilingual children with and without primary language impairment. *American Journal of Speech-Language Pathology*, *23*(4), 655-667.	Exclusion criteria 2 – assessment partly in Spanish
Gillam, R. B., Peña, E. D., Bedore, L. M., Bohman, T. M., & Mendez-Perez, A. (2013). Identification of specific language impairment in bilingual children: I. Assessment in English. *Journal of Speech, Language, and Hearing Research*, *56*(6), 1813-1823.	Exclusion criteria 2 – assessment partly in Spanish

Girbau, D., & Schwartz, R. G. (2008). Phonological working memory in Spanish–English bilingual children with and without specific language impairment. *Journal of Communication Disorders*, *41*(2), 124-145.	Exclusion criteria 2 – assessment partly in Spanish
Girolametto, L., & Cleave, P. L. (2010). Assessment and intervention of bilingual children with language impairment. *Journal of Communication Disorders*, *43*(6), 453.	Exclusion criteria 3 – did not have original data
Gutiérrez-Clellan, V., & Simon-Cereijido, G. (2009). Using language sampling in clinical assessments with bilingual children: Challenges and future directions. *Seminars in Speech and Language, 30*(4), 234- 245.	Exclusion criteria 3 – did not have original data
Gutiérrez-Clellen, V. F., & Simon-Cereijido, G. (2007). The discriminant accuracy of a grammatical measure with Latino English-speaking children. *Journal of Speech, Language, and Hearing Research*, *50*(4), 968-981.	Exclusion criteria 2 – assessment relevant to Spanish speaking children
Gutiérrez-Clellen, V. F., & Simon-Cereijido, G. (2010). Using nonword repetition tasks for the identification of language impairment in Spanish-English-speaking children: Does the language of assessment matter? *Learning Disabilities Research & Practice*, *25*(1), 48-58.	Exclusion criteria 2 – assessment in Spanish and English
Håkansson, G. (2010). Development or impairment? *Applied Psycholinguistics*, *31*(2), 293-297.	Exclusion criteria 3 – did not have original data
Han, W., Brebner, C., & McAllister, S. (2016). Redefining 'Chinese'L1 in SLP: Considerations for the assessment of Chinese bilingual/bidialectal language skills. *International Journal of Speech-Language Pathology*, *18*(2), 135-146.	Exclusion criteria 3 – did not have original data
Hemsley, G., Holm, A., & Dodd, B. (2014). Identifying language difference versus disorder in bilingual children. *Speech, Language and Hearing*, *17*(2), 101-115.	Exclusion criteria 3 – did not have original data

Hoff, E., & Core, C. (2018). Advances in the assessment of young bilinguals: comments on Floccia et al. *Monographs of the Society for Research in Child Development*, *83*(1), 109-123.	Exclusion criteria 3 – did not have original data
Holmström, K., Salameh, E. K., Nettelbladt, U., & Dahlgren Sandberg, A. (2016). A descriptive study of lexical organisation in bilingual children with language impairment: Developmental changes. *International Journal of Speech-Language Pathology*, *18*(2), 178-189.	Exclusion criteria 2 – assessment partly in Arabic
Holmström, K., Salameh, E. K., Nettelbladt, U., & Dahlgren-Sandberg, A. (2016). Conceptual scoring of lexical organization in bilingual children with language impairment. *Communication Disorders Quarterly*, *38*(1), 24-34.	Exclusion criteria 2 – language of assessment was Swedish and Arabic
Iglesias, A. (2015). Language impairment in bilingual children: From theory to practice. *Seminars in Speech and Language*,*36*(2), 87-88.	Exclusion criteria 3 – did not have original data
Iluz-Cohen, P., & Walters, J. (2012). Telling stories in two languages: Narratives of bilingual preschool children with typical and impaired language. *Bilingualism: Language and Cognition*, *15*(1), 58-74.	Exclusion criteria 2 – assessment partly in Hebrew
Jonak, J. (2015). Bilingual language development and language impairment in children. *Acta Neuropsychologica*, *13*(1), 63-79.	Exclusion criteria 3 – did not have original data
Kohnert, K., & Medina, A. (2009). Bilingual children and communication disorders: A 30-year research retrospective. *Seminars in Speech and Language*, *30*(4), 219-233.	Exclusion criteria 3 – did not have original data
Korkman, M., Stenroos, M., Mickos, A., Westman, M., Ekholm, P., & Byring, R. (2012). Does simultaneous bilingualism aggravate children's specific language problems? *Acta Paediatrica*, *101*(9), 946-952.	Exclusion criteria 2 – assessment in Swedish

Lee-James, R., & Washington, J. A. (2018). Language Skills of Bidialectal and Bilingual Children. *Topics in Language Disorders*, *38*(1), 5-26.	Exclusion criteria 5 – did not refer to a DLD or SLI
Lugo-Neris, M. J., Peña, E. D., Bedore, L. M., & Gillam, R. B. (2015). Utility of a language screening measure for predicting risk for language impairment in bilinguals. *American Journal of Speech-Language Pathology*, *24*(3), 426-437.	Exclusion criteria 2 – assessment in Spanish and English
Meir, N., Walters, J., & Armon-Lotem, S. (2016). Disentangling SLI and bilingualism using sentence repetition tasks: The impact of L1 and L2 properties. *International Journal of Bilingualism*, *20*(4), 421-452.	Exclusion criteria 2 – assessment in different language
O'Toole, C., & Hickey, T. M. (2013). Diagnosing language impairment in bilinguals: Professional experience and perception. *Child Language Teaching and Therapy*, *29*(1), 91-109.	Exclusion criteria 3 – did not have original data
Paradis, J. (2010). The interface between bilingual development and specific language impairment. *Applied Psycholinguistics*, *31*(2), 227-252.	Exclusion criteria 3 – did not have original data
Paradis, J. (2016). The development of English as a second language with and without specific language impairment: Clinical implications. *Journal of Speech, Language, and Hearing Research*, *59*(1), 171-182.	Exclusion criteria 3 – did not have original data
Peña, E. D., Bedore, L. M., & Kester, E. S. (2015). Discriminant accuracy of a semantics measure with Latino English-speaking, Spanish-speaking, and English–Spanish bilingual children. *Journal of Communication Disorders*, *53*, 30-41.	Exclusion criteria 2 – assessment partly in Spanish
Peña, E. D., Bedore, L. M., & Kester, E. S. (2016). Assessment of language impairment in bilingual children using semantic tasks: Two languages classify better than one. *International Journal of Language & Communication Disorders*, *51*(2), 192-202.	Exclusion criteria 2 – assessment partly in Spanish

Pesco, D., & Bird, E. K. R. (2016). Perspectives on bilingual children's narratives elicited with the Multilingual Assessment Instrument for Narratives. *Applied Psycholinguistics*, *37*(1), 1-9.	Exclusion criteria 3 – did not have original data
Pieretti, R. A., & Roseberry-McKibbin, C. (2016). Assessment and intervention for English language learners with primary language impairment: Research-based best practices. *Communication Disorders Quarterly*, *37*(2), 117-128.	Exclusion criteria 3 – did not have original data
Rothweiler, M. (2010). The potential of studying specific language impairment in bilinguals for linguistic research on specific language impairment in monolinguals. *Applied Psycholinguistics*, *31*(2), 327-332.	Exclusion criteria 3 – did not have original data
Sandgren, O., & Holmström, K. (2015). Executive functions in mono-and bilingual children with language impairment–issues for speech-language pathology. *Frontiers in Psychology*, *6*(1074), 1-5.	Exclusion criteria 3 – did not have original data
Thordardottir, E., & Brandeker, M. (2013). The effect of bilingual exposure versus language impairment on nonword repetition and sentence imitation scores. *Journal of Communication Disorders*, *46*(1), 1-16.	Exclusion criteria 2 – assessment in French
Thordardottir, E., Cloutier, G., Ménard, S., Pelland-Blais, E., & Rvachew, S. (2015). Monolingual or bilingual intervention for primary language impairment? A randomized control trial. *Journal of Speech, Language, and Hearing Research*, *58*(2), 287-300.	Exclusion criteria 2 – assessment partly in French Exclusion criteria 4 – study refers to intervention rather than assessment
Tuller, L., Hamann, C., Chilla, S., Ferré, S., Morin, E., Prevost, P., ... & Zebib, R. (2018). Identifying language impairment in bilingual children in France and in Germany. *International Journal of Language & Communication Disorders*, *53*(4), 888-904.	Exclusion criteria 2 – assessment partly in another language

Vender, M., Garraffa, M., Sorace, A., & Guasti, M. T. (2016). How early L2 children perform on Italian clinical markers of SLI: A study of clitic production and nonword repetition. *Clinical Linguistics & Phonetics*, *30*(2), 150-169.	Exclusion criteria 2 – assessment in Italian
Verhoeven, L., Steenge, J., van Weerdenburg, M., & van Balkom, H. (2011). Assessment of second language proficiency in bilingual children with specific language impairment: A clinical perspective. *Research in Developmental Disabilities*, *32*(5), 1798-1807.	Exclusion criteria 2 – assessment in Dutch
Weismer, S. E., & Kaushanskaya, M. (2010). The use of descriptive data from bilingual children to inform theories of specific language impairment. *Applied Psycholinguistics*, *31*(2), 277-282.	Exclusion criteria 3 – did not have original data
Windsor, J., Kohnert, K., Lobitz, K. F., & Pham, G. T. (2010). Cross-language nonword repetition by bilingual and monolingual children. *American Journal of Speech-Language Pathology*, *19*(4), 298-310.	Exclusion criteria 2 – assessment partly in another language
Zurer-Pearson, B. (2010). We can no longer afford a monolingual norm. *Applied Psycholinguistics*, *31*(2), 339-343.	Exclusion criteria 3 – did not have original data

Appendix C: Summary of Included Articles

Summary of articles included for review

Author	*N*	Country	First & second language of children	Method/Design	Assessment(s) employed	Conclusions
Boerma & Blom (2017)	132	Netherlands	Turkish (L1), Moroccan (L1) & English (L2)	Four group design (i.e., monolingual and EAL children with and without a DLD) and the presence or absence of a DLD was measured	-The Questionnaire for Parents of Bilingual Children -Nonword Repetition Task; The Multilingual Assessment Instrument for Narratives (Boerma & Blom, 2017)	The tools could accurately identify a DLD amongst children with EAL
Chiat & Polišenská (2016)	42	United Kingdom	Turkish (L1), Spanish (L1) & English (L2)	A 4 × 2 × 2 mixed-design, with two groups (i.e., monolingual and bilingual)	- Crosslinguistic Nonword Repetition framework -The British Picture Vocabulary Scales–Third Edition (BPVS-III; Dunn, Dunn, Styles, & Sewell, 2009)	Potential for assessing children with EAL for DLD
Danahy et al. (2007)	100	United States of America (USA)	Spanish (L1) & English (L2)	Cross-sectional quantitative study examining verbal working memory as an indicator of an SLI	Counting Span (i.e., verbal working memory)	Findings revealed the 'counting span' assessment was sensitive enough to identify an DLD in both monolingual and EAL children

				across three groups (i.e., monolingual English-speaking children with an DLD, monolingual children without an DLD, bilingual children with an SLI)		
Komeili & Marshall (2013)	36	United Kingdom	Farsi (Persian) (L1) & English (L2)	Cross-sectional quantitative study examining sentence repetition as a measure of morphosyntax across two groups (i.e., English-speaking and EAL children)	School-Age Sentence Imitation Test-English 32 (SASIT-E32) (Marinis et al., 2011)	EAL children did not omit words (word ommissions are common in children with EAL), meaning that the SASIT-E32 could be a useful tool in identifying DLDs amongst children with EAL
Paradis et al. (2013)	178	Canada	Variety of L1 language (Arabic, Assyrian, Cantonese, Farsi, Hindi, Mandarin, Portuguese, Punjabi,	Cross-sectional quantitative study examining sentence repetition as a measure of morphosyntax across two groups (i.e., EAL children with and	English standardised tests of nonword repetition, tense morphology, narrative story grammar, and receptive vocabulary. Parents were given a questionnair	Possibility of detecting differentiating between children who have EAL and children who have an SLI by developing norm-references (i.e., EAL norms) for standardised tests, as well as using parent questionnaires

Urdu, Somali, Spanish, and Vietnamese) and English (L2)	without SLIs)	e on children's first-language development. Specifically, these tests incorporated: - The Alberta Language Development Questionnaire (ALDeQ; Paradis et al., 2010) - The Nonword Repetition/Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999). - Screener/Test of Early Grammatical Impairment (TEGI; Rice & Wexler, 2001). - Story Grammar/Edmonton Narrative Norms Instrument (ENNI; Schneider, Dube´, & Hayward, 2005)

					- The Peabody Picture Vocabulary Test—III (PPVT; Dunn & Dunn, 1997).	
Peña et al. (2014)	54	USA	Spanish (L1) & English (L2)	Cross-sectional design using dynamic assessment to differentiate between EAL and DLD	Dynamic Assessment	Findings suggested that dynamic assessment can be a clinically useful tool for identifying SLIs in EAL children Teacher ratings may be an effective screening method prior to subsequent referral to clinicians
Pua et al. (2017)	78	Singapore	Malay/ Mandarin (L1) & English (L2)	Cross-sectional design using dynamic assessment to differentiate between EAL and DLD	- The Bilingual Language Assessment Battery (BLAB) Preschool Parent Report, BLAB Preschool Teacher Report and BLAB receptive language assessment (Pua et al., 2013)	
Ziethe et al. (2010)	73	Germany	Turkish, Italian, Polish, Greek, Finnish, Vietnamese, and English	Retrospective study with four groups (i.e., monolingual and EAL children with children	-Included prerequisite testing (e.g., intelligence testing and language testing) - Digit Span of the	Verbal working memory reductions were evident in groups who had a DLD

(L1s) & German (L2)	with DLD and typically developing children with EAL and DLD). Groups were compared in terms of their performance on a digit span and sentence repetition task	Kaufmann Assessment Battery for Children - Sentence Repetition Task - Subtest Imitation of Grammatical Structure Forms

Appendix D: Weight of Evidence Quality Criteria

WoE A: Methodological quality. Each of the five studies for review were appraised for their methodological quality using an adapted version of Gersten and Edyburn's (2007) 'quality indicators for special education technology research', as well as an adapted version of the 'Newcastle-Ottawa Scale' (Wells et al., 2009). Both tools were adapted to ensure that they are applicable to a cross-sectional design, as well as to ensure that the indicators were relevant to the systematic review being conducted. Gersten and Edyburn's (2007) guidelines had originally suggested that studies are scored as 'unacceptable', 'essential' and 'desirable'. For the purpose of the current systematic review, and to ensure consistency across all weightings of evidence, the terms 'low', 'medium' and 'high' were used instead with corresponding scores. Scores from each of the criteria were averaged in order to provide an overall WoE A of low, medium, or high, where low was 1.6 or lower, medium was 1.7 – 2.4 and high was 2.5 and over.

Quality Indicators for Methodological Quality

	Area	Quality Indicator	3 points (High)	2 points (medium)	1 point (low)	Score
1.	Conceptualisation of the Research Study	1.1 The research design is appropriate for the type of evidence sought (i.e., explanatory, single case, comparative, programme evaluation etc.)	The research design is appropriate and evidence is provided on why/how this methodology will extend previous research.	The research design is appropriate for the type of evidence sought.	The research design is not appropriate for the described purposes.	

		1.2. Valid arguments supporting the proposed assessment, as well as the nature of the participant groups, are presented	The assessment is clearly defined and contrasted with other assessments of known impact. Clearly defined procedures are outlined.	The assessment is grounded in the research literature. The research design provides for another group.	Fails to connect the current work with the research literature.
		1.3. The research questions are derived from the purpose of the study and are stated clearly.	The research questions are logical, focused, and measurable.	The research questions are a logical extension of what is known and not known	The research questions are presented without adequate grounding in the knowledge base.
2.	Sample Selection	2.1. Sample selection procedures are appropriate for extrapolating the findings to the population.	Children are randomly selected and contain more than one group (e.g., monolingual and bilingual children)	Students are randomly selected	No description of the sampling strategy.

	2.2. A power analysis is provided to describe the adequacy of the minimum cell size. A power analysis is conducted for each analysis to be examined.	Evidence that a power analysis was conducted for each analysis that will be conducted is provided as a rationale for determining adequate sample size.	Evidence that a power analysis was conducted for the primary variables is provided as a rationale for determining adequate sample size.	No information is provided on how the sample size was determined.
	2.3. Characteristics of the sample reflect the characteristics of the population	Detailed evidence is provided on how the statistical properties of the sample reflect the population	Evidence is provided that the sample is reflective of the characteristics of the population on at least one important variable.	No information is provided on how the sample reflects the population.
3. Description of participants	3.1 Sufficient information is presented to determine/ confirm whether the participants were suitable for assessment	Detailed evidence is provided regarding eligibility (e.g., EAL status, no hearing difficulties etc)	The researcher demonstrates how he or she reaffirmed the child's characteristics and qualifications to participate in the intervention.	No evidence provided that the participant is eligible to take part in the intervention

4. Assessment	4.1. Evidence of reliability and validity for the assessment is provided.	The assessment reflects the highest technical adequacy available for measuring the constructs.	Reliability and validity measures for each assessment instrument are appropriate (.6 for new measures, .8 for established measures).	Inadequate information is available on the reliability and validity of the outcome measures.
	4.2. Assessors are blind to the participants' status (i.e., DLD or no DLD)	Detailed descriptions are provided to clearly indicate how independent data collectors and/or scorers are used to guard against researcher bias.	Independent data collectors and/or assessors are used to guard against researcher bias.	Inadequate information is provided to rule out researcher bias relative to data collection and assessment.

5. Data Analysis	5.1. Data analyses and research questions are aligned with the appropriate unit of analysis for each research question.	The research questions are aligned with the appropriate unit of analysis, and appropriate analysis procedures are outlined.	Analysis procedures are appropriate.	The research questions are not aligned with the appropriate unit of analysis or appropriate analysis procedures.
	5.2. The chosen data analysis techniques are appropriate and linked in an integral fashion to key research questions and hypotheses.	Analysis procedures are appropriate for answering the research questions.	Analysis procedures are appropriate.	Analysis procedures are not appropriate for the type of data or are not designed to answer the research questions.

WoE B: Methodological relevance. WoE B was calculated by considering the validity of the assessment tool in identifying a potential DLD in children with EAL. The quality criteria employed in calculating each rating is presented the table below. Quality criteria are an adapted version of those provided by Evans' (2003) 'evidence hierarchy' where studies, or in this case, assessment tools with high validity are provided with a high rating. Studies or assessment tools which threaten validity are given a lower rating.

Rationale and criteria for WoE (methodological relevance to review question)

Weighting	3 points (High)	2 points (Medium)	1 point (Low)
Rationale	The study must include: The assessment used most be published in a peer-reviewed journal and must include data collected from more than one group of participants (e.g., monolinguals and bilinguals) and one or more of the following: • More than one measure of DLD taken in order to ensure triangulation of assessment data. • Study has stated evidence of validity and reliability of the assessment tool	The study must include: The assessment used most be published in a peer-reviewed journal and one or more of the following: • More than one measure of DLD taken in order to ensure triangulation of assessment data. • Study has stated evidence of validity and reliability of the assessment tool.	If the study has not met the previous criteria and therefore includes at least one of the following: • Unpublished assessment tool • Study has not stated evidence of validity and reliability of the assessment tool • Only one form of assessment gathered

WoE C: Topic relevance. WoE C is review specific and ascertains if the study is relevant to the systematic review question, as proposed above. Therefore, the relevance of each study to the review question (i.e., which assessment tools can potentially identify a DLD in an EAL population?) were determined using the criteria outlined the table below. Again, studies were provided with a 'high', 'medium' or 'low' score depending on their relevance.

Rationale and criteria for WoE (methodological relevance to review question)

Weighting	3 points (High)	2 points (Medium)	1 point (Low)
Rationale	The study must include *all* of the following: • Provides evidence that at least one group of participants being assessed have EAL • States evidence/completes pre-assessment procedures to ascertain if the child qualifies to receive the status of EAL and/or to rule out other potential confounding variables (e.g., hearing impairment) • Assessment measure has the specific purpose of ascertaining the presence of a DLD in an EAL population	The study must include *two* of the following: • Provides evidence that at least one group of participants being assessed have EAL • States evidence/completes pre-assessment procedures to ascertain if the child qualifies to receive the status of EAL and/or to rule out other potential confounding variables (e.g., hearing impairment) • Assessment measure has the specific purpose of ascertaining the presence of a DLD in an EAL population	The study must include *one or none* of the following: • Provides evidence that at least one group of participants being assessed have EAL • States evidence/completes pre-assessment procedures to ascertain if the child qualifies to receive the status of EAL and/or to rule out other potential confounding variables (e.g., hearing impairment) • Assessment measure has the specific purpose of ascertaining the presence of a DLD in an EAL population

WoE D: Overall weightings and rationale for cut-off points. In order to determine the overall rating of each study, the ratings provided in WoE A, WoE B and WoE C were combined and averaged, thus providing an overall measure known as WoE D. A Studies must have received two or more 'high' ratings on the various weight of evidence domains in order to receive an overall high WoE D. The table below provides numerical rating details.

Overall WoE categories and numerical ratings

Weight Category	**Numerical Rating**
Low	1.6 or lower
Medium	1.7 – 2.4
High	2.5 or higher

Appendix E: Example of Coding Protocol for Danahy et al.'s (2007) Study

Quality Indicators for Methodological Quality

Area	Quality Indicator	3 points (High)	2 points (medium)	1 point (low)
1. Conceptualisation of the Research Study	1.1 The research design is appropriate for the type of evidence sought (i.e., explanatory, single case, comparative, programme evaluation etc.)	The research design is appropriate and evidence is provided on why/how this methodology will extend previous research.	The research design is appropriate for the type of evidence sought.	The research design is not appropriate for the described purposes.
	1.2. Valid arguments supporting the proposed assessment, as well as the nature of the participant groups, are presented	The assessment is clearly defined and contrasted with other assessments of known impact. Clearly defined procedures are outlined.	The assessment is grounded in the research literature. The research design provides for another group.	Fails to connect the current work with the research literature.
	1.3. The research questions are derived from the purpose of the study and are stated clearly.	The research questions are logical, focused, and measurable.	The research questions are a logical extension of what is known and not known	The research questions are presented without adequate grounding in the knowledge base.

2. Sample Selection		2.1. Sample selection procedures are appropriate for extrapolating the findings to the population.	Children are randomly selected and contain more than one group (e.g., monolingual and bilingual children)	Students are randomly selected	No description of the sampling strategy.
		2.2. A power analysis is provided to describe the adequacy of the minimum cell size. A power analysis is conducted for each analysis to be examined.	Evidence that a power analysis was conducted for each analysis that will be conducted is provided as a rationale for determining adequate sample size.	Evidence that a power analysis was conducted for the primary variables is provided as a rationale for determining adequate sample size.	No information is provided on how the sample size was determined.
		2.3. Characteristics of the sample reflect the characteristics of the population	Detailed evidence is provided on how the statistical properties of the sample reflect the population	Evidence is provided that the sample is reflective of the characteristics of the population on at least one important variable.	No information is provided on how the sample reflects the population.
3. Description of participants	3.1 Sufficient information is presented to determine/ confirm whether the participants were		Detailed evidence is provided regarding eligibility (e.g., EAL	The researcher demonstrates how he or she reaffirmed	No evidence provided that the participant is

	suitable for assessment	status, no hearing difficulties etc)	the child's characteristics and qualifications to participate in the intervention.	eligible to take part in the intervention
4. Assessment	4.1. Evidence of reliability and validity for the assessment is provided.	The assessment reflects the highest technical adequacy available for measuring the constructs.	Reliability and validity measures for each assessment instrument are appropriate (.6 for new measures, .8 for established measures).	Inadequate information is available on the reliability and validity of the outcome measures.
	4.2. Assessors are blind to the participants' status (i.e., DLD or no DLD)	Detailed descriptions are provided to clearly indicate how independent data collectors and/or scorers are used to guard against researcher bias.	Independent data collectors and/or assessors are used to guard against researcher bias.	Inadequate information is provided to rule out researcher bias relative to data collection and assessment.
5. Data Analysis	5.1. Data analyses and research questions are aligned with the appropriate unit of analysis for each research question.	The research questions are aligned with the appropriate unit of analysis, and	Analysis procedures are appropriate.	The research questions are not aligned with the appropriate unit of analysis

WoE B:		appropriate analysis procedures are outlined.		or appropriate analysis procedures.
	5.2. The chosen data analysis techniques are appropriate and linked in an integral fashion to key research questions and hypotheses.	Analysis procedures are appropriate for answering the research questions.	Analysis procedures are appropriate.	Analysis procedures are not appropriate for the type of data or are not designed to answer the research questions.

Methodological relevance

Rationale and criteria for WoE (methodological relevance to review question)

Weighting	3 points (High)	2 points (Medium)	1 point (Low)
Rationale	The study must include: The assessment used most be published in a peer-reviewed journal and must include data collected from more than one group of participants (e.g., monolinguals and bilinguals) and one or more of the following: • More than one measure of DLD taken in order to ensure triangulation of assessment data.	The study must include: The assessment used most be published in a peer-reviewed journal and one or more of the following: • More than one measure of DLD taken in order to ensure triangulation of assessment data. • Study has stated evidence of validity and reliability of the assessment tool	If the study has not met the previous criteria and therefore includes at least one of the following: • Unpublished assessment tool • Study has not stated evidence of validity and reliability of the assessment tool • Only one form of assessment gathered

	• Study has stated evidence of validity and reliability of the assessment tool

WoE C: Topic relevance

Rationale and criteria for WoE (methodological relevance to review question)

Weighting	3 points (High)	2 points (Medium)	1 point (Low)
Rationale	The study must include *all* of the following: • Provides evidence that at least one group of participants being assessed have EAL • States evidence/completes pre-assessment procedures to ascertain if the child qualifies to receive the status of EAL and/or to rule out other potential confounding variables (e.g., hearing impairment) • Assessment measure has the specific purpose of ascertaining the presence of a DLD in an EAL population	The study must include *two* of the following: • Provides evidence that at least one group of participants being assessed have EAL • States evidence/completes pre-assessment procedures to ascertain if the child qualifies to receive the status of EAL and/or to rule out other potential confounding variables (e.g., hearing impairment) • Assessment measure has the specific purpose of ascertaining the presence of a DLD in an EAL population	The study must include *one or none* of the following: • Provides evidence that at least one group of participants being assessed have EAL • States evidence/completes pre-assessment procedures to ascertain if the child qualifies to receive the status of EAL and/or to rule out other potential confounding variables (e.g., hearing impairment) • Assessment measure has the specific purpose of ascertaining the presence of a DLD in an EAL population

WoE D: Overall weightings and rationale for cut-off points

Overall WoE categories and numerical ratings

Weight Category	Numerical Rating
Low	1.6 or lower
Medium	1.7 – 2.4
High	2.4 or higher

Total Score = 6.97 divided by 3

Average = 2.32 (medium)

Appendix F: Grade Descriptors for the Common European Framework

Type of User	Grade	Descriptor
Proficient User	C2	Individual can comprehend almost everything heard and read. Can express him/herself with fluency and accuracy and can form complex arguments and sentences.
	C1	Individual can comprehend a wide range of language and can express him/herself fluently without difficulty. Can use language across a range of contexts (i.e., socially, academically and professionally).
Independent User	B2	Can comprehend the central components of complex text on both concrete and more complex topics, including technical discussions pertaining to his/her area of expertise. Can speak with some fluency to native speakers.
	B1	Can comprehend the central messages pertaining to subjects which he/she is familiar with at work, school or socially and can write simple text related to such.
Basic User	A2	Can comprehend and use familiar expressions of most relevance to the individual (e.g., family information). Can communicate in simple sentences.
	A1	Can comprehend and use familiar expressions and can use and comprehend very basic phrases. Can communicate with native speakers if the native speaker speks slowly and helps the A1 Basic User.

Adapted from The Council of Europe (2018)

Appendix G: Monolingual Questionnaire

Demographic Questionnaire (for monolingual parents)

Please do not put your child's name anywhere on this form. When you have completed this short questionnaire, please place in envelope provided, and return to your child's school. Thank you in advance for you and your child's participation.

Child's Date of Birth:	**Class:**
Your phone number:	**Code (For researcher only):**

1. What is your child's first language? _____
2. What is your child's gender? _____
3. Does your child speak any other languages? _____
4. If so, does your child speak these languages fluently? YES NO SOMETIMES
5. Does your child speak English at home? YES NO SOMETIMES
6. Does your child speak English in school? YES NO SOMETIMES
7. Do both of the child's parents/guardians have the same first language? YES NO
8. If you answered 'no' to the above, what languages do you speak? _____
9. Does your child have any diagnosed special educational needs or language difficulty? YES NO
10. If you answered 'yes' what diagnosis did your child receive? _____
11. Does your child have any hearing impairments? _____
12. Does your child have any vision impairments? _____
13. Does your child have any physical impairments?
14. Has your child received a cognitive assessment in the previous two years? YES NO
15. If you answered yes to the above, what assessment tool was used? _____

16. Please indicate the occupation and highest level of education for each parent:

Mother	Father
1. _____ Primary school	1. _____ Primary school
2. _____ Post-primary school	2. _____ Post-primary school
3. _____ Some college education	3. _____ Some college education
4. _____ College degree or diploma	4. _____ College degree or diploma
5. _____ Graduate or professional degree	5. _____ Graduate or professional degree
Occupation: _____	Occupation: _____
First Language: _____	First Language: _____
Second Language: _____	Second Language: _____
Other Language: _____	Other Language: _____

Thank you for completing this questionnaire.

Appendix H: Language and Social Background Questionnaire

Language and Social Background Questionnaire

Please do not put your child's name anywhere on this form. When you have completed this short questionnaire, please place in envelope provided, and return to your child's school. Thank you in advance for you and your child's participation.

Child's Date of Birth:	**Class:**
Your phone number:	**Code (For researcher only):**

1. Please answer the following:

2. What is your child's gender? _____
3. Does your child have any diagnosed special educational needs or language difficulty?
   YES NO
4. If you answered 'yes' what diagnosis did your child receive? _____
5. Does your child have any hearing impairments? _____
6. Does your child have any vision impairments? _____
7. Does your child have any physical impairments?
8. Has your child received a cognitive assessment in the previous two years?
   a. YES NO
9. If you answered yes to the above, what assessment tool was used? _____

10. Please indicate the occupation and highest level of education for each parent:

Mother	Father
1. _____ Primary school	1. _____ Primary school
2. _____ Post-primary school	2. _____ Post-primary school
3. _____ Some college education	3. _____ Some college education
4. _____ College degree or diploma	4. _____ College degree or diploma

5. _____ Graduate or professional degree Occupation: _____ First Language: _____ Second Language: _____ Other Language: _____	5. _____ Graduate or professional degree Occupation: _____ First Language: _____ Second Language: _____ Other Language: _____

11. Was your child born in Ireland? **Yes** ☐ **No** ☐

If **no**, where were was your child born? _____

When did you move to Ireland? _____

Year

12. Has your child ever lived in a place where English is not the dominant communicating language? **Yes** ☐ **No** ☐

		From	**To**
If **yes**, where and for how long?	1. _____	_____	_____
	2. _____	_____	_____
	3. _____	_____	_____
		Year	**Year**

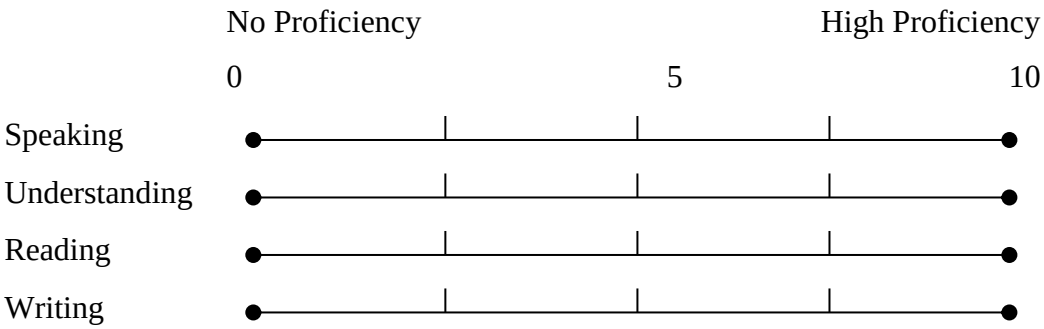
Language Background

13. List all the language and dialects your child can speak and understand including English, ***in order of fluency***:

Language	Where did he/she learn it?	At what age did your child learn it? (If learned from birth, write age "0")	Were there any periods in your child's life when they did not use this language? Indicate duration in months/years.
1._____	☐**Home** ☐**School** ☐**Community** ☐**Other:** _____		
2._____	☐**Home** ☐**School** ☐**Community** ☐**Other:** _____		
3._____	☐**Home** ☐**School** ☐**Community** ☐**Other:** _____		
4._____	☐**Home** ☐**School** ☐**Community** ☐**Other:** _____		
5._____	☐**Home** ☐**School** ☐**Community** ☐**Other:** _____		

14. Relative to a highly proficient speaker's performance, rate your child's proficiency level on a scale of 0-10 for the following activities conducted in English and your child's other language(s).

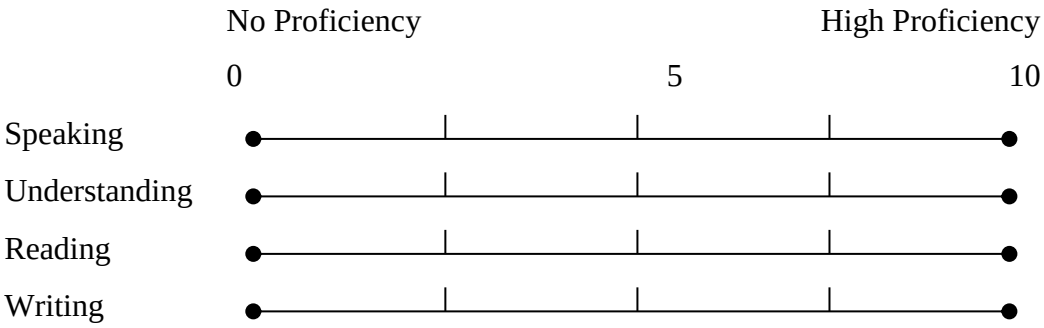
English



15. Of the time your child spends engaged in each of the following activities, how much of that time is carried out in English?

	None	Little	Some	Most	All
Speaking	☐	☐	☐	☐	☐
Listening	☐	☐	☐	☐	☐
Reading	☐	☐	☐	☐	☐
Writing	☐	☐	☐	☐	☐

Other Language: _____



16. Of the time your child spends engaged in each of the following activities, how much of that time is carried out in this language?

	None	Little	Some	Most	All
Speaking	☐	☐	☐	☐	☐
Listening	☐	☐	☐	☐	☐
Reading	☐	☐	☐	☐	☐
Writing	☐	☐	☐	☐	☐

Community Language Use Behaviour

17. Please indicate which language(s) your child most frequently heard or used in the following life stages, both inside and outside home.

	All English	Mostly English	Half English half other language	Mostly the other language	Only the other language
Infancy	☐	☐	☐	☐	☐
Preschool age	☐	☐	☐	☐	☐
Primary School age	☐	☐	☐	☐	☐

18. Please indicate which language(s) your child generally uses when speaking to the following people.

	All English	Mostly English	Half English half other language	Mostly the other language	Only the other language
Parents	☐	☐	☐	☐	☐
Siblings	☐	☐	☐	☐	☐
Grandparents	☐	☐	☐	☐	☐
Other Relatives	☐	☐	☐	☐	☐
Neighbours	☐	☐	☐	☐	☐

19. Please indicate which language(s) your child generally uses in the following situations.

	All English	Mostly English	Half English half other language	Mostly the other language	Only the other language
Home	☐	☐	☐	☐	☐
School	☐	☐	☐	☐	☐
Work	☐	☐	☐	☐	☐
Social activities (e.g. hanging out with friends, movies)	☐	☐	☐	☐	☐
Religious activities	☐	☐	☐	☐	☐
Extracurricular activities (e.g. hobbies, sports, volunteering, gaming)	☐	☐	☐	☐	☐
Shopping/ Restaurants/ Other commercial services	☐	☐	☐	☐	☐

20. Please indicate which language(s) your child generally uses for the following activities.

	All English	Mostly English	Half English half other language	Mostly the other language	Only the other lan gu

					ag e
Reading	☐	☐	☐	☐	☐
Watching TV/ listening to radio	☐	☐	☐	☐	☐
Watching movies	☐	☐	☐	☐	☐
Browsing on the Internet	☐	☐	☐	☐	☐
Praying	☐	☐	☐	☐	☐

21. Some people switch between the languages they know within a single conversation (i.e. while speaking in one language they may use sentences or words from the other language). This is known as "language-switching". Please indicate how often your child engages in language-switching. If your child does not know any language(s) other than English, fill in all the questions with 0, as appropriate.

	Never	Rarely	Sometimes	Frequentl y	Alw ays
With parents and family	☐	☐	☐	☐	☐
With friends	☐	☐	☐	☐	☐

Thank you for participating!

Appendix I: Phonetic Transcriptions of the Nonword Repetition Test

NRT - Nonword Repetition Test

Dollaghan, C., and Campbell, T. F. 1998. Nonword Repetition and Child Language Impairment. *Journal of Speech, Language, and Hearing Research* Vol.41 1136-1146

Table 2. Phonetic transcriptions of the nonwords at each length.

One syllable	Two syllables	Three syllables	Four syllables
/naɪb/	/tɛɪvak/	/ʃɪnɔɪtaʊb/	/veɪtaʃɔɪdɔɪp/
/voʊp/	/ʧaʊvæg/	/naɪʃaʊvɛɪb/	/dævaʊnɔɪʧɪg/
/taʊdʒ/	/vætʃaɪp/	/dɔɪtaʊvæb/	/naɪʃɔɪtaʊvʊb/
/dɔɪf/	/nɔɪtaʊf/	/tɛɪvɔɪʧaɪg/	/tævaʃɪnaɪg/

Appendix J: Protocol in the Event of Difficulties

Protocol in the event of difficulties

1) Parents/guardians will provide their contact details on the demographic questionnaire. Parents will be contacted by the researcher if their child receives the following scores:
2) If a child receives a score below **80 (i.e., borderline)** on the nonverbal intelligence test. As overall cognitive scores between 80 and 85 are still deemed to be within the low average range, only parents of children who receive scores below 80 will be contacted as scores beneath 80 *may* indicate a learning difficulty.
3) If a child scores below the **10th percentile** (normed on the sample collected during the research) on **overall processing speed** or **overall verbal working memory** scores, or both.
4) If a child scores below the **10th percentile on the word reading** (i.e., pseudoword reading) subtest.

5) *If a child receives scores that might indicate a language or learning difficulty, the parents/guardians will be provided with an explanation of what the scores mean (i.e., explanation of what verbal working memory/processing speed means and description of standard scores or percentiles). It will be explained to parents/guardians that this **may** indicate a difficulty, but parents/guardians will be reminded that these tests only assess a child in a moment in time. It would therefore be advisable that parents/guardians consider these test results in light of the child's overall strengths and difficulties. Parents/guardians will be advised to discuss results and these issues with the child's class teacher and/or Special Educational Needs Co-Ordinator.*

6) Parents/guardians will also be contacted, as well as the child's class teacher in an occasion where:

7) The child becomes **upset** during or after the assessment.

8) In line with Best Practice in Child Protection, if any **child protection issues** come to light during the assessment or through child disclosure, the Designated Liaison Person in the school will be contacted immediately. Child protection issues may include if a child discloses that she/he is harming herself or others, if he/she reports a crime or if it is reported that someone is hurting the child.

9) Some children may not complete the whole assessment due to having a cognitive score below 85. In order to reassure the child, it is highlighted in the Children's Information Sheet that 'not every child will do every test and that's okay, nor will every child do the exact same tests'. Furthermore, if a child becomes upset during or after the assessment, the child's teacher and parents/guardians will be informed.

Appendix K: Consent Form for Obtaining Results

Parent/Guardian Informed Consent Form for Receiving Results

Dear Parent/Guardian,

Please read the following statements and tick each box before signing the consent form with regards to obtaining results from testing completed with your child.

- I understand that **if I wish to share these results with the school, it is my decision to do so, with due consideration for the views of my child**
  ☐
- I understand that this testing was carried out as **part of a research project and that the researcher's role is not to individually interpret the results.**
  ☐
- I understand that **I can share these results with my child's teachers or other professionals if I wish to do so.**
  ☐
- I understand that the researcher will **store the completed consent form and a copy of the template of results with due consideration for data protection.**
  ☐
- I understand that a **copy of results will be posted to the school and will be available for me to collect in a sealed envelope** from the school**.**
  ☐

Child's name (required for obtaining results): _____

Name (PRINTED): _____

Name (Signature): _____

Date: _____

Appendix L: Template for Results for Parents

Results from Testing

Child's Name:

Perceptual Reasoning Index from WASI-II*	Standard Score: **XX**
Pseudoword Decoding (i.e., reading nonsense words) from WIAT-III**	Standard Score: **XX**
Verbal Working Memory from Nonword Repetition Test***	Percentage of Total Sounds Correct: **XX%**
Processing Speed from Visual Search Task******	Average Speed of Responses: **XX milliseconds** Accuracy of Responses: **XX%**

**Between 90-109 is in the Average Range*

***Between 90-109 is in the Average Range*

**** Scores above X were at or above the 10th percentile*

***** Scores above X were at or above the 10th percentile*

Appendix M: Empirical Paper

Doctorate in Educational and Child Psychology

Empirical Paper

Can verbal working memory and processing speed distinguish between children who have English as an additional language and children with developmental language disorder?

Lainey Keane

Supervised by Dr Margaret Egan

ABSTRACT

Background: Children with English as an Additional Language (EAL) often present with language difficulties and make errors that are similar to children with Developmental Language Disorder (DLD). Apparent language difficulties, which may be attributed to a child's EAL status, are instead misunderstood as being a Developmental Language Disorder (DLD) (Raul & Ahyea, 2017). Research illustrates how assessment tools are often biased against children with EAL (Alfano, Holden & Conway, 2016). Following a systematic review of the literature, a corpus of evidence suggested that less-biased assessments, such as tests of Verbal Working Memory (VWM) and Processing Speed can distinguish children with EAL from children with DLD (Sandgren & Holmström, 2015).

Aim: The aim of the research was to ascertain if tests of VWM and Processing Speed could distinguish between children with EAL and children who had a DLD.

Method: Participants from monolingual (n = 15), EAL (n = 15) and DLD (n = 12) groups, who were aged between seven and nine years old, completed literacy and intelligence screening, followed by a Visual Search and Nonword Repetition Test (NRT). The latter two tests measured Processing Speed and Verbal Working Memory, respectively.

Results: Influenced by a post-positivist stance, results have indicated that the NRT (i.e., VWM) can distinguish between children who have EAL and children who have a DLD, $p < .001$, $\eta^2 = .457$ (i.e., medium effect, Cohen, 1988). The DLD group also scored lower on the Visual Search task but this did not reach the significance level. Likelihood ratios and tests of specificity and sensitivity using a Receiver Operating Characteristic (ROC) Curve also indicated that the VWM measure had a good degree of accuracy.

Conclusion: Assessments of VWM using non-words may be able to differentiate between children who have EAL and children who have DLD. Such findings could hold implications for educational psychology practice, research and policy, nationally and internationally.

EMPIRICAL PAPER

1.0. Introduction

In the influential paper 'Language, Power and Pedagogy: Bilingual Children in the Crossfire', Cummins (2000) alluded to the challenges associated with catering for the needs of children who have English as an Additional Language (EAL). At the heart of Cummins' (2008) assertions is that the area of 'assessment is a crucial issue for minority students' (p. 203). According to the most recent Irish definition, children who have EAL typically have a different home language to English despite English being the language of instruction used in school (Department of Education and Skills; DES, 2005). As the title of Cummins' (2000) magnum opus implies, it appears as though such children are caught in the 'crossfire' in terms of educational provision, namely assessment. Research illustrates that there are difficulties associated with the assessment of children with EAL, resulting in detrimental outcomes for this population (Artiles & Ortiz, 2002). Apparent language difficulties, which may otherwise have been attributed to their EAL status, are instead misunderstood as being Developmental Language Disorder (DLD) (Raul & Ahyea, 2017). DLD may be described as a neurodevelopmental disorder where children typically present with receptive and expressive deficits (e.g., morphosyntax) and cognitive deficits (e.g., attention or working memory difficulties) (Ponari, Norbury, Rotaru, Lenci & Vigliocco, 2018). Children with EAL often present with language difficulties and make errors that are similar to monolingual children with DLD (Armon-Lotem, 2012; Paradis, 2010). Apparent language difficulties in children with EAL could thus be attributed to a child's EAL status (Ferlis & Xu, 2016).

Adding to the difficulties associated with identifying DLDs is the increasing number of children with EAL who are undergoing DLD assessments (Armon-Lotem, de Jong & Meir 2015; O' Toole & Hickey, 2012). This is unsurprising given that the recent influx of children from non-Irish backgrounds has also come to the forefront of educational discourse in recent years. According to the Irish Census for 2016 (Central Statistics Office; CSO, 2017), the number of individuals speaking a foreign language at home accounted for over 600,000 of the Irish population. Amongst this number, 20,000 were pre-school children, with 85,000 children attending Irish primary and post-primary schools (CSO, 2017). The Economic and Social Research Institute (ESRI, 2009) found that approximately 60% of Irish schools have newcomer students, with many of these students coming from diverse language backgrounds. In fact, numerous researchers have

highlighted difficulties in accessing translation services, tools or professionals capable of assessing children from minority ethnolinguistic backgrounds (Boerma & Blom, 2017). As the population of Ireland is rapidly diversifying (CSO, 2017), appropriate assessment tools appear warranted for this minority, yet significant proportion of society.

Due to the overlap in language characteristics of children with EAL and DLD and given the lack of appropriate tools, increasing numbers of children are being misdiagnosed following the assessment process (Paradis, 2005). Disentangling EAL from DLD has been described by Paradis (2005) as the 'teasing apart of non-fluent and errorful language' so that children with EAL are not provided with a 'mistaken identity' or 'missed identity' (p. 173). Erroneously identifying the presence or indeed absence of a DLD in children with EAL can result in children receiving inappropriate school instruction, which may be ineffective in meeting their needs (Sullivan, 2011).

2.0. Language Development of Children

So how do the language profiles of children with EAL and children with DLD overlap? With a prevalence of approximately 7.5% (Norbury et al., 2016), research illustrates how DLD is often related to reduced vocabulary and difficulties with comprehension and expression (Ponari et al., 2018). Children with DLD may also present with poorer phonological awareness and they may have word retrieval issues (Epstein, Shafer, Melara, & Schwartz, 2014; Laloi, de Jong & Baker, 2017). Children with marked language difficulties may also have difficulties with the morphological aspects of language (Özçelik, 2018), whilst Paradis (2005) explains that children with DLD may have difficulties with suffixes, plurals, verbs and content nouns. Specifically, research illustrates how children with DLD may have difficulties with tense morphology, and thus, tense morphology often represents a clinical marker of DLD (Rice & Wexler, 1996).

According to Weismer and Kaushanskaya (2010), early EAL language development may mirror that of DLD language development. Specifically, children with EAL may make similar errors to children with DLD, such as morphological errors (Weismer & Kaushanskaya, 2010). In fact, a wealth of research has indicated that the language profiles of children with DLD and children with EAL (i.e., in their second language – 'L2') share significant commonalities (Crago & Paradis, 2003; Windsor & Kohnert, 2004). For example, Mak, Tribushinina, Lomako, Gagarina, Abrosova and Sanders (2017) claimed that children with EAL may have less developed language skills than their typically developing monolingual peers. Underdeveloped language skills may

be attributed to insufficient exposure to their first language (i.e., 'L1'), non-native L2 instruction and cross-linguistic issues, inter alia (Mak et al., 2017). Paradis (2005) also argued that children with EAL and DLD should be typically developing in all areas outside of language, further increasing the likelihood of erroneous diagnoses.

One of the most noteworthy theories on EAL language development is that of Cummins' (2000, 2008). Cummins (2000, 2008) stated that language acquisition may follow two distinct trajectories including Cognitive Academic Language Proficiency (CALP) and Basic Interpersonal Communication Skills (BICS). The former refers to a child's ability to display competency in both written and verbal academic language (Cummins, 2000). CALP often represents the more complex of both language acquisition pathways, whilst BICS refers to more informal, conversational language (Cummins, 2000). CALP is often acquired later than BICS, and subsequently, children may present with more apparent language difficulties in school than in more informal contexts (Cummins, 2008). Research suggests that it could take a child approximately nine years to achieve proficiency in an additional language, with the development of CALP taking longer than the development of BICS (Cummins, 2008; Slama, 2012). Cummins (1984) stated that by failing to make a distinction between BICS and CALP, professionals may engage in inaccurate psychological assessments of children with EAL. Perhaps most notably, research has highlighted how a misunderstanding of the processes and theories underlying second language acquisition can lead to further misidentification of DLDs amongst the EAL population (Ferlis and Xu, 2016). In fact, it has consistently been confirmed that the training of teachers in EAL theories is inadequate (Lyons, 2010; Murtagh & Francis, 2012).

3.0. The Policy Context

It appears as though difficulties in assessing children with EAL may be exasperated by a dearth of EAL policy provision. The Organisation for Economic Co-operation and Development (OECD) conducted a review of Irish policies and practice pertaining to the educational provision for children from migrant backgrounds (Taguma, Kim, Wurzburg & Kelly, 2009). Firstly, in their report, Irish policy initiatives and efforts were commended in terms of language support provision, as well as the availability of language assessment toolkits for ascertaining language proficiency (Taguma et al., 2009). These efforts were reflected in the primary (National Council for Curriculum and Assessment; NCCA, 2006) and post-primary (DES, 2012) guidelines for teachers and

schools. The documents highlighted the importance of assessing children from EAL backgrounds, albeit they provided tenuous advice on how to assess this population. The NCCA (2006) encouraged teachers to be apprehensive in making assumptions about a child's ability based on results from standardised tests, as underperformance on these tests may be attributed to a lack of language proficiency. Both documents also advocated the use of language proficiency toolkits. The DES (2005) have also published guidelines entitled, 'English as an Additional Language in Irish Primary Schools: Guidelines for Teachers', which highlights some assessment and pedagogical approaches for teachers working with children who have EAL.

The misdiagnoses of children from minority backgrounds may, therefore, be surprising given the recent impetus towards assessment both nationally and internationally. However, the emergence of the new model of Special Educational Needs (SEN) in Ireland, as per circular 0013/2017 (DES, 2017), has had a direct impact on children who would previously have received language support under a more General Allocation Model and EAL Model. According to the recent Circular 0013/2017 (DES, 2017), where previously children with EAL would have received support from a Language Support Teacher, such additional support is now provided by Special Education Teachers. Again, this may serve as a prompt to teachers to provide 'Special Education' to children with EAL, rather than specialised language support. Furthermore, despite the plethora of assessment documents, references to the assessment of children with EAL are sparse. It appears that the lack of clear guidelines at a policy level has been reflected at a practice level. In post-primary schools, a DES Inspectorate report concluded that 'only two-fifths of schools had effective assessment procedures for EAL students in mainstream subjects' (DES, 2012, p. 40). At primary level, the Inspectorate noted that 'there was a critical absence of comprehensive assessment data in schools' (DES, 2012, p. 51). Similarly, the 2009 OECD report stated that 'there is scope for improvement' in terms of the assessment of children with EAL in Irish schools (Taguma et al., 2009, p. 31). They called for the translation of ambitious policy directives into practice, with specific reference to the continued development of assessment tools for children with EAL. In fact, Murtagh and Francis (2012) found that Irish teachers were also concerned about the potential overidentification of SEN amongst children with EAL, with explicit reference to a lack of appropriate assessment tools.

4.0. Alternative Assessment Methods?

It appears as though assessments of children with EAL may therefore be hampered by a lack of policy provision, professional misunderstanding of central theories on EAL language development, as well as the prominence of language-based assessments for assessing, which often focus on language-based similarities between children with EAL and DLD rather than their differences. Should assessments, therefore, focus on the underlying differences between children with EAL and children with DLD? A thorough review of the literature revealed that children with DLD, typically, have impaired cognitive functioning in terms of verbal working memory, processing speed and attention (Sandgren & Holmström, 2015), whilst typically developing children with EAL should not have impaired functioning in these domains (Laloi et al., 2017; Marton & Schwartz, 2003; Sandgren & Holmström, 2015). Laloi et al. (2017) suggest that the non-verbal measures of cognitive differences could subsequently serve as diagnostic indices of a DLD in an EAL population. Given that such assessment tools would require non-verbal responses or the use of novel words (i.e., nonsense words), they could be used with a heterogenous population that is reflective of Ireland's diverse population.

5.0. Theoretical Perspectives

There are several theories which support the hypothesis that children with DLD may have different cognitive profiles to children with EAL. Inherent to our understanding of DLD are Limited Processing Capacity (LPC) theories of language development (e.g., Kail, 1994; Montgomery, 2000). LPC theories of DLD delineate that language difficulties may be the result of cognitive impairments (Paradis, 2010). Sandgren and Holmström (2015) argued that learning a second language may, in fact, improve upon these domain-general cognitive aspects, rendering children with EAL with potentially more cognitive advantages than monolingual children. Leonard, Weismer, Miller, Francis, Tomblin & Kail (2007) proposed that LPC theories are triarchic in nature. Firstly, Kail and Salthouse (1994) proposed that the computational aspect of memory is restricted; in other words, there is a limited space for storing information. Secondly, Kail and Salthouse (1994) posited that limited processing is akin to expending fuel or energy prior to completion of a task. Finally, it was proposed that information is vulnerable to corrosion if it is not processed in prompt manner (Kail & Salthouse, 1994). Leonard et al. (2007) proposed that the first two perspectives may represent working memory, whilst the third perspective of time represents processing speed.

5.1. Verbal working memory. Verbal working memory refers to an individual's ability to temporarily retain and transform information while performing mental operations (Pham & Hasson, 2014). With an expansive research base, Baddeley's (1986) model of working memory aimed to explain the concept of working memory in terms of both a phonological (i.e., phonological loop) and visual spatial storage system. Empirical evidence suggests that children with DLD have particular difficulties with the processes associated with the phonological loop (Gathercole & Baddeley, 1990). Boerma and Blom (2017) explained that due to deficits in the phonological mechanism of working memory, children with DLD often struggle with repeating nonwords. Conversely, typically developing children with EAL usually do not have difficulties with verbal working memory mechanisms (Sandgren & Holmström, 2015; Leonard et al., 2007) or nonword repetition (Boerma & Blom, 2015).

5.2. Processing speed. There are also several theories that explain why children with DLD may have delayed processing speed (e.g., general slowing hypothesis; Kail, 1994). Processing speed typically refers to an individual's ability to process visual information with speed and with reasonable accuracy (Jacobson et al., 2011). Kail (1994) argued that children with DLD typically have slower Response Times (RTs) than typically developing children. The processing speed difficulties evident in children with a DLD are often described by the general slowing hypothesis (Kail, 1994) and the temporal processing theory of DLD (Tallal, Miller & Fitch, 1993). Kail's (1994) general slowing hypothesis suggests that children with DLD often have difficulties with overall cognitive processing, whilst children with DLD would also have slower RTs across most tasks in comparison to same-aged typically developing peers.

5.3. Cattell-Horn-Carroll theory and specific learning difficulty. Interestingly, the deficits associated with DLDs appear to be aligned somewhat to those associated with Specific Learning Difficulties (SLD). For example, Smith-Spark and Fisk (2007) suggested that children with SLDs may have deficits in verbal working memory and processing speed. Recent advancements in the assessment of children with SLDs may be applicable to the assessment of children with DLD. Such an advancement is related to the Cattell-Horn-Carroll (CHC) theory of intelligence (McGrew, 1997). Ultimately, CHC Theory (McGrew, 1997) proposed that intelligence was composed of ten broad abilities and 70 narrow abilities (Flanagan, 2007). CHC theory has directly influenced what is known as the 'third option(s)' of SLD identification, which focusses on a child's

performance across a broad range of cognitive abilities, in particular those associated with SLD (Flanagan, Fiorello & Ortiz, 2010). These recent advancements in SLD assessment may have implications for the assessment of a suspected DLD in children who have EAL. Specifically in light of the evidence which suggests that children with DLD may have specific cognitive difficulties, namely, in verbal working memory and processing speed.

6.0. Aim of the Research

The overall aim of the research was to ascertain if tests of verbal working memory and processing speed could distinguish between children with EAL and children who had a DLD. Such tests could offer language-reduced methods of assessing a diverse range of children with EAL.

7.0. Research Questions

1. Can assessments of verbal working memory and speed of processing aid in differentiating between children who have EAL and children who have DLD?
2. Will children with DLD perform significantly lower on assessments of processing speed and verbal working memory than children with EAL and monolingual children?
3. Will children with EAL and monolingual children have similar processing speed and verbal working memory scores?
4. Can processing speed and verbal working memory scores detect the presence or absence of a DLD?

8.0. Methodology

In order to address these research questions, the following methodologies were informed both by a (post)positivist philosophical paradigm and by methodologies employed in previously reviewed research (Dollaghan & Campbell, 1998; Leonard et al., 2007).

8.1. Design. The research consisted of a quasi-experimental design. There was one independent variable with three levels (i.e., children who had DLD, typically developing children who had EAL and children who were typically developing and monolingual) and three dependent variables (i.e., total processing speed score, total percentage of correct processing speed responses and total verbal working memory score).

9.0. Participants

Using a purposive sampling technique, fifty-six participants were initially recruited but following piloting (n = 5) and the application of exclusion criteria (n = 9), the remaining participants included 12 monolingual children with DLD, 15 children with EAL and 15 typically developing monolingual children. Participants were assigned to either the DLD group, the EAL group or the monolingual group based on the criteria presented in Appendix 1. The strict assignment of participants to each grouping ensured that any potential confounder variables, which may have impacted on processing speed and verbal working memory, were controlled for, insofar as possible.

Typically developing children who were monolingual and children who had EAL were excluded if they had an SLD, or if they received a score below the 10th percentile on a pseudoword reading test. However, children who had both DLD and SLDs were included as evidence suggests that both disorders may essentially be different labels for the same difficulties (Tallal, 2004). Children were eligible to participate in the study if they had an overall cognitive ability of 85 or over. A cut-off score of 85 and over was chosen as this range of scores was relative to broad average norms. This cut-off point was also chosen so as to ensure that any deficits in verbal working memory or processing speed were not attributed to an intellectual disability or general learning disability.

9.1. Demographical information. For the EAL and monolingual group, all eligible children were deemed free from any vision, motor, language or learning impairments. Literacy and cognitive testing also revealed that these children had low average and above standard scores, indicating that a specific or nonspecific learning difficulty was unlikely. For the DLD group, children were free from vision and motor impairments and did not have another SEN (i.e., except for SLD). Cognitive testing also revealed that a general learning difficulty was unlikely amongst this group.

9.1.1. Monolingual group. Of the 15 children included in the monolingual group, six were male and nine were female. Participants' ages ranged from seven years four months to eight years eight months, with an overall mean age of seven years nine months. All children were fluent in English, whilst it was reported that three children spoke a second language (i.e., Irish), albeit these children were not fluent in the second language. All children spoke English at home and at school, whilst all of the participating children's parents had English as their first language. Maternal education ranged from primary level education to professional or graduate level, where 6.7% of mothers' highest

level of education received was at primary level, 26.7% was at post-primary level, whilst 50% of mothers had some form of college education. In terms of paternal education, 46.7% of fathers of monolingual children had some college education, whilst the remainder completed primary (i.e., 6.7 %) and post-primary (i.e., 33.3%) education.

9.1.2. English as an additional language group. Fifteen children with EAL were eligible for inclusion in the research and these children comprised of five males and 10 females. Participants' ages ranged from seven years one month to nine years six months, with an overall mean age of seven years eight months. Regarding parental levels of education, 20% of fathers had received education as far as post-primary school, whilst the remainder of participants' fathers had received at least some college education (80%). Maternal levels of education included 6.7% of mothers who received primary education, 13.3% of mothers who received post-primary education, with the remainder of parents receiving at least some college education (80%). The majority of children in the EAL group were born in Ireland, with other children born in India (n = 1), Lithuania (n = 2) and Poland (n = 1). Eligible children's English language proficiency ranged from A1.2. to A2.2, indicating low levels of English proficiency. Parent reports suggested that participating pupils had a variety of first languages and second languages including Urdu, Tigrina, Mandarin, Arabic, Indian, Malayiam, Hindi, Lithuanian, Russian, Somali, Punjabi and Polish. All participating children had received language support and had been identified as, and registered as, 'EAL' learners officially by the schools.

9.1.3. Developmental language disorder group Participants included six males and six females, with ages ranging from seven years three months to nine years seven months, with an overall mean age of eight years one month. In terms of paternal levels of education, of the parents who reported this information, 75% had received a post-primary education, whilst the remainder (i.e., 25%) had received some college education. Maternal education comprised of 58.3% of mothers who reached post-primary level of education, with the remainder receiving some college education (41.7%). Five children were recruited from language units, whilst seven children were recruited from mainstream primary school classes. All children had received formal diagnoses of DLD (i.e., formerly known as Specific Language Impairment or Specific Speech and Language Disorder), according to teacher or parental reports. It was reported that one child had also received a diagnosis of dyslexia, whilst another child was reported to have hypermobility and

sensory issues. Hypermobility and sensory issues were not deemed severe enough to impact on performance on the assessments.

10.0. Materials

10.1. Demographic questionnaires. A demographic questionnaire was provided to each parent/guardian of participating monolingual children with a DLD and typically developing monolingual children, in order to establish if the child was eligible for inclusion in the study. These questionnaires also gathered essential demographical data on each participant and their parents. In order to gather demographical data and to ascertain the language exposure of children with EAL, an adapted version of the adult form of the Language and Social Background Questionnaire (LSBQ) (Anderson et al., 2018) was provided to parents of children with EAL.

10.2. Nonverbal Intelligence. Nonverbal intelligence was measured using the Block Design and Matrix Reasoning subtests of the WASI-II (Weschler, 2011). The WASI-II is an individually-administered abbreviated test of intelligence that can be used with individuals ranging in age from six years old to 90 years old. The WASI-II (Weschler, 2011) comprises four subtests, including Block Design, Vocabulary, Matrix Reasoning and Similarities. Irby and Floyd (2013) suggested that the Block Design and Matrix Reasoning subtests of the Weschler intelligence tests can provide a measure of Fluid Reasoning. Fluid intelligence is less dependent on prior experience and prior knowledge than crystallised intelligence (Cattell, 1971). Weiss et al. (2013) presented the g-loadings of Block Design (.660) and Matrix Reasoning (.660) based on a four-factor model of the WISC-IV, a test from which the WASI-II is in part derived (Weschler, 2011), whilst an accumulation of evidence suggests associations between ‘g’ and Matrix Reasoning and Block Design on various Weschler tests (Canivez, 2014; Vernon, 1983). Therefore, it may be interpreted that Block Design and Matrix Reasoning represent a robust measurement of ‘g’. Participants’ nonverbal intelligence was expressed by a Perceptual Reasoning score.

10.3. Literacy assessment. All participants’ literacy attainments were individually measured by the researcher using the pseudoword probe sheet from the WIAT-III (Weschler, 2009). According to Weschler (2009), the WIAT-III is a standardised achievement test that can provide both norm-referenced and criterion-referenced scores for children aged between four years old to 19 years 11 months. The

Pseudoword Decoding subtest required participants to read a list of nonsense words of increasing difficulty from a probe sheet (Weschler, 2009). Although the pseudowords were derived from English-consistent morphemes (McCrimmon & Climie, 2011), pseudowords as opposed to 'real' words were used so as to present a fairer chance to children who had EAL. For example, with regards to language tasks, Kohnert, Windsor and Yim (2006) argued that pseudowords (i.e., nonsense words) are not dependent on the participants' experiences and thus 'de-emphasise the role of prior knowledge' (p. 19). Essentially, these may be less biased as they are 'equally unfamiliar to participants (such as nonsense words that do not exist in the test language)' (as cited in Kohnert et al., 2006, p. 20).

10.4. Processing speed. A test of processing speed adapted from Leonard et al.'s (2007) study was run using SuperLab 4.5 (Cedrus Corporation, 2011). The processing task was presented on a Packard Bell Easy Note TV laptop with a screen size of 15.6 inches. Each visual stimulus was approximately 3 x 4 cm or 3 x 3 centimetres (cm) and each stimulus was presented horizontally in the centre of the screen. There was approximately 1.5 cm punctuating each of the five stimuli, whilst a wider gap of approximately 3 cm remained between the target and other five stimuli. However, measurements varied to some degree throughout the trials. The target stimulus was presented at the left side of the screen, whilst the other five stimuli were presented in a row to the right of the target. The visual stimuli used in the Visual Search Task were originally developed by Kail, Pellegrino, and Carter (1980) and had previously been used by Miller, Kail, Leonard and Tomblin (2001). The task differed somewhat from Leonard et al.'s (2007) and Miller et al.'s (2001) task, as the nonsense symbols were grouped by similarity (i.e., spatial arrangements of the one symbol per trial). The task was slightly adapted in order to increase the difficulty of the tasks, in order to potentially increase the discriminatory abilities of the task in distinguishing between those with higher and lower processing speed skills.

For this task, nonsense figures were used as is evident in Figure 1. Participants were shown a target (i.e., nonsense visual) and then were advised to scan a five-figure array of other nonsense images. The participant responded to whether or not a stimulus was present by either striking a red key (i.e., target not present) or a green key (i.e., target present) as quickly as possible. The green key (i.e., the 'g' key) was marked by a green circular sticker, whilst the red key (i.e., the 'j' key) was marked by a red circular sticker.

The researcher modelled the completion of two trials and indicated the search process (e.g., scanning left to right) using nonverbal cues. Participants then completed six practice trials. In total, participants therefore completed 36 trials.

Figure 1. Visual search task. This figure represents one of the visual search tasks used to ascertain processing speed.

10.5. Verbal working memory. The Nonword Repetition Test (NRT, Dollaghan & Campbell, 1998) was used to assess verbal working memory using non-words or nonsense words. Derived from Baddeley's (1986) notion of the phonological loop (Im-Bolter et al., 2006), evidence suggests that poorer performance on nonword repetition tasks often means that children have reduced verbal working memory (Gathercole, Willis, Baddeley & Emslie, 1994). Chiat and Polišenská (2016) argued that tests like the NRT ensure that the role of prior knowledge is insignificant and therefore children with EAL and those who have a smaller vocabulary are not disadvantaged. For the NRT, the researcher played a recording provided by Dollaghan and Campbell (1998) of 16 nonsense words of increasing length and asked the child to repeat it back immediately. The instructions and nonwords were pronounced in a neutral American female accent. The researcher phonetically transcribed the sounds as each child repeated them back. Please see Dollaghan and Campbell (1998) for more details on scoring procedure.

11.0. Procedure

The procedure for the study was partly in line with that of Leonard et al. (2007), whilst the procedure adopted by Dollaghan and Campbell (1999) was also adhered to closely. The study was preceded by pilot testing. The procedure followed two stages; a screening stage and an assessment stage. In total, the testing phases (i.e., both at the screening stage and the processing speed and verbal working memory assessment stage), took 25 to 40 minutes to administer depending on the cognitive ability, age, behaviour and test-taking ability of the participant. The assessments were individually-administered by the researcher in a quiet room in the schools. The researcher had been trained in test administration.

The assessments were administered to the child in the same order subsequent to obtaining child assent. The screening stage included initial screening by the participating schools, parental completion of the demographic questionnaires, as well as prerequisite testing. Initial principal screening involved school principals only providing the relevant documentation to parents of children who met inclusion criteria. This was followed by parental completion of the LSBQ (Anderson et al. 2018) or demographic questionnaire (i.e., for monolingual participants). Participants were subsequently excluded at this stage if parental questionnaires indicated that the participant did not meet inclusion criteria. Prerequisite testing involved the individual administration of the WASI-II and WIAT-III, where the latter occurred immediately following completion of the WASI-II. However, children who did not receive a score of 85 or over on the WASI-II did not complete the WIAT-III. Participants proceeded to Stage 2 regardless of results on the WIAT-II, as literacy difficulties were controlled for in later analyses.

Stage 2 incorporated the tests of processing speed and verbal working memory as described in sections 10.4 and 10.5. Participants were instructed to sit in front of the laptop, whilst the Visual Search task was run. This was followed by the NRT, where participants were asked to listen carefully as the instructions and subsequent nonsense words were played via the researcher's laptop.

12.0. Data Analysis

12.1. Preliminary analyses. Descriptive statistics revealed that the Processing Speed data, as measured using RT data, were not normally distributed, as indicated by a *p* value of 0.01 on the 'Kolmogrov-Smirnov' test. As well as considering the significant value on the Kolmogrov-Smirnov test, the Q-Q Plot (see Figure 2 below) revealed that data were positively skewed (i.e., data were leptokurtic, where the Skewness value was 2.411), as is typical in RT data (Whelan, 2008). Furthermore, data were highly peaked (i.e., kurtosis is 11.483) and a number of extreme scores (i.e., outliers) were evident. Evidence suggests that RT data (i.e., data obtained from processing speed task), that are not normally distributed, are therefore often best interpreted using a 'Log Transformation', in line with the Box-Cox procedure (Box & Cox, 1982; van Zandt, 2002; Whelan, 2008). A log transformation includes transforming raw data to logged data and then back to its original format (e.g., in milliseconds) using the exponential log function. This process attempted to make the data more normal and less skewed, allowing for further analysis of RT scores. The aging literature argues that transforming raw scores

to log scores can increase the power of an analysis to detect differences between groups (Doksum & Wong, 1983; Rasmussen & Dunlap, 1991). In line with Whelan's (2008) suggestions, RTs under 200 milliseconds were also eliminated, as these may not have presented a 'thoughtful response' from the participant. An upper cut-off point was not established as the Visual Search/Processing Speed task also measured attention. As is evident in Figure 3, the log transformation process essentially ensured that the data were more normal and interpretable.

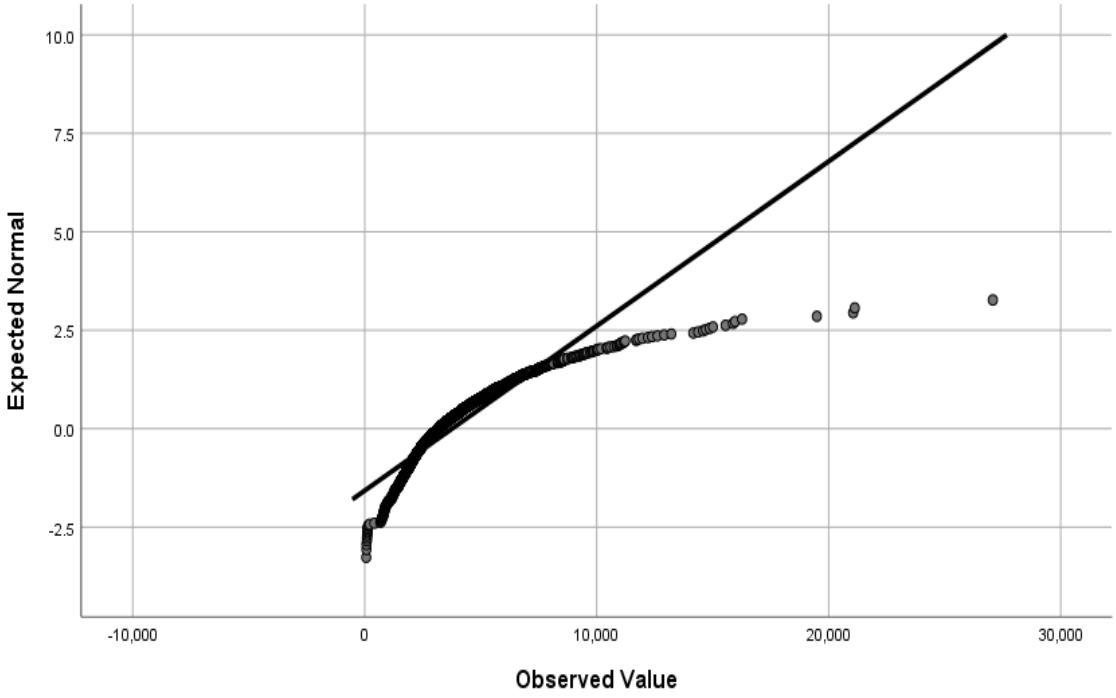


Figure 2. Q-Q Plot showing distribution of Processing Speed/Reaction Time scores. This figure shows that data were not normally distributed.

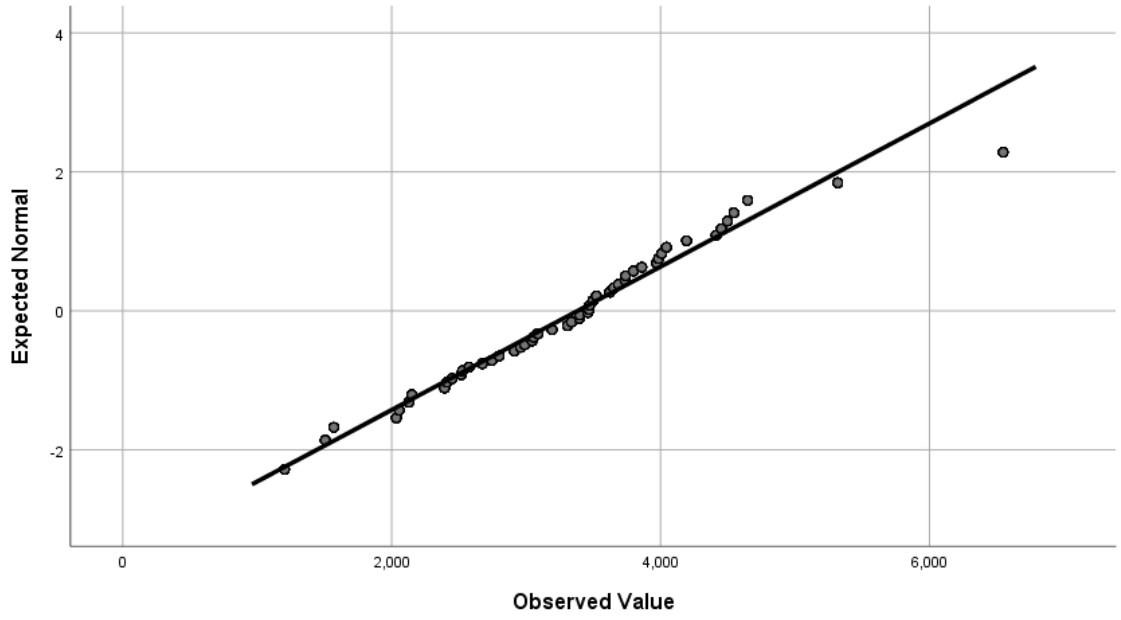


Figure 3. Q-Q Plot showing distribution of Processing Speed/Reaction Time scores following the Log Transformation process. This figure shows that data were more normally distributed following the transformation.

After log transforming the processing speed scores, an arcsine transformation was employed for error rate data as a Kolmogrov-Smirnov test showed that the distribution of accuracy data was statistically different from a normal distribution, where $p = 0.03$. This allowed for the accurate calculation of non-normal accuracy data. Evidence suggests that an arcsine transformation can be used to normalise data and reduce variance of percentage data (Sokal & Rohlf, 1981).

12.2. Descriptive statistics. A series of independent samples *t*-tests revealed that there were no differences in the mean performance of males and females across perceptual reasoning, t (40) = 1.022, p = .313, literacy, t (40) = -1.327 p = .192, Verbal Working Memory, t (40) = -.099, p = .922, Processing Speed, t (40) = -.203, p = .840, and Processing Speed accuracy, t (40) = -.771, p = .445 scores. As is evident from Table 1 below, there were no significant differences in the performance of age groups across any of the age ranges. A one-way ANOVA also showed that the average age of each group did not differ significantly.

Table 1.

ANOVAs showing that there were no age differences in terms of performance for all participants.

Dependent variable	Sum of Squares	df	Mean Square	*F*	Signifiance Value
Perceptual Reasoning (measured using WASI-II)	219.74	4, 41	59.94	.564	.817
Literacy (measured using pseudoword decoding)	1228.89	4, 41	307.25	1.406	.251
Verbal Working Memory (measured using as the TOTPPC from the NRT)	591.03	4, 41	147.758	1.446	.238
Processing Speed (measured using Visual Search task)	1166122.71	4, 41	291530.676	.235	.917
Processing Speed accuracy (measured using Visual Search Task)	.839	4, 41	.210	.807	.528

There were significant differences in the literacy scores at the $p < 0.01$ level between the DLD group (M = 82.83, SD = 10.86), EAL (M = 109.2, SD = 11.01) and monolingual groups (M = 104.47, SD = 9.32), F (2, 39) = 23.64, $p < 0.01$. Post-hoc tests (i.e., Tukey test) showed that children with DLD performed significantly lower than their EAL ($p < .001$) and monolingual peers ($p <. 001$) on literacy (i.e., pseudoword decoding tasks). Field (2009) argued that controlling for a particular variable in order to find a 'true effect' can sometimes be difficult; often a covariate and a dependent variable cannot be truly independent of one another. As Tallal (2004) has suggested, DLD and literacy difficulties may essentially be different labels for the same difficulty. As a result, literacy cannot be controlled for through an ANCOVA, In terms of general intelligence, a one-way ANOVA showed that there were no differences in the mean Perceptual Reasoning scores between the monolingual (M = 98.73, SD = 10.04), EAL (M = 100.4, SD = 14.72) and DLD groups (M = 92.17, SD = 7..4), F (2, 39), = 245.1, p = .161.

Table 2.

Literacy and Perceptual Reasoning Scores

Group	Literacy	Perceptual reasoning
Overall mean of three groups (*N* = 42)	99.98	97.45
Monolingual (*n* = 15)	104.47	98.73
DLD (*n* = 12)	82.83	92.17
EAL (*n* = 15)	109.2	100.4

Results also indicated that there were not significant differences in the performances of children on the three dependent variables across the five levels of parental education. However, it is interesting to note that maternal level of education had a significant impact on children's literacy scores as measured on the pseudoword test, F (4, 36) = 695.87, p = .011, η^2 = .55 (large effect size, Cohen, 1988). Children whose mothers had a graduate or professional degree (M = 114.2, SD = 11.74) scored significantly higher than children whose mothers had received post-primary education, as their highest level of education (M = 93.85, SD = 12.33), p = .008, and mothers who had received some degree/diploma (M = 94.76, SD = 11.55), p = .033.. As literacy was not considered a dependent variable, level of maternal education is not controlled for in future analyses.

12.3. Verbal working memory. A series of ANOVAs were employed to determine differences between groups for the percentage of one syllable phonemes recalled correctly, two syllable phonemes, three syllable phonemes, four syllable phonemes and Total Percentage of Phonemes Correct (TOTPPC). A one-way ANOVA was firstly conducted to ascertain if there were significant differences in verbal working memory performance on the NRT between the monolingual, EAL and DLD groups. In In terms of TOTPPC, there were significant differences between the three groups, F (2, 39) = 16.397, p < .001, η^2 = .457 (medium effect size, Cohen, 1988). Post-hoc comparisons using the Tukey HSD test showed that there were significant differences between the DLD group (M = 71.03, SD = 10.78) and the EAL group (M = 87.92, SD = 4.97) (p < .001) and the DLD and monolingual group (M = 83.54, SD = 9.32) (p = 0.01). There were no significant differences between the EAL and the monolingual group (p = .285). Therefore, the EAL and monolingual groups' scores on overall verbal working memory did not differ significantly from one another. However, the DLD group scored

significantly lower than the EAL and monolingual groups for overall verbal working memory. Please see bar chart in Figure 4 showing the means of the TOTPPC for each group. Table 3 shows the mean scores across the three dependent variables for each group.

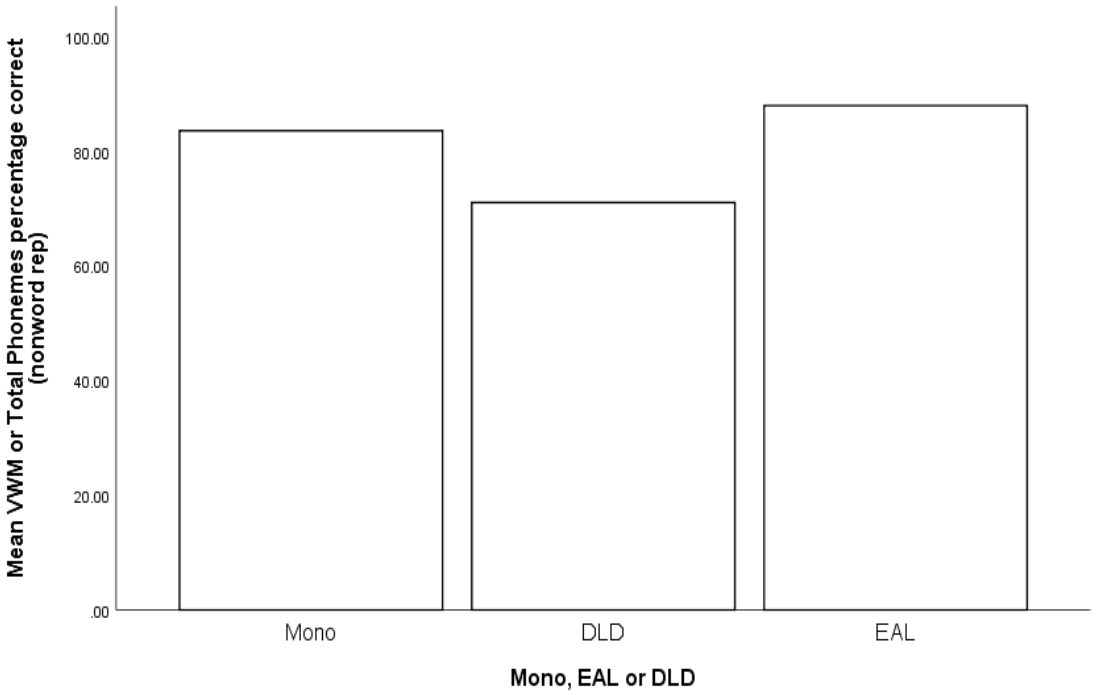


Figure 4. Bar-Chart showing mean scores for each group for Total Percentage of Phonemes Correct scores.

Table 3.

Mean scores across dependent variables

Group		VWM	Processing speed	Accuracy for processing speed in %
Mono	Mean	83.54%	3187.61ms	78.89%
DLD	Mean	71.03%	3601.95ms	61.34%
EAL	Mean	87.92%	3161.74ms	67.62%
Total	Mean	81.53%	3296.75ms	69.85%

Results also indicated that there was a length effect, where significant differences between groups became more apparent with increased demand on working memory (i.e., with increased syllables to be recalled). A Kruskal-Wallis test, using the Exact test, which is recommended when sample sizes are small (Field, 2006), showed that there were not significant differences in the mean ranks between the three groups, in terms of the

Percentage Correct of One Syllable Words, H (2) = 3.67, p = .162. However, one-way ANOVAs showed that there were significant differences between the three groups in terms of Percentage Correct of Two Syllable Words, F (2, 39) = 4.495, p = .018, η^2 = 0.187 (i.e., small effect, Cohen, 1988) Three Syllable Words, F (2, 39) = 7.399, p = .002, η^2 = 0.275 (i.e., small effect, Cohen, 1988) and Four Syllable Words, F (2, 39) = 12.55, $p < .001$, η^2 = 0.392 (i.e., medium effect size, Cohen, 1988). Tukey HSD comparison tests showed that participants with DLD performed significantly lower than the EAL and monolingual groups regarding Percentage Correct of Two, Three and Four Syllable Words.

The diagnostic accuracy of the verbal working memory measure was assessed using sensitivity and specificity calculations. Following generation of a Receiving Operating Curve (ROC) (see figure 5 below), it emerged that the sensitivity of the verbal working memory tool (i.e., NRT Test) for the three groups was 75.5%, meaning that over 75% of participants were correctly identified as having a DLD. Evidence suggests that the sensitivity of an assessment tool should be at least 70% (Glascoe, 2005; VanDerHeyden, 2011). The specificity of the assessment tool was 83.3%, meaning that it accurately identified the absence of a DLD in 83.3% of participants. Interestingly, Glascoe (2005) argued that specificity should be approximately 80% 'to minimize overreferrals' (p. 174). The positive likelihood ratio was 4.500 and the negative likelihood ratio was 0.300. Using McGee's (2002) bedside estimates, the assessment increased the likelihood of accurately detecting a DLD by 25% and decreased the likelihood of misdiagnosing a DLD by 25%.

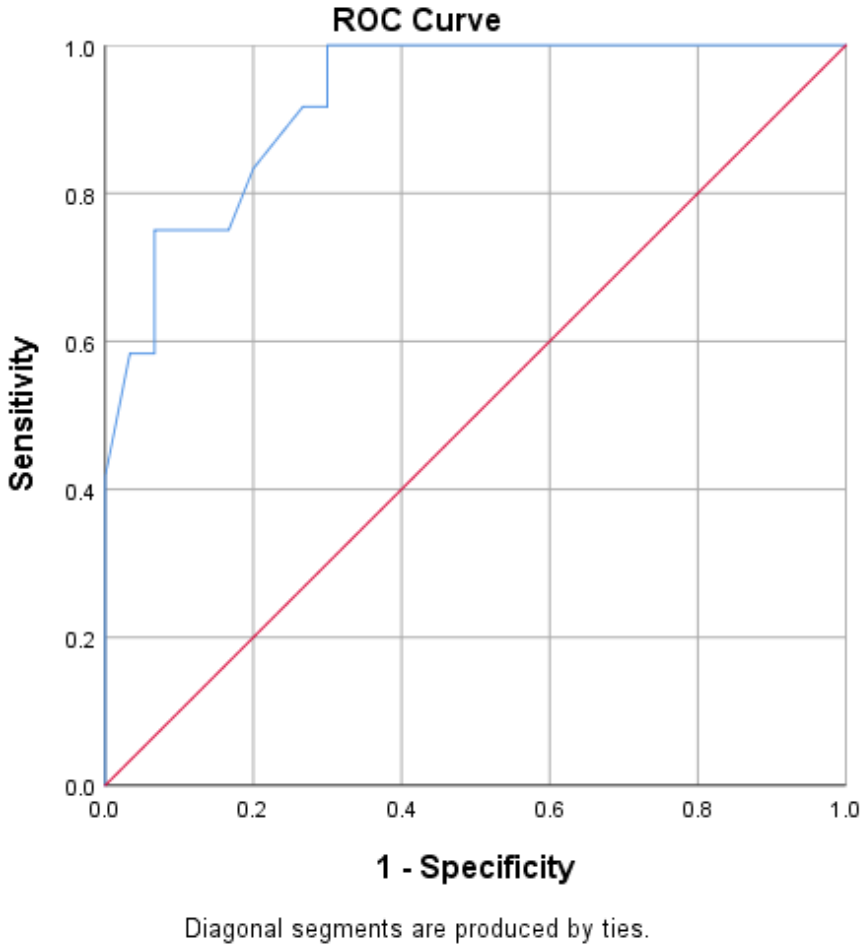


Figure 5. ROC Curve showing the sensitivity and specificity of the Verbal Working Memory measure.

12.4. Processing speed. A series of one-way ANOVAs were conducted to establish if there were significant differences in the performance of the DLD, EAL and monolingual group in terms of processing speed. Using the exponentially logged mean RT score, the means of each group were compared. Results indicated that there were not significant differences in mean RT scores, as measured in milliseconds, of the three groups, F (2, 39) = .674, p = .515. The DLD group (M = 3601.9, SD = 1389.85) scored lower on the processing speed task than the monolingual (M = 3187.61, SD = 965.16) and EAL groups (M = 3161.74, SD = 890.89), but not significantly so. The accuracy of participants' responses were approaching significance, F (2, 39) = 3.23, p = .05. However, the eta squared statistic (η^2 = 0.116) was small (Cohen, 1988), which means that it is unlikely that accuracy can distinguish between the three groups. Although the DLD group's overall accuracy scores (M = 61.34, SD = 15.14) were also lower than the EAL (M = 67.62, SD = 26.57) and monolingual groups (M = 78.89, SD = 17.12), the difference

did not reach significance (p = 0.41). The ROC Curve, shown in Figure 6, indicated that RT was not an accurate measure for assessing the presence of absence of a DLD. An analysis of the co-ordinates of the ROC Curve analysis indicated that Processing Speed, as measured in mean Reaction Time, possessed approximately 40% sensitivity and 45% specificity.

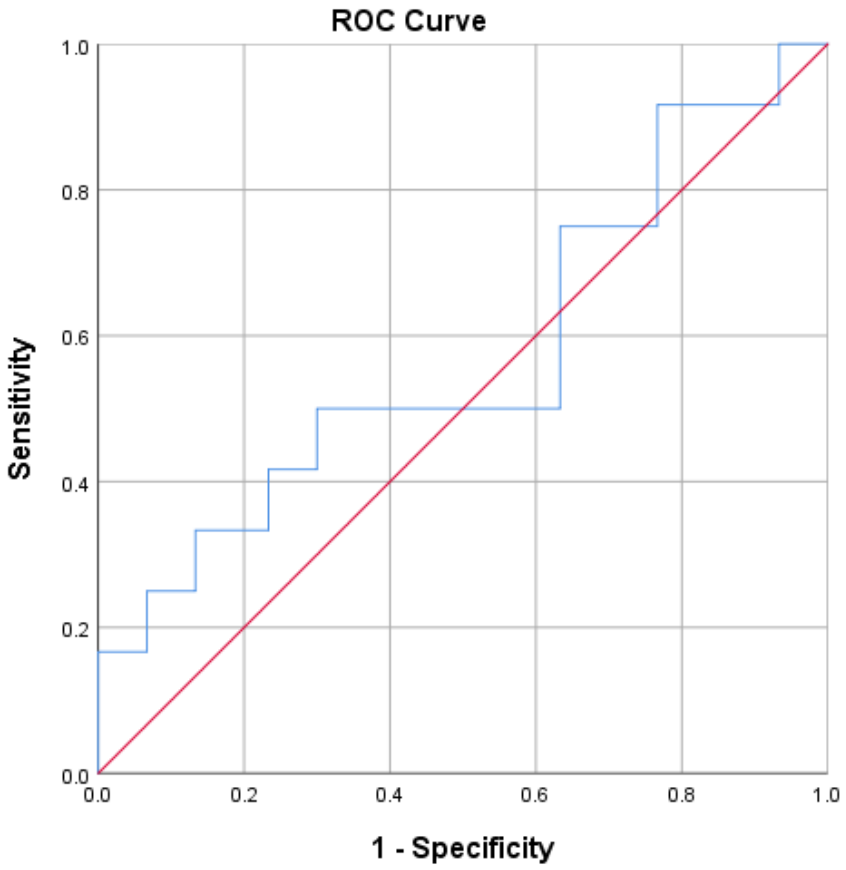


Figure 6. ROC Curve showing the sensitivity and specificity of the Processing Speed measure.

13.0. Discussion

Proponents of language-reduced assessment tools for assessing children with EAL argue that tests of verbal working memory and processing speed can distinguish between EAL and DLD (e.g., Laloi et al., 2017; Marton & Schwartz, 2003; Montgomery et al., 2010; Sandgren & Holmström, 2015). Arising from this evidence, the use of processing speed and verbal working memory measures for this purpose were intuitively and empirically appealing. Findings revealed that assessments of verbal working memory using non-words may discriminate between children who have EAL and children who have DLD, whereas tests of processing speed did not hold such promise.

13.1. Verbal working memory. In line with initial hypotheses, children with EAL had similar verbal working memory performances to children who were monolingual, whereas, as predicted, children who had DLDs scored lower. As well as examining the differences between the EAL, monolingual and DLD groups, it was also necessary to assess the specificity and sensitivity of the verbal working memory tool to establish if the NRT could successfully predict the presence or absence of a DLD. It emerged that the task could predict the presence or absence of a DLD, with some accuracy. These results are unsurprising. Findings were anticipated in light of the abundance of research indicating that children with DLD may have reduced verbal working memory (e.g., Leonard et al., 2007; Sandgren & Holmström, 2015). A 'length effect' was also observed where children with DLD performed comparably well to the monolingual and EAL groups when the nonwords were shorter. However, their performance decreased as the words became more cumbersome. Drawing from information related to the phonological loop and episodic buffer, Baddeley (2000) argued that individuals typically find it easier to recall short words than longer words due to the burdensome task of having to rehearse and recall polysyllabic words. Specifically, Baddeley (2000) argued that the word-length effect may be attributed to time-based decay of information and the limited capacity of a phonemically-based store, again which is related to the LPC model of DLD. Therefore, it is unsurprising that children with DLD's verbal working memory performance became progressively reduced as the words became more complex.

As well as a length effect for the verbal working memory task, it was noted that children who had EAL scored slightly higher than the monolingual group, albeit differences were not outstanding. The research base suggesting that bilingual children may have a cognitive advantage is expansive (Adesope, Lavin, Thompson & Ungerleider, 2010; Warmington, Kandru-Pothineni & Hitch, 2018). Yang (2017) offers compelling evidence that a working memory advantage may come from the need to hold and decode incoming L2 information, which would place increased demand on working memory. Similarly, enhanced executive functioning and working memory may be attributed to a requirement to engage in attentional inhibition of either the child's L1 or L2 depending on the language context or requirements (Zhang, 2018). Interestingly, Sangren and Holm (2015) reported that children with EAL often have superior cogntive performance in terms of executive functioning and verbal working memory than monolingual children, in particular when tasks become increasingly demanding. This is in stark contrast to

children with DLD, where increased complexity (i.e., longer nonwords) resulted in reduced performance relative to the children with DLD and EAL. Perhaps if the nonwords presented to the EAL and monolingual groups further increased in complexity, an EAL cognitive advantage may have been more evident.

13.2. Processing speed measure. Although it appears that verbal working memory may successfully distinguish between the EAL and DLD groups, the processing speed measure offered less promising results. Considering the abundance of research which suggested that processing speed could be a useful marker for differentiating between EAL and DLD, the findings were unexpected. For example, several authors have illustrated how children with DLD typically have slower processing speed than children who do not have a DLD (Johnston & Weismer, 1983; Kail, 1994; Leonard et al., 2007; Miller et al., 2001; Montgomery & Windsor, 2007). Furthermore, in line with LPC theories on language development, it would have been anticipated that the DLD groups' performance on processing speed would have been similar to that of verbal working memory. Interestingly, however, Leonard et al. (2007) subsequently found that processing speed and verbal working memory should be regarded as distinct entities. The findings arising from the current research support these assertions. However, this still does not provide a plausible explanation as to why children with DLD did not have slower processing speed than the EAL and monolingual groups, despite the abundance of research to the contrary. Some researchers have reported findings where processing speed was not a particularly useful clinical marker for DLD. For example, Lahey, Edwards and Munson (2001) disputed the idea that processing speed differed depending on severity of the DLD. Leonard et al. (2007) have also suggested that variability of results across studies may be attributed to the fact that different assessment tools may have examined different processing speed processes. Therefore, it is possible that the assessment tool employed for the current research was not robust enough to detect true differences.

14.0. Implications of Research

The finding that verbal working memory may help to distinguish between EAL and DLD lend themselves to CHC theory and a Pattern of Strengths and Weaknesses (PSW) approach. CHC theory and the PSW approach are closely aligned (Miciak, Fletcher, Stuebing, Vaughn & Tolar, 2014). In line with cognitive frameworks of DLD, a PSW approach dictates that children with learning difficulties may be identified by certain patterns of cognitive strengths and weaknesses (Hale et al., 2010). Miciak et al.

(2014) refers to certain methods that can aid in implementing the PSW approach, including the Cross-Battery Assessment Method (XBA; Flanagan, Ortiz & Alfonso, 2013). Specifically, the XBA method dictates that there should be a deficit in an academic (i.e., language) and cognitive component (i.e., verbal working memory), where theoretically, there is causality between the academic and cognitive components (Miciak et al., 2014). The XBA approach also contends that the child should have an otherwise typical cognitive profile, whilst it advises that clinicians should also consider 'exclusionary clauses' (i.e., economic, language and cultural factors) in determining the presence of a difficulty. Although emerging research exists in support of an XBA method for assessing children with an SLD, more research may be required to investigate if the method is suitable for assessing children with EAL for a possible DLD.

14.1. Clinical implications: Patterns of strengths and weaknesses approach. Therefore, it is recommended that clinicians consider adopting a PSW or XBA approach when assessing children with EAL for a DLD. In order to interpret patterns of strengths and weaknesses, clinicians should reflect on the following (Flanagan et al., 2013).:

1. Is the language difficulty evident across different sources of data?

2. Does the literature support the connection between the language difficulty and the cognitive difficulty?

3. Are there data that would suggest that there may be another underlying cause of the language difficulty?

4. Is other information required before making a diagnosis?

Although the XBA method promotes the place of formal testing, clinicians should adopt standardised language assessments for children with EAL with caution (Rosamond et al., 2003). It may be necessary to consider the bias of assessment tools in the context of the CHC Culture-Language Interpretive Matrix, whereby tools are rated as possessing either 'low', 'moderate' or 'high' cultural and language loadings (Flanagan et al., 2013). The approach also governs that clinicians ascertain potential 'exclusionary factors' which may indicate that a child does not have a DLD. It is therefore advisable that clinicians gather considerable data on certain 'bilingual factors' including age, context of acquisition, social value attributed to language, genetics, language proficiency in all languages and parental education. Phipps and Beaujean (2016) also advocated the use of a Response to Intervention in conjunction with a PSW approach. Therefore, it is

recommended that clinicians aid in the implementation, or promote, the use of a Response to Intervention approach in schools and clinical settings, being mindful that a child with EAL may require up to nine years to become fluent in another language (Cummins, 2000). In line, clinicians may support schools in implementing and monitoring evidence-based interventions (Ehren, 2007). This may be particularly of relevance to Speech and Language Therapists, who may in the future be assigned to Irish schools, and who may wish to aid in the implementation of tiered approaches to intervention in line with international best practice (see McCartney, 2018).

Overall, clinicians should ensure the triangulation of data, namely data obtained through cognitive and language assessments, parental questionnaires and Response to Intervention. The use of standardised assessment tools should also be adopted with caution. The flowchart presented in Appendix 2 does not serve to be prescriptive, but rather a potential guide for educational psychologists and speech and language therapists, when determining if a child with EAL has a DLD of not.

14.2. Educational implications. The theoretical and clinical implications of research findings also have direct consequents for schools. Specifically, arising from the findings presented here, it is recommended that ITE and Continued Professional Development for existing teachers, places an emphasis on the importance of understanding key theories related to EAL language acquisition. In Irish school contexts, it has consistently been confirmed that the training of teachers in supporting children with EAL is often sub-standard (Lyons, 2010; Murtagh & Francis, 2012).The fallacies of standardised testing and the potentially hazardous consequences of teacher over-referrals also warrant exploration, as do the implications of school placements of children with EAL in language classes. Firstly, given the potential deleterious impact of misdiagnosing a child with EAL with a DLD, raising teachers' awareness of theories related to second language acquisition may be the ultimate safeguard for ensuring a reduction of missed or mistaken diagnoses of DLD. Ferlis and Xu (2016) argued that theories such as Cummins' (2008) BICS and CALP Theory, as well as theories such as Sociocultural theory (Vygotksy, 1978) are often misunderstood by teachers. As a result, children with EAL are often victims of unnecessary referrals which can lead to inaccurate diagnoses (Ferlis & Xu, 2016).

At the heart of the current paper is the sentiment that there is an overrepresentation of children with EAL in special education and evidence suggests that such instruction is

not appropriate for children with EAL (Artiles & Ortiz, 2002; Keller-Allen, 2006; Sullivan, 2011). According to Circular 0013/2017 (DES, 2017), special education comprises of 'additional support hours' for children with needs which is often provided in a one to one, small group or team-teaching setting. Rosamond et al. (2003) also argued that whether or not a child is receiving the appropriate EAL support provision can greatly influence whether a child is enabled to access the curriculum. Therefore, if a child receives inappropriate support, such as SEN support, this may further hamper their efforts to develop the additional language. Adding to the possibility that children with EAL may receive SEN support is the revision of the Irish model of SEN (Circular 0013/2017) (DES, 2017), where 'language support teachers' are now regarded as 'Special Education Teachers'. Again, this may add to confusion around the type of instruction that a child with EAL should receive. It is recommended that 'Special Education Teachers' make a distinction between children with EAL, who require specialised, evidence-based language support, and children who have an SEN.

14.3. Policy and economic implications. Of course, it may not be possible for teachers or clinicians to comply with the aforementioned recommendations in the absence of supporting policies. Hutchinson (2018) contended that EAL policy in the UK should follow that of other English-speaking jurisdictions such as Australia and the US. As the US and Australia have longstanding experiences of catering for the needs of children with EAL, it is recommended that Irish EAL policies also follow such procedures. Specifically, Irish policies on EAL should mandate the testing of all children with EAL using language proficiency toolkits, so that a child's language proficiency can be measured using the Council of Europe's Common European Framework of Reference for Languages. In line, children with EAL's Response to Intervention can be measured. This may also facilitate the categorisation of children with EAL, which may lead to more tailored interventions. Hutchinson's (2018) proposed that terms such as 'New to English, Early Acquisition, Developing Competence, Competent, or Fluent' may be useful categorisations. Such categorisations could be streamlined, to some degree, with the language milestones or 'Oral Language Progression Continua' of the new Primary Language Curriculum in Ireland (DES, 2015).

Perhaps the most influential policy advancement in terms of children with EAL is the emergence of Circular 0013/2017 (DES, 2017). It is recommended that the DES Circular 0013/2017 (DES, 2017) is revised in order to cater for the needs of children with

EAL. With this in mind, it is advised that additional support is provided by 'Language Support Teachers' as opposed to 'Special Education Teachers' in line with the now defunct SEN policy (02/05). Such teachers should be provided with appropriate training informed by evidence-driven interventions for improving the language acquisition process.

15.0. Limitations of Research and Directions for Future Research

The main limitation of the current research is that although tests of sensitivity and specificity were conducted on assessment tools, robust tests of reliability and validity were not completed due to the limited time available to conduct research. Other issues with assessment tools may also pertain to the processing speed measure, which may have been overly simplistic and subsequently it may not have detected true differences between the EAL, DLD and monolingual groups (Zhang, 2018). Equally, the use of a nonword repetition task for the EAL group may have had some limitations. Although children with EAL's performance was on par with the monolingual group, Kohnert (2010) expressed some concerns around the use of such a task with children with EAL. It was argued that although nonwords do not possess any real meaning, they are phonotactically derived from English, which may result in a degree of bias against children whose first language differs from English (Kohnert, 2010). As well as this potential issue, the researcher also phonetically transcribed participants' responses on the NRT, where future researchers should be more inclined to record participants' responses using a recording device.

In terms of statistical techniques, the full variability of within-group differences that may have occurred in the group with EAL were not wholly accounted for in data analysis. Evidence suggests that those from lower socioeconomic status or minority ethnolinguistic backgrounds (i.e., where the L1 is not considered a 'high status' language) may have had different language presentations or cognitive profiles to other children with EAL (Han, Brebner & McAllister, 2016). Future research should endeavour to develop inventive methods for analysing within-group differences, with due respect for the variability in languages, dialects and backgrounds that may exist. Statistical analyses focussing on within-group differences was not possible due to another limitation associated with the current research, namely, the limited sample size. Button et al. (2013) argued that small sample sizes can undermine the reliability of studies. Future researchers should endeavour to meet the expectations set out by their initial power analysis, whilst

being mindful of the potential recruitment challenges associated with recruiting clinical subgroups.

16.0. Concluding Remarks

The central message of the current research is that the language difficulties associated with having EAL should not be equated with the language difficulties associated with having a DLD. Unfortunately, as Artiles and Trent (1994) noted in the early nineties, 'disability and cultural difference' are too often 'implicitly equated' (p. 424). Although distinguishing between EAL and DLD is undoubtedly a complex task due to the overlap of language profiles and the prominence of language-loaded assessment tools, there are cognitive differences between the two groups which can be exploited when assessing children with EAL for a DLD. The results from the current research indicate that verbal working memory, namely the NRT, may offer an unbiased method for assessing children with EAL. Although more robust research is required to support findings, the results presented here offer hope that language-reduced assessment tools used in the context of an XBA assessment approach, may serve to lessen equality gaps.

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EMPIRICAL PAPER APPENDICES

Appendix 1. Criteria for assignment to each grouping

Criteria for assignment to each grouping

Children who have DLD	Typically developing children with EAL	Typically developing monolingual children
• Should be monolingual (i.e., English should be their first language). • Should not be bilingual or multilingual. • The child should have a formal diagnosis of DLD. • Should not have any co-morbid diagnoses but can have another Specific Learning Difficulty such as dyslexia. • Should have an average or above average cognitive ability as tested using the WASI-II (i.e., tested by the researcher). • Free from any vision, motor or hearing impairments.	• EAL children must have been exposed to the English language for at least 6 months and no more than 9 years (see Cummins, 2008). • EAL children must have scored in the 'A' range on any aspect of written language, expressive or receptive language (in line with the Common European Framework of Reference for Languages, CEFR) on the Primary School Language Assessment Toolkit in order to be deemed EAL. • Should not have a diagnosis of any SEN including DLD. • Free from any vision, motor or hearing impairments. • Should have an average or above cognitive ability as tested using the WASI-II (i.e., will be tested by the researcher).	• Should be monolingual (i.e., English should be their first language). • Should not be bilingual or multilingual. • Should not have a diagnosis of any SEN including DLD. • Free from any vision, motor or hearing impairments. • Should have an average or above cognitive ability as tested using the WASI-II (i.e., tested by the researcher).

Appendix 2. Flowchart

Adapted PSW approach for determining the presence of absence of a DLD