

Dyslexia Assessment and Reading Intervention for Pupils in Irish-Medium Education:

Insights into Current Practice and
Considerations for Improvement

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DECLARATION

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Dyslexia Assessment and Reading Intervention for Pupils in Irish-Medium Education:

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Emily Barnes

The aim of this research is to analyse the efficacy of (a) dyslexia assessments and (b) reading support provided to immersion pupils and native Irish speakers in Irish-medium education, and to provide considerations for the improvement of current practice. In order to provide the appropriate foundation for this discussion, a broad characterisation of dyslexia is provided, taking into account its differing manifestations across languages. In addition, the orthography of the Irish language is analysed.

In light of the fact that there are currently no standardised assessments for dyslexia in the Irish language, the validity of using standardised assessments designed for English-speaking children on populations in Irish-medium education is examined theoretically. Then, a qualitative study is carried out with educational psychologists to gain insight into their current practice and their perception of its accuracy. The findings suggest that the three participants who work with immersion pupils use standardised assessments for English and take the language background of the child into account in the formulation, while one participant who works with native Irish speakers uses self-developed materials to carry out assessments on this population, but does not have access to any normative data. It is found that while the assessment of immersion pupils presents challenges for educational psychologists, the lack of standardised assessments for Irish leaves Irish native speakers at a particular disadvantage.

In relation to reading support, previous research suggests that Irish language reading support is rarely provided to those with dyslexia in Irish-medium education, due in part to a lack of guidance and training in this regard. In light of this, the literature on reading interventions across languages is examined, in order to establish universal and language-specific elements of effective interventions. Then, some considerations are made for the implementation of a reading intervention in Irish, based on an analysis of the Irish orthography and context. It is hoped that these findings will provide a starting point for language-specific research in these areas.

Dedication

For Nandi

Acknowledgements

Gabhaim buíochas leis An Chomhairle um Oideachas Gaeltachta agus Gaelscolaíochta, a mhaoinigh an taighde seo.

Is mian liom buíochas ó chroí a ghabháil leis an Ollamh Ailbhe Ní Chasaide, agus leis an Ollamh Cúnta Neasa Ní Chiaráin as na ceachtanna go léir, idir foirmiúil agus neamhfhoirmiúil, atá foghlamtha agam le linn an dá bhliain atá caite agam sa tSaotharlann.

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List of acronyms

DES: Department of Education and Skills
 EP: Educational psychologist
 IM: Irish-medium
 IME: Irish-medium education
 L1: First language
 L2: Second language
 NIS: Native Irish-speaking
 SEN: Special educational needs

Chapter One:

Introduction

Assessment and intervention for developmental disorders must be based on an understanding of how a given skill is acquired by typically-developing children, and a sound theory of what causes a deviation from the norm (Snowling & Hulme, 2001). In order to assess for dyslexia, the typical developmental trajectory of literacy acquisition must be established, so that individuals who develop atypically can be identified. There is an extensive research base which describes this trajectory, however it is “largely confined to English speakers reading in their native tongue” (Share, 2008, pp.584). In recent years, cross-linguistic research has shown that there is a large amount of variation in the development of literacy acquisition in different languages, both in terms of the time it takes to become literate and the specific challenges presented to the beginning reader (Seymour, Aro & Erskine, 2003; Ziegler et al, 2010). This cross-linguistic variation is caused by differences in the orthography, or writing system, of each language (Ziegler & Goswami, 2005). Literacy acquisition and dyslexia in the Irish language are the focus of this dissertation, and while there is little empirical research available on the subject, the differences between Irish and English in terms of orthography would indicate that the path to literacy acquisition would look quite different for each language.

The orthography, of course, is not the only factor which differentiates the population of monolingual English speakers from the Irish-speaking population. Children who learn to read in Irish come from two subgroups; children for whom Irish is a first language, and children for whom Irish is an additional language¹. This situation means that some children who learn to read in Irish are learning to read in their first language, while others are learning to read in their second language. In addition, Irish is a minority language, and is subject to significant interference from English, the majority language (Hickey, 2007; Ó Giollagáin & Charlton, 2015), and this must be taken into account in the discussion of literacy development. Because of the dominance of English, native Irish speakers become bilingual at an early age, and children who attend immersion schools are emergent-bilinguals. Bilingualism has an effect on the cognitive mechanisms involved in literacy development (Bialystok, 2009), and so this is another factor which should form part of the conversation on literacy development. In short, there are many variables which indicate that the literacy development of Irish-speaking populations will differ significantly from the literacy development of English-speaking monolinguals; the orthography of Irish, its status as a minority language, the effects of bilingualism and biliteracy, and for non-native speakers, the effect of learning to read in a second language.

The lack of research on literacy-related matters in Irish puts native Irish speakers and immersion pupils with dyslexia at a disadvantage in comparison to their peers in English-medium education. A revised model of provision for children with Special Educational Needs (SEN) is being rolled out in Ireland in the academic year 2017-18, which places more responsibility on the class teacher to identify SEN and devise a plan of intervention (DES, 2017a). The Department of Education and Skills (DES) has

¹ In the most recent census, it was reported that there are over 20,000 in Gaeltacht regions who speak Irish daily, although it is not clear exactly how many of these are native speakers (CSO, 2017). There is a trend towards a decrease in native Irish speakers, while the number of new speakers of Irish is increasing (Houses of the Oireachtas, 2016).

developed guidelines for the new model, which state that the plan of intervention should be informed by “diagnostic assessments in literacy and numeracy” and “results of standardised testing measures such as cognitive ability” (DES, 2017a, pp.9-10). While an appendix to these guidelines state that “Irish-medium education should provide for the needs of all pupils, including those with special needs” (pp. 43), the capacity of educators and other professionals to provide for the needs of those with SEN is limited by the absence of diagnostic assessments and standardised assessments for dyslexia in Irish, as well as guidelines for literacy instruction. This raises inevitable questions of equality on the part of the children in IME and the professionals who work with them. It is inequitable that a state which provides education in two official languages, should only provide appropriate assessment and learning support for the speakers of one of those languages. It is also contrary to the provisions of the Education for Persons with Special Educational Needs Act 2004, which states that the “the provision of resources by the State...shall be such as to ensure the equitable treatment of every child in the state” (Government of Ireland, 2004).

In this dissertation, a broad range of cross-linguistic research is presented to separate universal findings from language-specific findings, and to show the diversity that exists in the development of literacy in different languages. This, along with a qualitative study with educational psychologists, provides a basis for examining the following questions:

- How are immersion pupils and native Irish speakers currently assessed for dyslexia?
- How effective is the current practice in identifying dyslexia in immersion pupils and native Irish speakers?
- What skills and assessment tools would be necessary in order to provide appropriate assessments for dyslexia in Irish?
- What elements should an effective reading intervention for both immersion pupils and native Irish speakers contain?

While cross-linguistic research provides a starting point for this discussion, it is certainly not the intended destination. It is hoped that the findings of this research in relation to assessment and intervention will help to stimulate language-specific research in these areas.

1.1 Aims

The aims of this dissertation are as follows:

- (a) To provide a knowledge base for the discussion of dyslexia assessments and reading interventions in the Irish language, which includes the provision of:
 - (i) a balanced, cross-linguistic perspective on dyslexia, and
 - (ii) a characterisation of the Irish orthography and the challenges it presents readers.
- (b) To examine the current practice of educational psychologists in relation to diagnosing dyslexia in native Irish speakers and Irish immersion pupils, to examine the efficacy of this practice, and provide considerations and recommendations for its improvement.
- (c) To examine literature on elements of effective reading interventions in different languages, for both native speakers and second language learners, and provide some considerations for the implementation of such interventions in the Irish language.

1.2 Outline

The following is an outline of the dissertation, structured in terms of its chapters:

- Chapter Two examines the manifestation of dyslexia in different languages, as well as the current state of knowledge in relation to the causal factors in dyslexia at the cognitive, neurobiological and genetic levels.
- Chapter Three provides an analysis of the orthography of the Irish language due to the bearing that this has on the development of literacy acquisition. In addition, this chapter gives a brief description of Irish-medium education (IME) and examines the approach to literacy instruction in Irish.
- Chapter Four examines the efficacy of current practice in diagnosing dyslexia in immersion pupils and native Irish speakers. This includes a theoretical examination of the validity of using standardised assessments designed for English-speaking children on populations in IME. This is followed by a qualitative study in which educational psychologists are interviewed in relation to their current practice and their perception of the efficacy and accuracy of this practice.
- Chapter Five examines the current provision of learning support for children with dyslexia in Irish, which shows that learning support is rarely provided in Irish literacy for those with SEN. As it was found that guidelines are needed in relation to designing learning support programmes in Irish literacy, the elements of effective reading interventions in different languages are analysed, and based on the characterisation of Irish provided in Chapter Three, some considerations are provided with regard to the implementation of such an intervention in Irish.
- Chapter Six provides a summary of the findings, structured around the questions posed in this chapter. The limitations of this research are discussed and recommendations are made in relation to assessment, intervention and future work in light of these findings.

Chapter Two:

A Cross-Linguistic Perspective on Dyslexia

2.1 Introduction

The aim of this chapter is to provide a characterisation of dyslexia which takes into account the variation in the manifestation of dyslexia in different languages. The scope of this characterisation is broad, and follows the path from the behavioural characteristics of dyslexia to its genetic basis. Definitions of dyslexia are presented first, illustrating the lack of consensus in characterising dyslexia, followed by a cross-linguistic examination of literature of the behavioural, cognitive, neurobiological and genetic features associated with dyslexia.

2.2 Definitions of dyslexia

No conclusive definition of dyslexia currently exists, and it has been noted that a definition of dyslexia may be “tempered by its purpose” (Elliott & Grigorenko, 2014, pp.6), be that research, clinical diagnosis or advocacy. Taking the definitions of dyslexia by the International Dyslexia Association (IDA, 2017) and the Dyslexia Association of Ireland (DAI, 2017) - organisations which disseminate information on dyslexia to the public - it is evident that even within domains which serve a similar purpose, there is significant variation in the conceptualisation of dyslexia:

Definition of dyslexia according to the International Dyslexia Association (IDA):

*“Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by **difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities**. These difficulties typically result from a **deficit in the phonological component of language** that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include **problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge**”*

Definition of dyslexia according to the Dyslexia Association of Ireland (DAI):

*“a specific learning difficulty affecting the **acquisition of fluent and accurate reading and spelling skills**. This occurs despite access to appropriate learning opportunities. Dyslexia is characterised by **cognitive difficulties in (1) phonological processing, (2) working memory, and (3) speed of retrieval of information from long term memory**. Dyslexic difficulties occur on a continuum from mild to severe and affect approximately 10% of the population. People with dyslexia may experience greater stress and frustration as they endeavour to learn, resulting in heightened anxiety, particularly in relation to literacy acquisition. People with dyslexia may also have accompanying learning strengths.”*

At the behavioural level (underlined in green), both the definition of the IDA and the DAI make reference to difficulties in reading and spelling, and the IDA also refer to secondary issues of reduced

reading comprehension and vocabulary levels. At the cognitive level (underlined in blue), both the IDA and the DAI refer to a deficit in phonological processing, and the DAI also characterise dyslexia in terms of issues with working memory and speed of retrieval of information from long-term memory. The IDA definition indicates that dyslexia has a neurobiological origin, while the definition of the DAI considers the emotional toll dyslexia can take.

The differences in these definitions reflect the varying definitions of dyslexia by researchers in the field, and different interpretations of the cognitive factors involved in the reading difficulties which people with dyslexia have. The rest of this chapter aims to investigate these cognitive level factors, as well as factors at the genetic, neurobiological and behavioural level, in order to arrive at a holistic understanding of dyslexia.

2.3 Characterising dyslexia at the behavioural level

At the behavioural level, the manifestation of dyslexia differs depending on the individual and the language in which they read. The concept of orthographic depth is central to the discussion regarding variation among writing systems; deep orthographies (e.g. English) are ones in which there are many ways to spell a sound and many ways to pronounce a string of letters, while shallow orthographies (e.g. Spanish) have a much simpler relationship between letters and sounds. This will be further discussed in §3.2.2. In addition, though the idea of subtypes of dyslexia is not universally accepted, it is considered here.

2.3.1 Primary characteristics

Dyslexia is characterised primarily by inaccurate and tedious reading in deep orthographies such as English, while in shallow orthographies people with dyslexia usually show a high level of accuracy but a slow pace of reading (Landerl, Wimmer & Frith, 1997; Davies, Cuetos & Glez-seijas, 2007 ; Furnes & Samuelsson, 2011). Dyslexia also affects spelling ability²; in English, analysis of spelling errors by children with dyslexia shows that they seem to make similar errors to their younger typically-developing counterparts, including phonetically-influenced errors on consonants, simplistic single-letter spellings of phonemes and omissions of unstressed vowels (Bourassa & Treiman, 2003). In more shallow orthographies, children with dyslexia tend to acquire the basic letter-sound correspondences and spelling errors seem to be phonologically-plausible, and so are confined to words in which there is some unpredictability in the spelling (Angelelli et al, 2010; Wimmer & Mayringer, 2002).

2.3.2 Subtypes of dyslexia

There is some evidence for the existence of distinctive subtypes of dyslexia, and although the subtypes have been conceptualised in different ways by different researchers (see Vellutino & Fletcher, 2005, for an overview), the classifications essentially relate to whether a person has a poorer ability to read non-words (based on letter-to-sound rules for the language e.g. *lape*) or exception words (which do not adhere to the letter-to-sound rules of a language e.g. *yacht*). Those with difficulty reading non-words are referred to as having “phonological dyslexia” i.e. they cannot implement the letter-to-sound rules, while those who have trouble reading exception words are said to have “surface dyslexia” i.e. they cannot read words which do not obey rules they have learned (Castles & Coltheart, 1993). These

² Some researchers would prefer spelling deficits to be considered separately to the disorder (e.g. Elliott & Grigorenko, 2014) this seems like an unnecessary distinction in most cases and, spelling is considered when diagnosing dyslexia (Pennington, 2008) and included in definitions in research (e.g. Vellutino, Fletcher, Nolan & Scanlon, 2004), as well as in advocacy groups (see, for instance the IDA and DAI definitions at the start of this chapter).

deficits are paralleled in the spelling patterns of each subtype (Curtin, Manis & Seidenberg, 2001). These subtypes however seem to exist along a continuum rather than being categorical (Peterson, Pennington & Olson, 2013), and it has been suggested that this reflects the severity continuum of the disorder, with poorer exception word reading (surface dyslexia) at the less severe, and poorer non-word reading (phonological dyslexia) at the more severe end of the continuum (Griffiths & Snowling, 2002). Alternatively, it has been theorised that the two subgroups are qualitatively different, with surface dyslexia signalling a delayed developmental trajectory, and phonological dyslexia signalling a deviant developmental trajectory (Sprenger-Charolles, Siegel, Jimenez, & Ziegler, 2011). In keeping with this, it was found that surface dyslexia had a stronger environmental contribution, while phonological dyslexia had a stronger genetic contribution (Castles, Datta, Gayan & Olson, 1999).

2.3.3 Resultant and co-morbid characteristics

Individuals with dyslexia may have accompanying literacy issues which arise from the core characteristics, for example, fluency issues may arise from the basic decoding deficits (see § 5.3.2). On another note, although academic definitions of dyslexia rarely make reference to the emotional toll dyslexia can take, people with dyslexia are often affected with poorer self-esteem in academic and social domains (Humphrey & Mullins, 2002; McNulty, 2003). Humphrey and Mullins (2002) emphasise the link between self-esteem, motivation and later achievement.

Some scholars in the field hold that other characteristics, such as a deficit in general motor skills or poor muscle tone, are characteristic of dyslexia (e.g. Nicholson, Fawcett & Dean, 2001). However, given the high level of comorbidity between dyslexia and other developmental disorders such as ADHD and dyspraxia (Habib, 2000; Pennington, 2006), traits which are thought to be characteristic of dyslexia at the behavioural level may pertain to a comorbid disorder.

2.4 Characterising dyslexia at the cognitive level

Deficits in relation to various cognitive constructs - Phonological Awareness (PA), Rapid Automatized Naming (RAN), and Verbal Short-term memory/Working memory (VSTM/WM) – have been found to be characteristic of dyslexia, and are thus included in dyslexia assessments. There is an abundance of theories which have been proposed to account for the cognitive deficits shown by people with dyslexia at the cognitive level. The discussion in this section, however, is shaped around the tasks, and various theories are considered in the interpretation of these tasks. Many more theories exist than are discussed in this section, and a paper by Vellutino and colleagues (Vellutino, Fletcher, Nolan & Scanlon, 2004) can be consulted for an overview of these.

There is much variation in the cognitive deficits seen in individuals with dyslexia (Menghini et al, 2010). Variation between individuals is even more pervasive than is perceptible from the literature as often only between-group differences are reported (Gottardo, Pasquarella, Chen & Ramirez, 2015).

2.4.1 Phonological awareness tasks

PA tasks involve the manipulation of units of sound (e.g. syllables, onsets and rimes, phonemes), by, for example, blending two units of sound together or isolating a unit of sound. These verbal tasks are included on measures used in dyslexia assessments, such as the Comprehensive Test of Phonological Processing (CTOPP) (Wagner, Torgesen, Rashotte & Pearson, 2013). Phonemic awareness tasks are a subgroup of PA tasks, which involve manipulating phonemes in words and non-words, and these have been found to be predictive of reading ability (see Melby-Lervåg, Lyster & Hulme, 2012, for a recent meta-analytic review). The relationship between phonemic awareness and reading ability has been

documented in various alphabetic languages (e.g. Anthony and Francis, 2005; Wimmer, Landerl, Linortner, & Hummer, 1991; Cardoso-Martins, 1995; Caravolas, Volín, Hulme, 2005). However, the strength of the correlation between phonemic awareness and reading ability depends on the language and orthography; it is stronger in deep orthographies such as English, and weaker in shallow orthographies such as Finnish (Ziegler et al, 2010), and Hungarian (Everatt, Smythe, Ocampo, & Gyarmathy, 2004).

2.4.2 Accounting for performance on PA tasks: Phonological Deficit Hypothesis

The Phonological Deficit Hypothesis (PDH) posits that the poorer performance which children with dyslexia often have on PA tasks, and the reading issues that they have, both stem from poorly specified phonological representations, which affect their PA (Vellutino & Fletcher, 2005). PA is the explicit awareness that the spoken word consists of individual phonemes or combinations of phonemes (Snowling, 2000). The PDH has its grounding in the early work of Liberman which highlighted the importance of an explicit awareness of the structure of language in order to be able to learn to read (e.g. Liberman, 1973 ; Liberman, Shankweiler, & Liberman, 1989), and was further fostered by Vellutino (1979). The PDH is currently the prevailing theory in the literature (Snowling, 2013).

2.4.3 Shortcomings of the Phonological Deficit Hypothesis

Cross-linguistic research poses problems for the PDH. Large studies which examine predictors of reading ability using aligned assessment measures in different alphabetic orthographies, show that phonemic awareness (as measured by a phoneme deletion task) is a stronger predictor of reading ability in complex orthographies than in simple orthographies (Ziegler et al, 2010; Landerl et al, 2013). If dyslexic readers have a deficit purely in phonological representations, then this would be expected to be relatively stable across languages, instead it is mediated by the number and consistency of letter-sound correspondences. In addition to this, while poorer phonological representations could potentially explain the main feature of dyslexia in English – inaccurate reading – it does not offer a suitable explanation for the accurate but slow reading seen in more transparent orthographies (Landerl, Wimmer & Frith, 1997; Serrano & Defior, 2008; Davies, Cuetos & Glez-Seijas, 2007).

PA tasks tap multiple abilities, and are not a pure test of the explicit awareness of sounds. It is interesting to note that studies examining the speech perception of people with dyslexia in comparison to controls have not found evidence of deficits in the dyslexic group in silence or noise (Hazan, Messaoud-Galusi, Rosen, Nouwens & Shakespeare, 2009; Robertson, Joanisse, Desroches, & Ng, 2009; Blomert, Mitterer & Paffen, 2004). However, one study found a group deficit in a synthetic noise condition but not in silence (Ziegler, Pech-Georgel, George & Lorenzi, 2009), and another study found that 7 of the 25 participants with dyslexia had a speech perception deficit, in comparison to 1 in the age control group and 3 in the reading-age control group (Manis, McBride-Chang, Seidenberg, Keating, Doi, Munson & Petersen, 1997). This study did not screen participants for Specific Language Impairment (SLI), so it is not clear whether a co-morbid disorder could have had a bearing on results. On the balance of evidence, it seems that a minority of people with dyslexia may have a perception deficit for speech sounds, but it is not a necessary condition for dyslexia.

Further evidence that PA tasks are not a pure test of the explicit awareness of phonemes comes from the fact that phonemic awareness develops primarily as a result of exposure to literacy instruction (Mann, 1986); evidence comes from the poorer performance of children who have not been exposed to phonics instruction, compared to controls (Mann & Wimmer, 2002; Bruck & Genesee, 1995), and illiterate adults who perform poorly on PA tests at the syllable and phoneme level (Adrián, Alegria &

Morais, 1995). There are various explanations for this; the first is that learning to read gives children an awareness of the sounds and sound structure of a language (Morais, Alegria & Content, 1987), and the second is that children have access to the visual representation of words after they learn to read successfully, which aids them in carrying out manipulation tasks (Wimmer & Schurz, 2010).

Evidence for the latter theory is demonstrated in the performance of children and adults on phoneme deletion and reversal, where participants performed more accurately when there was a direct correspondence between the phoneme and the grapheme, than when there was not (e.g. deleting /s/ from **rocks** as oppose to from **fox**) (Castles, Holmes & Neath, 2003 ; Tyler & Burnham, 2000). The use of an orthographic-visual strategy is seen in children who are good readers, but rarely in children who are poor readers (Stuart, 1990), indicating that good readers have access to a lexical representation which aids their performance in PA tasks. In sum, there are multiple sources of evidence indicating that the deficit seen in children with dyslexia on PA tasks is not purely a phonological one, and may be influenced by lexical representations.

2.4.4 An alternative theory: deficit in the quality of lexical representations

Scholars involved in cross-linguistic research have posed alternative theories to account for the characteristics of dyslexia across languages. Specifically, in light of evidence from the German language, Wimmer & Schurz (2010, pp.16) propose that dyslexia is caused by “reduced neurocognitive connectivity between orthographic representation and phonological ones”. Blomert (2011) also proposes that dyslexia is caused by poor integration of the phonological representations (e.g. phoneme) with an arbitrary symbol (a letter) into an audiovisual object. This means that a child may have perfect explicit awareness of the phonemes of a language, and even know the letter-sound rules, but the audio component (phoneme) and the visual component (grapheme) which it corresponds to are not automatically integrated. It has been suggested that the declarative memory system may have a compensatory role in dyslexia (Ullman, 2004³), and it may be the case that the declarative memory system compensates for the lack of automatic integration, and is sufficient to allow accurate but slow reading in orthographies with a small number of letter-sound correspondences.

There is an extra dimension to the phonological-orthographic representation at the word level, as words also have a semantic element. It is more difficult for typically-developing and poor readers to develop phonological-orthographic bonds with low meaning words (i.e. function words) than high meaning words (i.e. content words) (Vellutino, Scanlon & Spearing, 1995), and it is noted that children with dyslexia often make function word errors (Pennington, 2008). While it has been proposed that this comes about due to the reader focussing their attention on reading the content words (Pennington, 2008), it is possible that it is due to the arbitrariness of these words (i.e. function words do not have a semantic anchor with which to integrate the orthographic and phonological representation). Perfetti and Hart’s lexical quality hypothesis claims that a high quality lexical representation contains orthographic, phonological and semantic constituents, and that the quality of lexical representations affects the ease of lexical retrieval (Perfetti & Hart, 2002).

2.4.5 Rapid automatised naming tasks

In addition to the deficits seen on PA tasks, people with dyslexia also consistently perform poorly on tests of rapid naming of visual items (Norton & Wolf, 2012). Studies which examine multiple aspects

³ This paper, in part, gave rise to a recently developed theory – the procedural learning deficit (e.g. Lum, Ullman, Conti-Ramsden, 2013; Nicholson & Fawcett, 2007). While Ullman’s original (2004) paper makes a compelling case for the role of memory in learning disorders, given that dyslexia is a very specific disorder, the procedural deficit theory is far too broad, and is in need of refinement.

of literacy have found that RAN is more closely linked to word and non-word reading, and that PA is more closely linked to spelling (Furnes & Samuelsson, 2011; Moll, Fussenegger, Willburger & Landerl, 2009). Vaessen et al (2010) studied the relative contribution of a phoneme deletion task and RAN task to reading fluency (measured by a task in which children had to read as many words as possible accurately from a list in 30 seconds) from Grade 1 to Grade 4, in Hungarian, Dutch and Portuguese. They found that the contribution of performance on the phoneme deletion task declined as reading experience increased, while the contribution of performance on RAN tasks increased with reading experience. The authors attribute the increasing contribution of RAN to the increasing role of efficient matching of phonological-orthographic information in experienced readers.

While RAN has been subsumed under the umbrella of phonological processing skills by proponents of the PDH (e.g. Wagner & Torgesen, 1987 ; Vellutino, Fletcher, Nolan & Scanlon, 2004), other scholars in the field are of the opinion that reducing the process of rapid naming to a purely phonological one is simplistic and inaccurate (Wolf, Bowers & Biddle, 2000). RAN has been conceptualised (with some overlap) as reflecting slow lexical retrieval (Ramus, 2004), a lower speed of processing letters (Neuhaus, Foorman, Francis & Carlson, 2001), a microcosm of the processes involved in reading (Denckla, 1998, as cited by Wolf & Bowers, 1999) or a lack of automaticity (Wolf, Miller & Donnelly, 2000). The debate over the conceptualisation of RAN is still ongoing, and it is likely that RAN represents a compound skill encompassing various processes related to early literacy (Furnes & Samuelsson, 2011). Because of its stronger link to word reading than spelling, and because of its greater predictive ability in relation to reading fluency in more experienced readers, it may be that RAN takes into account the semantic element of word reading, and it may in part represent the lexical quality of representations (orthographic-phonological-semantic). This is purely speculative, and needs further research.

2.4.6 Working memory and short-term memory tasks

As is evident from the definitions in §2.2, working memory is not always included in definitions of dyslexia. There is not yet a consensus on the components of working memory or how it is operationalised (Cowan & Alloway, 1997), and while many tasks have been used to test working memory, only the two most common tasks in dyslexia assessments – digit/word span tasks and non-word repetition – are discussed here. The relationship of these measures to reading is not clear (Savage et al, 2007), and large cross-linguistic studies of young children with dyslexia have shown that span tasks and non-word repetition tasks have a relatively minor role in predicting dyslexia compared to RAN and PA tasks (Landerl et al, 2013; Ziegler et al, 2010).

Span tasks

Span tasks involve listening to a list of digits or letters and recalling them in order or reverse order (Savage et al, 2007). Forward span tasks are considered a measure of short-term memory as they involve the storage of information, while backward span tasks are considered to be a measure of working memory as they involve the manipulation of information. Proponents of the PDH attribute span task deficits to deficits in phonological representations (e.g. Vellutino, Fletcher, Nolan & Scanlon 2004), while others consider it a measure of the phonological loop component of working memory⁴ (e.g. Baddeley, 2003). It seems unlikely that span tasks can be reduced to the simple repetition of phonological codes; there is evidence that concrete words are recalled better than abstract words (Allen & Hulme, 2006), words with many phonological neighbours are recalled better than more

⁴ A short-term memory store for speech sounds (Baddeley & Hitch, 1994)

unusual words (Roodenrys et al, 2002), and high frequency words are recalled better than low-frequency words (Hulme et al, 1997). Thus, it appears that various connections – semantic, phonological and orthographic – act as anchors to allow for recall.

Non-word repetition

Non-word repetition has also been conceptualised in various ways; some consider it a measure of the phonological loop component of working memory (e.g. Baddeley, 2003), while others consider it a measure of phonological representations or sensitivity (e.g. Bowey, 2001). A recent meta-analysis of studies that assessed non-word repetition in dyslexia (Melby-Lervåg & Lervåg, 2012) found that people with dyslexia performed more poorly than age-level controls, but there was significant variation between studies. Because of the co-morbidity of SLI and dyslexia, and the poor performance of those with SLI on non-word repetition tasks (Chiat, Armon-Lotem, de Jong & Meir, 2015), this was attributed to the likely inclusion of people with co-morbid SLI in some studies where this was not controlled for in the inclusion criteria. The meta-analysis also found VSTM did not reliably moderate the variation in effect sizes of the non-word repetition deficits, suggesting that phonological memory is unlikely to explain the variation in non-word repetition.

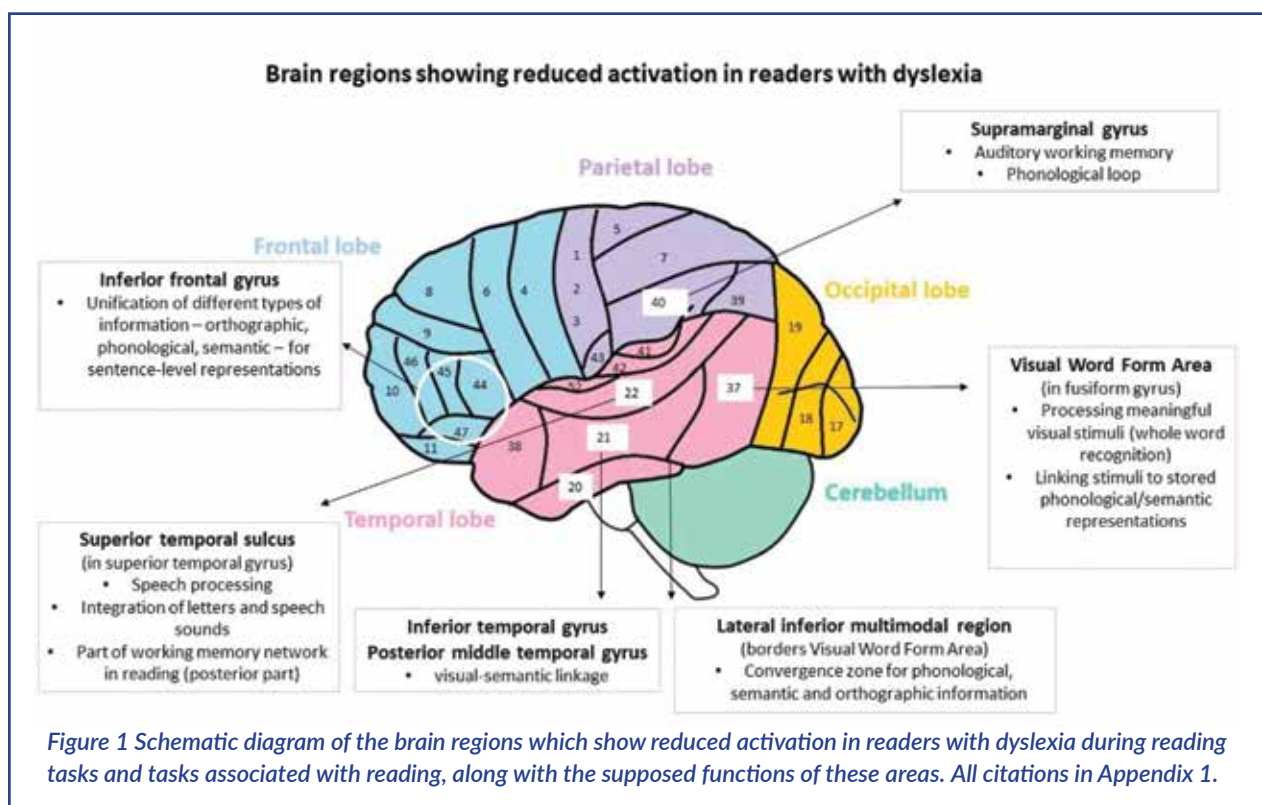
Interestingly, Melby-Lervåg & Lervåg (2012) found that English-speaking samples were more impaired on non-word repetition than non-English speaking samples, which the author's attribute to a greater difficulty in representing the non-words orthographically in memory due to the inconsistencies and complexity of letter-sound correspondence in English. The proposal that letter-sound correspondences are an aid in non-word repetition is supported by studies of illiterate and literate adults (from similar sociocultural backgrounds) which show that illiterate adults perform much more poorly than literate adults in repeating non-words, and that they utilise different areas of the brain to perform these tasks (Reis & Castro-Caldas, 1997; Castro-Caldas et al., 1998). A study by Nation & Hulme (2011) investigating the nature of the relationship between non-word repetition and reading also supports the theory that orthographic information organises phonological representations and supports non-word repetition.

2.5 Characterising dyslexia at the neurobiological level

In a post-mortem study of the brains of four males with dyslexia, Galaburda and colleagues found evidence of cortical ectopias and dysplasias (Galaburda et al, 1985). Cortical ectopias are groups of 50-100 neurons which fail to reach their target destination in the cortex and escape into the molecular layer (Ramus, 2004, pp. 1004). In a voxel-based morphology study, Silani et al (2005) found evidence of increased grey matter density in the left middle posterior temporal gyrus in the brains of people with dyslexia, which they suggested was indicative of cortical ectopias. They also found decreased white matter in the arcuate fasciculus (which links language areas in the frontal and temporal lobe), which may indicate perturbed connectivity between language areas (Silani et al, 2005).

People with dyslexia also show differences in patterns of brain activation during reading and reading-like tasks in comparison to their typically-developing peers. Quantitative and qualitative meta-analysis have found reduced activation in the Visual Word Form Area, and the inferior and middle temporal gyrus (Richlan, Kronbichler & Wimmer, 2009; Paulesu, Danelli and Berlinger, 2014). In addition, the quantitative meta-analysis found maxima of underactivation in the posterior part of the left superior temporal gyrus/sulcus and the inferior frontal gyrus (Richlan, Kronbichler & Wimmer, 2009), while the qualitative meta-analysis found clusters of underactivation in the supramarginal gyrus

of dyslexic individuals (Paulesu, Danelli and Berlingeri, 2014). Findings are mixed in relation to language-specific areas of underactivation. While the only cross-linguistic study that exists on the subject found the same areas of underactivation in French, Italian and English-speaking dyslexics, a meta-analysis of studies from a range of languages found that while there was a universal pattern of underactivation in the Visual Word Form Area in readers of all orthographies, there was more pronounced underactivation in the supramarginal gyrus in shallow orthographies, and in the right temporal sulcus in deep orthographies (Martin, Kronbichler & Richlan, 2016). **Figure 1** below presents a schematic diagram of findings in relation to the function of the brain regions which are underactivated in dyslexia readers, see Appendix 1 for discussion.



2.6 Characterising dyslexia at the genetic level

The observation that dyslexia is a heritable disorder is not a modern one, and has long been suspected based on behavioural evidence (e.g. Hinshelwood, 1900). Advances in research and technology has supported this, however, the causal path between genes and the characteristics of dyslexia is “variable and interacts crucially with environmental factors” (Oliver, Johnson, Karmiloff-Smith, & Pennington, 2000, pp.3). Nine chromosomal regions have been associated with dyslexia through genetic linkage studies. Of these nine regions, the most reliably replicated regions are DYX1 and DYX2 (Mascheretti et al, 2017). It is interesting to note that evidence has been found for linkage with ADHD on regions which coincide with DYX1 (Bakker et al, 2003) and DYX2 (Willcutt et al, 2002), meaning that genes in these regions may contribute to the comorbidity between these disorders (Schumacher et al, 2007). Candidate genes have been discovered for four of the nine chromosomal regions; DYX1, DYX2, DYX3 and DYX5. The candidate genes in DYX2 – DCDC2 and KIAA0319 – are considered to have the most convincing evidence supporting them (Schumacher et

al, 2007). DCDC2 has been linked with normal neuronal migration in humans (Meng et al, 2005), and Kiaa0319 is associated with normal neuronal migration in rats (Paracchini et al, 2006). ROBO1 is the candidate gene on DYX5; deactivation of ROBO1 causes malformation in the white matter structure in the corpus callosum of humans (Darki, Massinen, Salmela, & Matsson, 2017), which the authors suggest is relevant to the transfer of information between the hemispheres. The reader is referred to Appendix 2 for more information on candidate genes.

2.7 Summary and Conclusion

This section endeavoured to provide an overview of findings at all levels of investigation into dyslexia - behavioural, cognitive, neurobiological and genetic - and to highlight differences which exist across languages. A summary of the findings are provided in **Table 1** below, and the relationship between them is illustrated schematically in **Figure 2**.

Table 1 Summary of findings in relation to the behavioural, cognitive, neurobiological and genetic levels of dyslexia

| Level | Summary |
|------------------------|--|
| Behavioural | Dyslexia is characterised by inaccurate and dysfluent reading and poor spelling in deep orthographies, and slow but accurate reading (and possible poor spelling) in shallow orthographies. |
| Cognitive | In addition to word reading and IQ tests, assessments for dyslexia typically include cognitive measures of PA (particularly phonemic awareness), rapid automatized naming and verbal short-term memory/working memory. While the PDH is the prevailing causal theory of dyslexia, it has many shortcomings, and the concept of reduced neuro-connectivity between orthographic and phonological information, is a more likely explanation of the deficits present in those with dyslexia. |
| Neurobiological | It is of note that regions of underactivation in dyslexic readers are not specific to processing phonology, and the most robust region of underactivation in readers with dyslexia is the Visual Word Form Area, which is a multimodal region integrating phonological, orthographic and semantic information. The poorer integration of these sub-components of lexical representations may be explained by a poorer connection between functional areas of the brain, as considered by Paulesu, Danelli & Berlinger (2014), due to cortical ectopias or differences in grey and white matter structures. |
| Genetic | Overall, the research in this area shows that no sole chromosomal region or gene has been linked to dyslexia unequivocally, demonstrating that dyslexia "is a complex phenotype and several, if not many, genes are involved" (Meng et al, 2005, pp. 17058). However, it is interesting that the well-replicated candidate genes involved have similar functions involving neuronal migration and white matter structures in the brain, which coincide with neurobiological finding. It has been noted that the consistency of linkage findings is impressive in comparison to those of other neurodevelopmental disorders (Schumacher et al, 2007). |

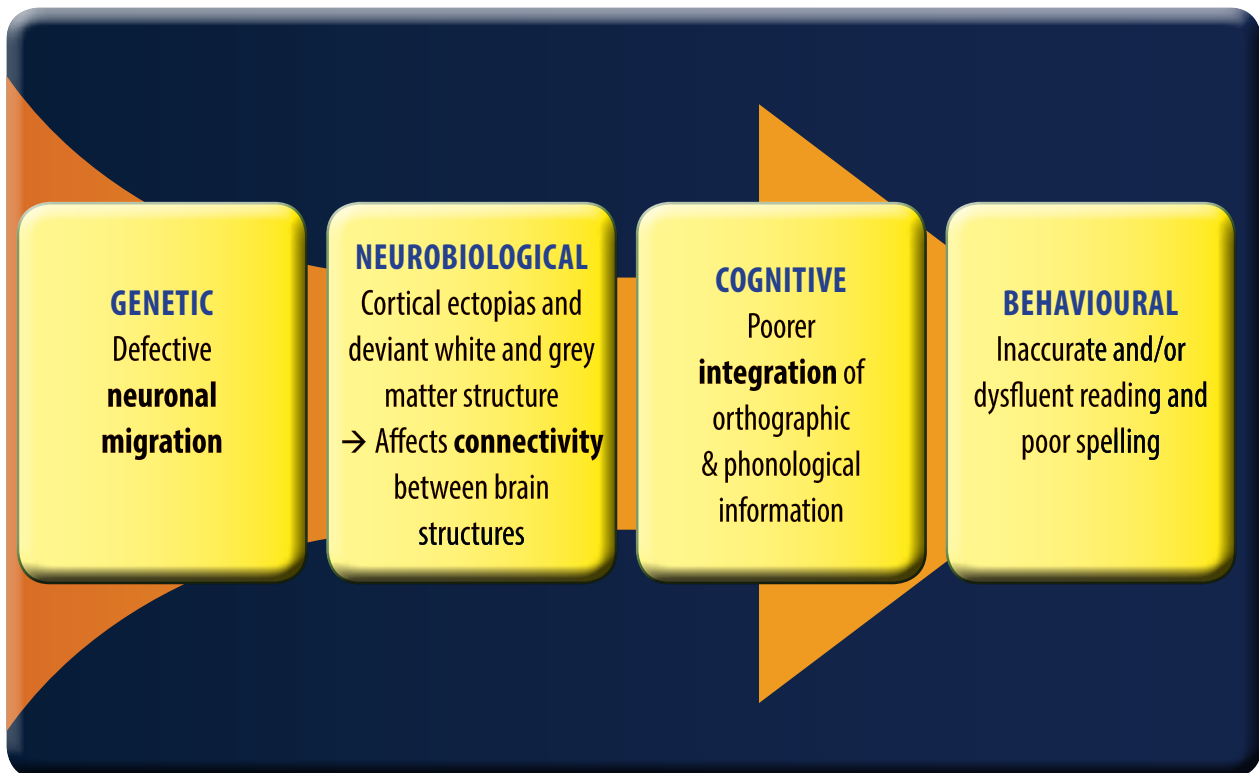


Figure 2 Schematic representation of the summary of findings in relation to dyslexia at the genetic, neurobiological, cognitive and behavioural level

Chapter Three:

Literacy in the Irish Language - Theory and Practice

3.1 Introduction

The orthography, or writing system, of a language is the primary cause of the variation that exists in the development of literacy acquisition in different languages. In this chapter, the way in which the orthography of a language affects literacy acquisition is discussed, and then the orthography of Irish is described. Due to the essential role of quality literacy instruction in literacy acquisition, the approach to literacy instruction in Irish is examined in the context of IME.

3.2 The effect of orthography on literacy acquisition

3.2.1 Orthography: phonological and morphological clarity

The orthography, or writing system, of some languages represent the spoken language very well; these include orthographies, such as Spanish and Finnish, which have a close link between letters and sounds. Other orthographies, such as English, preserve morphological information at the expense of a clear link between letters and sounds. Take the word 'magic' and the word 'magician'; in English, the orthography preserves the root word 'magic' at the expense of a more phonologically-intuitive representation (example from Goodwin & Ahn, 2010). In this sense, there is a trade-off in the orthography between phonological and morphological clarity (Katz & Frost, 1992).

3.2.2 Orthographic depth

It has become apparent through cross-linguistic research that the orthography of a language has a massive bearing on the process of literacy development in a language. A central concept in the discussion of variation in the reading process is that of orthographic depth. The concept of orthographic depth, as proposed by Katz and Frost (1992), expresses the level of complexity (number of rules) as well as the consistency (adherence to the rules) defining an orthography. It is usually thought of as a continuum running from "deep" orthographies (such as English) which are complex and inconsistent, to "shallow" orthographies (such as Finnish or Spanish) which are simple and consistent (Ziegler et al, 2010). Schmalz, Marinus, Coltheart and Castles (2015) argue that complexity and consistency are two distinct elements of orthographical depth which should be disassociated from one another. They use French to illustrate this point; French has been characterised as an intermediate orthography on the continuum of orthographic depth, however when complexity and consistency are separated it is apparent that it is very high on the scale of complexity but low on the scale of inconsistency.

3.2.3 Impact of orthographic depth on literacy acquisition

Orthographic depth affects the amount of time it takes to become fully literate in a language, and it also affects the manifestation of dyslexia at the cognitive and behavioural levels. The process of acquiring a deep orthography takes more time (see Ziegler and Goswami, 2005); cross-linguistic

studies have shown that the rate of literacy acquisition in deep orthographies (such as English) is slower than in shallow orthographies by a rate of about 2.5: 1 (Aro & Wimmer, 2003; Seymour, Aro & Erskine, 2003).

As discussed in § 2.3.1, the characteristics of dyslexia differ depending on the depth of the orthography. Dyslexia is more marked and constitutes a more serious disorder in languages with a deeper orthography such as English. In deeper orthographies, dyslexia is characterised by inaccurate and tedious reading, while in shallow orthographies the most pertinent characteristic of dyslexia is a slow reading speed (Landerl, Wimmer & Frith, 1997; Serrano & Defior, 2008; Davies, Cuetos & Glez-Seijas, 2007). At the cognitive level, the verbal test which most accurately predicts dyslexia varies depending on the language. It has been established in many languages that there is a link between performance on PA tasks and learning to read (e.g. Anthony and Francis, 2005; Wimmer, Landerl, Linortner, & Hummer, 1991; Cardoso-Martins, 1995; Caravolas, Volín, Hulme, 2005). However, the strength of PA as a predictor of reading ability depends on the language and orthography; it is stronger in deeper orthographies such as English than in shallower orthographies, where rapid automatised naming may be a better predictor (Landerl & Wimmer, 2000; Ziegler et al, 2010; but see also Landerl et al, 2013). These cross-linguistic differences may occur as a result of the faster rate of reading acquisition in shallow orthographies, as it has been found that, across languages, the strength of PA as a predictor of reading ability decreases as reading experience increases, while the contribution of rapid naming increases (Vaessen et al, 2010).

3.3 The orthography of the Irish language

3.3.1 Phonology

Irish has no spoken standard, and different dialects have different phonemic inventories. However, many features of the phonology are common to all dialects. The most important feature of Irish phonology is the two series of consonants - one velarised and one palatalised - which are represented systematically in the writing system (Ní Chasaide, 1999). This is a feature that it shares with Russian (Elkonin, 1988) and Scots Gaelic.

3.3.2 Morphology

Irish, in contrast to English, is a morphologically-rich language (Lynn, Foster, Dras, & Van Genabith, 2013). Perhaps the most distinctive feature of Irish morphology is the system of initial mutations - lenition and eclipsis - which fulfil a variety of grammatical functions (see Ó Siadhail, 1989 for an overview). Nouns are classified in terms of gender as masculine or feminine, and the ending of a noun indicates its gender, however there is not as much clarity of predictability in the system as there is in other languages such as Spanish. Nouns are inflected for gender, case and number, and verbs are inflected for person and tense or mood (Ó Siadhail, 1989).

3.3.3 Orthography

The orthographic depth of Irish has not yet been established, and the following is a crude attempt to characterise the orthography in order to provide a basis for discussion in the following sections. More research, particularly in the area of corpus linguistics, is necessary in order to validate this. This estimation comprises consistency and complexity, found to be indicative of orthographic depth in other languages, as well as syllable structure. Seymour, Aro and Erskine (2003) found that literacy acquisition was more difficult in a language with complex syllables than in one with simple syllables. Simple syllables are open (CV) and do not contain any consonant clusters, while complex syllables are closed (CVC/CVCC/CCVC etc.) and contain consonant clusters.

I. Complexity: rules of the system

There are about 177 graphemes in Irish (Ó Raghallaigh, 2014) - representing about 49 phonemes. This means that there are multiple ways to spell a given sound in Irish. There is regularity in the system however, and the key is being aware that consonants may be either palatalised or velarised. The same consonant letter is used for both the palatalised and velarised consonant, and it is disambiguated by the following vowel grapheme; <a>, <o> and <u> denote a velarised consonant, while <e> and <i> denote a palatalised consonant. This is further illustrated in § 5.3.3.

There are many context-dependent rules in Irish also, however there are few exceptions (Ó Raghallaigh, 2014). While Ó Siadhail (1989) can be consulted for a more comprehensive analysis of the context-dependent rules, the following are a couple of demonstrative examples: short vowels in unstressed positions are reduced (Ó Raghallaigh, 2014), and short vowels are lengthened before certain geminate consonants and other consonant combinations (Ó Siadhail, 1989).

II. Consistency⁵: adherence to the rules

In their pioneering research on the Irish orthography, Hickey and Stenson (2010) found that 71% of the 101 most frequent words in the early learning corpus were consistent (i.e. adhered to the rules), as compared to 52% in a similar study on the English language (Stuart, Dixon, Masterson & Gray 2003). Of the irregular words, just 15% which were irregular because of inconsistencies in grapheme-phoneme correspondence, with the rest being inconsistent because of an unexpected stress pattern.

III. Syllabic complexity

(a) Open/Closed:

Open and closed syllables are permitted in Irish, and closed syllables are very common. In the same Early Reading Corpus used by Hickey and Stenson (2010), 57 of the 101 most frequent words contain at least one closed syllable⁶

(b) Complex consonant clusters:

Consonant clusters are allowed at onset and coda (Green, 1997) and are quite common in Irish. A maximum of three consonants can occur in initial position e.g. **spleách**, and, a maximum cluster of two consonants (three consonantal graphemes) can occur in final position e.g. **bocht** (Ó Siadhail, 1989)

In sum, the Irish orthography presents many challenges to the beginning reader; it has a complex set of phoneme-grapheme correspondences, many context-dependent rules, a large proportion of multiletter graphemes and a rich morphology. However, it is more consistent than English. In terms of orthographic depth, this appears to put Irish on a similar level as French and Danish “which contain orthographic inconsistencies and complexities, including multiletter graphemes, context dependent

⁵ Also referred to as unpredictability (Schmalz, Marinus, Coltheart and Castles, 2015) and feedforward consistency (e.g. Ziegler, 1997).

⁶ This estimation is dependent on where the syllable boundary is deemed to be, and there is dialectal variation on this matter.

rules, irregularities and morphological effects” (Seymour Aro & Erskine, 2003, pp.146). Irish is high on the complexity measure, but also relatively high on the consistency measure.

3.4 The Irish language in the education system

While the Irish orthography is more consistent than the English orthography, this can only benefit pupils when it is taken advantage of in literacy instruction. There are also many more factors to be considered when looking at literacy acquisition in a language, including the status of Irish as a minority language living alongside a very dominant majority language, and the effects of biliteracy.

3.4.1. Types of Irish-medium education

In Ireland, most children start school at the age of 4 or 5 (DES, 2014). Parents have the option of sending their child to an Irish-medium (IM) school or an English-medium school. In an English-medium school, Irish is taught as a second language. The sector of IM primary education is a non-homogenous one. In Gaeltacht areas, schools are referred to as having a “language maintenance approach” where there are many native Irish speakers attending the school, and “total immersion” schools where there are a minority of native Irish speakers, in which the introduction of English is delayed (DES, 2015a, pp.3-4). Irish-medium schools outside of the Gaeltacht are also based on an immersion model of education, where Irish is the primary language of instruction and communication (DES, 2015b).

In the case of students within and outside of the Gaeltacht, additive bilingualism – acquisition of the second language (L2) without negatively impacting the native language (L1) – is the aim (DES, 2015b). While it is unlikely that the native language of English speakers would be negatively affected by acquiring Irish, their L2, the same cannot be said for native Irish speakers who are exposed to English. Hickey (2001) examines and highlights the negative impact that immersion education can have on native speakers of a minority language when there are many non-native speakers in the learning environment.

3.4.2 Exposure to Irish outside of the education system

There is much variation in the exposure a child has to the Irish language in the community and at home. In non-Gaeltacht areas, a small proportion of pupils are exposed to Irish in the home (Parsons & Lyddy, 2016) with presumably minimal Irish language input from the community. Those living in Gaeltacht areas will have more exposure to the language in the community, but they are nonetheless a heterogenous population in terms of home use; for some, Irish is their first language and the language used at home, others have some exposure to Irish before school entry and some have very little prior experience with the Irish language prior to entering school (DES, 2013).

3.4.3 Introduction of literacy instruction in IM schools

IM schools have the option to introduce English literacy instruction first, Irish literacy instruction first, or introduce them both concurrently. There is some variation in the estimates relating to the practice of schools in this regard; according to the (2004) study by Ní Bhaoill (as cited in Ní Bhaoill and Ó Duibhir, 2004) a slight majority of schools teach Irish first (51%), just over a third teach English first (36%) and a small number introduce literacy in both languages concurrently (7%). A more recent study (Shiel, Gillece, Clerkin & Millar, 2011) separated Gaeltacht schools from immersion schools outside the Gaeltacht, and found that the number of schools introducing Irish literacy first was significantly higher in non-Gaeltacht IM schools; in IM schools outside the Gaeltacht 73% introduced Irish first, 17% introduced English first and 11% introduced literacy in both languages concurrently, whereas in

Gaeltacht schools roughly a third of schools introduced Irish first, a third introduced English literacy first, and a third introduced both together.

3.4.4 Approach to literacy instruction in Irish

Literacy instruction in the Irish language is mainly taught using a whole-word approach, and the grapheme-to-phoneme rules are rarely taught explicitly (Hickey, 2007). Ní Chiaruain (2009) examined the experience of students with dyslexia in an IM school and reported that while 13 of the 14 teachers who participated in the questionnaire believed that phonics should be used in Irish, only 4 teachers did so. In relation to the reading strategies the children with dyslexia used, it was found that while they could use phonological decoding strategies to read in English, they did not have this ability in Irish. This echoes the data from Parsons & Lyddy (2009), which showed that children used different strategies to decode in Irish and English, and only the best readers showed an ability to use a phonological decoding strategy in Irish.

Stenson and Hickey (2014) investigated why the letter-to-sound rules are not often taught in Irish, despite it being best practice and widely taught in English. It seems in part to have stemmed from the emphasis on a communicative approach to the teaching of Irish, which was interpreted as prizing the oral language at the expense of literacy. This culture is fostered due to a lack of confidence in teaching Irish literacy as well as a lack of awareness of the letter-to-phoneme rules. Importantly, it is noted in the paper that this problem stems from poor preparation in pre-service training. The authors also make the link between a lack of confidence among teachers in the pronunciation of Irish, and a poor ability to connect sounds to letters.

3.5 Conclusion

In this chapter, the Irish orthography was analysed and it was found to be high in complexity but relatively high in consistency too. Literacy instruction should take advantage of this consistency, however this is typically not the case. Irish is generally taught using a whole-word approach, and this is reflected in the limited ability of students to use phonological decoding strategies. This practice has come about due to a lack of awareness of the phonology of Irish and how it maps onto the orthography, and a lack of pre-service training with regard to teaching these aspects to children.

Chapter Four:

Dyslexia Assessment in Irish-Speaking Populations

4.1 Introduction

This chapter aims to examine (a) the current practice of educational psychologists in relation to diagnosing dyslexia in populations in IME (b) the efficacy of this practice, and (c) the viability and necessary considerations for developing standardised assessment tools for Irish. To that end, this chapter includes a review of relevant literature on these matters in relation to Irish-speaking populations and other bilingual populations. The review is followed by a qualitative study which involved interviewing educational psychologists (EPs) in regards to their current practice. The methodology for the study is explained in § 4.6, and the findings are shared in § 4.7, followed by a discussion in § 4.8. Where relevant, findings are examined separately for immersion pupils and native Irish-speaking (NIS) pupils.

4.2 Dyslexia assessment in IME: current practice

In a study on the provision for children with SEN in Northern Ireland, Ní Chinnéide (2009) reported that students in the IME sector are typically assessed through English, using assessment materials which are designed for monolingual English speakers. It was reported that while this was the prevailing practice, one educational psychologist reported using translated versions of some English language tests. Findings from the report suggest that the lack of standardised assessments for the Irish language made it challenging to assess them accurately (pp.151) and may result in a delay of the provision of services (pp.22). Indeed, it is noted in international research that assessing bilingual and emergent-bilingual children using tests normed for monolingual English-speaking children may result in over- or under-diagnosis of dyslexia in these populations (Everatt, Smythe, Adams & Ocampo). The development of diagnostic tools for Irish was one of the recommendations made by Ní Chinnéide (2009), and also by Ní Chiaruain (2009), who examined the experience of students with dyslexia in IME. In addition to this, primary school teachers in the IME sector have highlighted the need for assessments in Irish and educational psychology services through Irish (NCCA, 2007).

The Department of Education in Northern Ireland (2011) commissioned RSM McClure Watters (a tax, audit and consulting company) to undertake a needs assessment and feasibility study on the development of high level diagnostic tools in Irish for children with SEN in IME. The report examined a number of options and concluded that the development of diagnostic tests is not feasible due to the costs involved, the value for money (in light of the small population), and technical reasons such as the need for EPs to be fluent in Irish. The option they recommended was to keep the current practice, and in addition to this promote awareness of “issues for children in IM” so that “children being tested are supported by EPs who would have a greater awareness of the issues for children in IM” (pp.57). The report also states that this option “seeks to build capacity amongst teacher staff”

(pp.57). The report stated that current practice is reliable and effective at addressing the needs of IM pupils with SEN as EPs can use non-verbal tests; “the range of non-verbal tests is recognised as a valid and reliable way to test children for SEN” (pp.56). This is not the case for dyslexia assessments; verbal tests and language-specific literacy tests are crucial to providing an accurate diagnosis. This report demonstrates poor awareness on the part of the authors of the complexity of testing for SEN. Additionally, and importantly, it shows a lack of appreciation for the issues at hand in its reduction of what is, in part, a matter of rights and equality to a solely financial matter.

4.3 Efficacy of current practice

As discussed in Chapter Two dyslexia assessments typically include tests of literacy skills (including reading ability, vocabulary and comprehension), as well as cognitive skills such as PA, rapid naming and working memory. There are various factors which may confound the outcomes of these tests in IME populations; these include (a) being assessed in a second/weaker language; (b) being assessed in a language which is not the primary language of instruction; (c) the effects of bilingualism, including controlling a smaller vocabulary in each language, and slower lexical access (affecting rapid naming). The extent to which these factors affect performance will depend on the child and their schooling (e.g. the extent to which the child is bilingual, the exposure he or she has to the English language or English literacy instruction).

In this section, the extent to which populations in IME differ from monolingual English speakers on literacy-related and cognitive measures is assessed. There is some data available which is indicative of the performance on IM pupils on literacy-related measures. There is no data available for these populations in relation to the cognitive measures, however, and in this case research on other bilingual populations is examined.

4.3.1 English reading ability in populations in IME

One longitudinal study exists which assesses Irish and English reading ability in populations in IME; Parsons and Lyddy (2016) investigated literacy achievement in a Gaeltacht school, an English-medium school and two Irish immersion schools, one of which began Irish reading first (IRF) and one of which began English reading first (ERF). The study provides data on word reading and non-word reading, as well as vocabulary. The study reports group differences according to the school type, and so while the Gaeltacht group in the study are not all native speakers (57% reported speaking only Irish at home or more Irish than English), their results are indicative of the process of literacy acquisition in native speakers of Irish.

A summary of the findings is presented in **Table 2** (a more detailed account can be found in Appendix 3), and shows that the development of English literacy is significantly delayed in Gaeltacht pupils. This highlights the inapplicability of literacy assessment standardised on English-speaking children for this population. In addition, the findings show that while the IRF group do not differ in their non-word reading ability, their word reading ability is slightly delayed compared to ERF pupils. This would indicate that caution should be taken when interpreting the scores of IRF pupils on standardised word reading assessments in the early years. It is worth noting that the development of the Gaeltacht groups is similar to that of other minority language students learning to read in the majority language (e.g. Wagner, Spratt & Ezzaki, 1989), while the immersion pupils perform similarly to immersion pupils in Canada, where they catch up with their peers within one or two years of literacy instruction in English (see Cummins, 1998 and Genesee & Jared, 2008).

Table 2 Literacy-related achievement of pupils in IME, based on findings from Parsons & Lyddy (2016). IRF = Irish Reading First; ERF - English Reading First

| English word reading ability and vocabulary in Gaeltacht and Irish-medium schools | | | |
|---|---|---|--------------------|
| Measure | Gaeltacht school | Irish-medium (IRF) | Irish-medium (ERF) |
| <i>Non-word reading</i> | Weaker ability until fourth year of schooling | No difference | No difference |
| <i>Word reading</i> | Weaker ability until after fourth year of schooling | Weaker ability until fourth year of schooling | No difference |
| <i>Vocabulary</i> | No difference: take exposure into account | No difference | No difference |

4.3.2 Phonological awareness

Studies have reported that PA skills are correlated across both languages in bilinguals (e.g. in Spanish-English bilinguals: Goodrich & Lonigan, 2017; Anthony et al, 2009; in French-English bilinguals: Comeau, Cormier, Grandmaison & Lacroix, 1999). This has fuelled the idea that there is a common underlying proficiency in which the transfer of PA skills can occur between languages (Cummins, 2005). While this may be the case in languages which are similar, the concept should not be taken to mean that performance on PA tasks in one language is equivalent to performance on PA tasks in another language.

There is currently no data available for the performance of IM pupils on tests of PA, however studies in the international literature show that various linguistic factors performance on PA tasks. The effect of language exposure and the language of literacy on performance on PA tasks is discussed below, as well as the relationship of PA to reading ability in bilinguals.

PA in L2 learners

The performance of bilingual children depends on (a) their exposure to each language, and (b) the language(s) in which they learn to read. Studies assessing the PA of bilinguals in both of their languages underscore the importance of assessing PA in the language of literacy instruction. Bialystok, Majumder & Martin (2003) tested a group of monolingual English children and a group of bilingual children, fluent in French and English, who were educated in French but lived in English-speaking communities. They found an advantage for the monolingual English-speaking children on English PA tasks in their first study, however when the bilinguals were tested in their language of schooling (French), they performed at an equivalent level to the monolinguals. Similarly, Loizou and Stuart (2003) found that young English-Greek bilinguals performed significantly better than English monolinguals and Greek-English bilinguals on certain PA tasks when the testing was performed in their dominant language (English) in which they were primarily educated, but not when tested in their weaker language.

The performance of bilingual children on PA tasks may also vary depending on their exposure to each language. Kim (2009) examined the PA skills of two groups of Korean-English bilinguals and found that the group who were more proficient in English performed more similarly to monolingual English speakers (who are more sensitive to onset-rime units), while the group who were less proficient in English performed closed to monolingual Korean speakers (who are more sensitive to body-coda units). In light of the fact that the unit emphasised in literacy instruction affects performance on PA

tasks, it would be interesting to ascertain the literacy backgrounds of the two groups, however there is not enough information provided in the paper to establish this. The language of literacy instruction may be more important than proficiency in the language, as studies have found that second language students who are schooled entirely through the language of testing perform as well as L1 students on PA tests (e.g. Jongejan, Verhoeven and Siegel, 2007; Miller Guron & Lundberg, 2003⁷).

While studies have found PA tasks conducted in the L2 to be a reliable indicator of reading ability when conducted in the language of schooling (e.g. Everatt, Smythe, Adams & Ocampo, 2000; Guron & Lundberg, 2003), it has been found that, for bilingual children learning to read in two languages, reliable indications of reading ability can only be found if PA tasks are carried out in both languages (Everatt, Smythe, Ocampo, & Gyarmathy, 2004).

The relationship between PA and reading ability in L2 learners

The relative contribution of PA to reading ability is an independent issue. There is some evidence that the relationship between PA and reading ability differs depending on whether the child is a native speaker or an L2 speaker in the language of testing. In relation to English, Jongejan, Verhoeven and Siegel (2007) found that PA was the strongest predictor of reading for L1 speakers of English, and for English as a Second Language (ESL) students schooled through English. However, the contribution of PA to reading skill was less for the ESL students than for the L1 students; in the lower grades, PA accounted for 46% of the variance in reading skill for L1 students, as opposed to 36% for ESL students; in the higher grades, PA accounted for 74% of the variance in reading skill for L1 students in the higher grades, as opposed to 47% for ESL students.

4.3.3 Rapid automatized naming

Bilinguals have been found to perform more poorly than monolinguals on tasks of rapid naming and lexical retrieval (Ivanova & Costa, 2008; Bialystok & Craik, 2010; Sandoval, Gollan, Ferreira & Salmon, 2010; Gollan, Montoya, Werner, 2002), though also see (Everatt, Smythe, Adams & Ocampo, 2000) for contrasting results. The bilinguals in these studies were proficient in both languages, however the bilingual disadvantage persists even in the dominant language (Ivana & Costa, 2008), and one study even found that lexical access was worse in bilinguals' dominant language (Costa & Santesteban, 2004). Differing explanations have been offered in relation to the disadvantage for bilinguals in rapid naming tasks; the first is that it arises due to competition between two languages, of which one must be inhibited (supported by Sandoval, Gollan, Ferreira & Salmon, 2010). Alternatively, it has been suggested that bilinguals use words in each language less often than monolingual speakers, and so have weaker connections that take more time to retrieve (Ivanova & Costa, 2008).

4.3.4 Short-term memory and working memory

There are many measures used to assess different types of short-term memory (e.g. verbal short-term memory, visuospatial working memory) (Savage et al, 2007), this section is concerned only with span tasks and non-word repetition tasks, as these are typically used in dyslexia assessments.

Span tasks

Studies which examine the performance on bilingual children in comparison to monolingual children on backward and forward span tasks have found that the two groups do not differ (Engel de Abreu, 2011; Bialystok & Feng, 2009). Another study which compared low SES monolingual and bilingual

⁷ In this study, phonological tests were carried out using pen-and-paper tests. As PA is usually tested as an oral skill, this may have confounded results.

children on measures of working memory found that when Dutch vocabulary and SES were not controlled for, there was no difference between the monolinguals and bilinguals, however when these variables were controlled for, there was a bilingual advantage for the backward span task (but not the forward span task) at age 6 (but not age 5) (Blom et al, 2014). The authors theorise that the bilingual advantage exists on the backward digit span task for low SES children may be due to the enhanced executive function in bilinguals, which is required on the backward span task but not the forward span task. Bilingual children have shown improved performance on tasks which require controlling multiple pieces of information and suppressing interference from non-important information (Engel de Abreu et al, 2012; Barac & Bialystok, 2012). However, on the balance of evidence, it seems that working memory is not significantly affected by bilingualism.

Non-word repetition

Messer et al (2010) examined the performance of monolingual Dutch children and Turkish-Dutch bilinguals on non-word repetition tasks. They carried out the tasks in both Dutch and Turkish, using non-words with high phonotactic probability (which sounded more like real words) and non-words with low phonotactic probability (which sounded less like real words) in each language. In the Dutch non-word tasks, they found that monolingual Dutch speakers outperformed the Turkish-Dutch bilinguals in low and high phonotactic probability non-words. In the Turkish non-word tasks, it was found that Turkish-Dutch bilinguals outperformed the Dutch monolinguals on the high phonotactic probability non-words, but both groups performed similarly on the low phonotactic probability non-words. This indicates that language exposure is an important factor in non-word repetition tasks; greater language input results in a more developed phonotactic knowledge base, which supports the maintenance of novel language input in memory for short periods of time (Messer et al, 2010).

4.3.5 Summary of findings in relation to cognitive skills

Table 3 provides a summary of findings from § 4.3.2, § 4.3.3 and § 4.3.4 in relation to the cognitive skills tested in dyslexia assessments, indicating which variables should be taken into account when assessing children in IME.

Table 3 Variables affecting validity of cognitive assessments in bilingual pupils

| Variables affecting outcome of cognitive assessments in bilingual pupils | |
|--|---|
| Phonological awareness | (a) Language of literacy instruction: if the child has not had adequate literacy instruction (in phonemic awareness and phonics) in the language of testing, results may not be comparable to norms. |
| | (b) Exposure to language: if the child has not had adequate exposure to the oral language of testing, results may not be comparable to norms |
| | (c) PA may not have the same strength of relationship with reading ability in L2 speakers as it does in L2 English speakers. |
| Rapid naming | (a) Bilinguals typically perform worse than their monolingual peers on tests of rapid naming |
| Working memory | Span tasks: the results of these tests are not likely to be affected by bilingualism or by being tested in a second language. Results should be comparable to monolinguals Non-word repetition tasks: language exposure is likely to affect the results of these tests, and bilinguals who are not dominant in the language of testing are likely to perform worse than their monolingual peers. |

4.4 Development of standardised assessments for IME populations

There are myriad variables which can affect the validity of an assessment. This section does not intend to thoroughly explore all of the consideration for developing standardised assessments for Irish, but merely highlight the important elements in adapting or developing such assessments, and particular areas of importance for Irish. Many of the considerations below are taken from a wider and more general compilation of guidelines for adapting established assessments for different cultures and languages (Hambleton, 2005).

4.4.1 Dialectal variation

An overarching factor in developing linguistic tests in the Irish language is accounting for dialectal variation. Dialectal variation affects various aspects of the language including the pronunciation of phonemes, stress assignment and grammar. This should be taken into account in every area of adaptation.

4.4.2 Construct equivalence: PA

Construct equivalence relates to whether the construct holds the same meaning and value across cultures or languages. Taking PA as a cognitive-linguistic construct, it is evident that what constitutes good PA differs depending on the language. Depending on the characteristics of the language, children perform better on tasks involving individual phonemes (e.g. Greek, Icelandic) or on tasks involving syllables (e.g. French, Spanish, Russian) (Duncan et al, 2013; Kerek & Niemi, 2012). The cross-language variation in performance has been attributed to speech rhythm (Duncan et al, 2013), syllable structure (Caravolas & Landerl, 2010) and the phonological structure of a language (Kerek & Niemi, 2012). The performance of children on PA tasks differs depending on the type of literacy instruction they have been exposed to. Children tend to only be able to carry out phonemic awareness tasks when they have received some phonics instruction (Bruck & Genesee, 1995). Similarly, as discussed in § 3.2.3, the relationship between PA and reading ability varies depending on the orthography of the language.

4.4.3 Translation and adaptation

Word Reading

Tests which have been shown to work in one language are not necessarily reliable in another (Everatt, Smythe, Ocampo & Gyarmathy, 2004). Tests such as word reading ability should not simply be translated, but should be based on word frequency lists from relevant corpora, for example, Hickey (2007) presents word frequency lists based on *Corpas na Leabhar Gaeilge do Pháistí* (Corpus of Children's Books in the Irish language).

Non-word repetition

The level of phonotactic probability affects performance on non-word repetition tasks (Messer et al, 2010), and this should be controlled for if tests in Irish are to be comparable to those in English. Messer and colleagues provide a full description of how they establish high phonotactic probability non-words and low phonotactic probability non-words, which involves establish biphone frequency counts, and getting native speakers to construct non-words with high frequency biphones and low frequency biphones.

4.4.4 Test administration

In order to ensure that tests are administrated in an equivalent way across cultures, the tests administrators should be (a) drawn from target communities; (b) be familiar with the culture, language and dialects; and, (c) have adequate experience in test administration (Hambleton, 2005). This means that immersion pupils should be assessed by competent speakers of Irish, and insofar as possible, NIS

pupils should be assessed by native Irish speakers. In addition, professionals who carry out assessments would need a working knowledge of various dialects.

4.4.5 Norming

In order to make the tests reliable and useful to practitioners, accurate norms are needed. There is evidently much variation in the population in IME due to exposure to language and exposure to literacy instruction. Norms should be established separately for different subgroups of IME. This is feasible even in smaller populations. Virginia Mueller Gathercole and colleagues have developed standardised tests of receptive vocabulary for Welsh with norms which take into account the child's exposure to the language, given the linguistic context of Wales (Mueller Gathercole, Mon Thomas, & Hughes, 2008), and are in the process of developing other normed linguistic tests for Welsh (Gathercole, Thomas, Roberts, Hughes & Hughes, 2013). In order to standardise the vocabulary test, normative data was gathered from 611 children, including 214 from homes where only Welsh was spoken, 196 from homes where Welsh and English was spoken, and 201 from homes where only English was spoken (Mueller Gathercole, Mon Thomas, & Hughes, 2008).

4.4.6 Factors affecting interpretation of results: similarity of curricula

It is important that the type of literacy instruction received by children is taken into account when interpreting results. It is evident that many pupils are not taught Irish using a phonemic awareness and phonics strategy, and this can affect their ability to decode non-words (e.g. Ní Chiaruain, 2009) and may also affect their ability to perform phonemic awareness tasks (Bruck & Genesee, 1995).

4.5 The Current Study

In light of the lack of data relating to current practice in the Republic of Ireland, or its efficacy, a qualitative study was developed in order to examine these issues by interviewing education psychologists with experience in carrying out assessments in children from IME.

4.6 Methodology

4.6.1 Introduction

While previous sections in this chapter motivated various research questions, this chapter is concerned with how these research questions motivated the methodology employed in this study. As such, the research approach, research method, and type of sampling which were deemed optimal to answer these questions are discussed. The way in which the data was collected and analysed is then described, followed by its limitations.

4.6.2 Research questions

The aim of this study was to explore how EPs currently diagnose dyslexia in NIS pupils and immersion pupils. In addition, the study aimed to explore the opinions of EPs on the accuracy of the current practices, as well as find out what skills and assessment measures would be needed by EPs in order to carry out assessments in the Irish language. As such, the following are the research questions:

1. How are (a) native speakers of Irish and (b) Irish immersion pupils currently diagnosed with dyslexia?
2. Does current practice offer an accurate diagnosis to (a) native speakers of Irish and (b) Irish immersion pupils?

3. What skills and assessment measures would be needed by EPs in order to carry out assessments for dyslexia through Irish for native speakers of Irish and Irish immersion pupils?

4.6.3 Research approach

Flick (2014) states that the main reason a qualitative approach to research should be employed is because the research questions **require** it. As this study aimed to explore opinions, and attain more in-depth answers than quantitative methods would allow for, a qualitative approach was adopted. While the purpose of quantitative research is to make claims about a population based on a sample, qualitative research seeks to describe and understand a human experience (Polkinghorne, 2005).

4.6.4 Research method

A semi-structured interview was selected as the research questions are relatively complex, and semi-structured interviews are well-suited to answering more complicated research questions due to the flexibility involved and the room for expansion (Fylan, 2005). It was also considered that some questions may need to be further explained or require clarification, and that a semi-structured interview could allow for this. While there is danger of bias in gathering and interpreting nearly all kinds of data, it has been pointed out that because the researcher acts as a research instrument in qualitative research, it may be particularly susceptible to bias (Poggenpoel & Myburgh, 2003). This was considered and avoided at all stages of planning and implementing the study.

4.6.5 Sampling

Purposive sampling is a type of non-probability sampling which is most effective when knowledgeable experts in a particular domain are required (Tongco, 2007). The target population were not intended to be representative of the entire population, but chosen to provide optimal insight into the research questions. The researcher sought to recruit participants who were familiar with carrying out dyslexia assessments with (a) NIS pupils, and (b) immersion pupils.

The researcher contacted a number of organisations and individual EPs who provide assessments to children who may have dyslexia in Ireland, explained the aims of the study and requested their participation. Four EPs agreed to participate; three female and one male, and all of them regularly conduct assessments for dyslexia in the Irish population. One of the participants, a native Irish speaker, has significant experience in assessing NIS pupils for dyslexia. Three of the participants have experience in assessing immersion pupils. The researcher had no personal relationship with any of the participants.

| Participant number | Population with which participant has experience |
|--------------------|--|
| Participant 1 | Immersion pupils |
| Participant 2 | Immersion pupils |
| Participant 3 | Immersion pupils |
| Participant 4 | NIS pupils |

4.6.6 Data collection

Data collection took place during the summer of 2017. An ASUS laptop was used to record the interviews, which were carried out in the workplace of the participants. Interviewees were asked the

questions in the same sequence. Where clarification was required on the part of the interviewee of the interviewer, this was provided. Interviews ranged between ten minutes and forty minutes in duration.

4.6.7 Data analysis

The interviews were transcribed from the audio recording. Coding is a crucial aspect of qualitative research (Basis, 2003), and this was carried out manually by the researcher; the transcriptions were coded with keyword tags and these were analysed for commonalities, differences or patterns. As one of the interviews was carried out in Irish, it was decided to provide the original excerpts from the participant's interview in the Irish language and provide an English translation in Appendix 4. The translation was carried out by the researcher. Grammatical and lexical elements which are dialectal have been standardised to protect the identity of the participant.

4.6.8 Ethical considerations

Ethical approval was granted by the Research Ethics Committee of the School of Linguistic, Speech and Communication Sciences, Trinity College Dublin, in June 2017. The participants were given a participant information leaflet which contained details of the study, and subsequently given a consent form which each participant signed. It was made clear to the participants that they were free to withdraw from the study at any time.

4.6.9 Limitations

There are a number of limitations to this research. The study has a small sample size of four interviewees. While the purpose of this study is not to be entirely representative of the population of EPs in Ireland, a larger sample size would be likely to provide a more diverse range of opinions and experiences. In addition, as mentioned earlier, there is a more profound risk of bias in qualitative research than in quantitative research, and though this was taken into account during sampling, data collection and analysis, it is still a concern.

4.7 Findings

4.7.1 Introduction

In this section, the findings of the study are presented. The findings are organised around the three research questions posed in § 4.6.2, and include discussion on current practice used in assessing and diagnosing the population in question, the accuracy of current practice, as well as what skills and assessment measures would be necessary in order to carry out assessments through Irish. Findings relating to the three participants working with immersion pupils are discussed under the sub-heading "immersion pupils", while findings relating to the participant who works with NIS pupils are discussed under the sub-heading "NIS pupils". See Appendix 4 for translation of interview excerpts in Irish.

4.7.2 Current practice in assessing for dyslexia

Immersion pupils

The three participants with experience assessing immersion pupils indicated that they use the same assessment measures for this population as they do for native English speakers in English-medium education, and that they take the language background of the child into account in the formulation⁸.

⁸ A formulation "draws upon psychological theory in order to create a working hypothesis or 'best guess' about the reason for the client's difficulties" (Johnstone & Dallos, 2013, preface). It integrates information from the assessment process and draws on psychological theory (Division of Clinical Psychology, 2010).

"in the formulation - the diagnosis at the end - we're always having to bear in mind the background...there's nothing else really that we can do." (participant 1)

One participant indicated that, in developing the formulation, she takes into account the language background of the child as well as their level of exposure to literacy in the language.

"So, when you're meeting any child who has a bilingual background, you're trying to ascertain which is the more predominant language and have they had enough exposure to reading and writing in that language" (participant 3)

If the exposure to literacy in the language is deemed to be adequate and they are still below the norm, then dyslexia is considered:

"if they're had that exposure and they still can't read and write at their expected age level, then there's probably a learning difficulty there." (participant 3)

NIS pupils

The participant who regularly carried out assessments with NIS pupils indicated that he carries out assessments through Irish, using translated version of tools where possible, and developing his own tools where necessary. The participant indicated that he uses the IQ discrepancy analysis principle when assessing this population, which involves ascertaining if there is a discrepancy between the child's IQ and their level of literacy. Due to the complete absence of standardised assessment tools for Irish speakers, the participant translates the English version of the IQ test to Irish:

"Déanaim aistriúchán ar an leagan Béarla den IQ" (participant 4)

He also utilises grade-appropriate readers to test connected reading, and word frequency lists from Corpas Náistiúnta na Gaeilge in order to test word reading and spelling:

"Maidir leis an gcleachtas a bheadh agamsa, d'iarrfainn ar an bpáiste giota a léamh as leabhar a bheadh ar comhleibhéal leis an leis an léitheoir ranga, agus d'iarrfainn air an liosta minicíochta ó Chorpas Náistiúnta na Gaeilge - ar roinnt de na focail sin a léamh, agus thógfainn focail as an liosta sin freisin i gcomhair litriú. Arís, chaithfinn mo chuid súile ar na torthaí sin, agus thófaínnse cinneadh bunaithe ar mo chuid taithí, ach arís ní féidir braith orthu mar gheall nach bhfuil aon uirlisí caighdeánacha ann" (participant 4)

Unlike education psychologists who work through English, he cannot use other tests which are useful in diagnosing dyslexia - such as the phonological awareness tests - to support his decision.

"Cuid de na tástálacha sa verbals, ní féidir glanaistriúchán a déanamh orthu, sa chás sin déanaimse cinneadh tomhaiste - an ndéanfaidh mé an tástáil nó an battery trí Bhéarla leis? Tarlaíonn sé ó am go céile, go bhfuil an gasúr chomh compardach le Gaeile, ní bheadh ann ach cur amú ama" (participant 4)

In addition to his, unlike EPs who work through English, without the appropriate assessment tools or normative data for the population, he depends entirely on his own subjective analysis.

“Tá mo chuid comhleacaithe ag dul isteach sa chóras Béarla, agus tá na huirlisí acu, agus tá a gcuid tuairimí gairmiúla acu freisin, rud atá tábhachtach. Tá tuairimí gairmiúla agamsa, tá taithí agam ar an gcóras, tuigim an dátheangachas, tuigim an cainteoir dúchais, ach níl uirlisí agam, so níl aon eolaíocht an baint le mo bharúil ó thaobh ainilís chruinn bunaithe ar an eolaíocht a dhéanamh ar an disléicse.” (participant 4)

4.7.3 Accuracy of current practice

Immersion pupils

The participants indicated that there are certain issues in carrying out assessments through English on immersion pupils. One of the participants indicated that she had recently carried out an assessment with an immersion pupil; the child's word reading score in English was much lower than expected, but on analysis of her exposure to reading material in English this was understandable:

“all of her text books are in Irish, and she doesn't really do much reading at home for pleasure so most of her exposure to written language is in Irish, so her sight word vocabulary in English is going to be a little bit lower.” (participant 1)

The participant was then asked by the researcher if she thought that providing guidelines on this matter in bilingual children would be helpful, and the participant mentioned that incorporating an Irish version of word reading into the battery of assessments may be more representative of the child's skill than the English measure alone.

“possibly doing an Irish version of that to get a combined score would be a better representation of their word reading ability” (participant 1)

It was mentioned that there is a level of uncertainty in relation to students who are bilingual, whether their performance on rapid naming tests and working memory tests is an artefact of performing the test in a weaker language or not. The following comments were in relation to a bilingual child who spoke English and another European language:

“I wasn't sure when he scored very poorly on the speed of rapid naming test whether he wasn't very automatic at the task...I didn't know whether he was slow at it because he had a slow rapid naming speed or because he didn't know the numbers and letters as quick as he would in his native language.” (participant 1)

“the same with the working memory because it's to do with repeating numbers forward and backwards and you wonder are they translating them” (participant 1)

Another participant indicated that, though there were issues relating to assessments of immersion pupils and NIS pupils, a large population is necessary in order to standardised tests and if there were adapted tests with no norms, these may not be reliable.

“the Weschler tests are done, you know, on thousands of children worldwide, and there's a lot of data gathered on it, so I could imagine there'd be some limitations in terms of – I just wonder would it be as reliable” (participant 2)

Two of the participants said that it was native speakers of Irish the who were most affected by the lack of standardised assessments in Irish

“people who actually live in Gaeltacht areas whereby Irish is their native language...they’re probably the most disadvantaged” (participant 2)

One of these participants said that the English oral proficiency of immersion pupils provides a basis for the development of the PA skills tested, but that this is not the case where English is a second language:

“[immersion pupils] have had five years of learning the English language and they have a good solid foundation there of their phonics skills so it is those native Irish speakers where English is an additional language [who are most affected].” (participant 1)

NIS pupils

The participant working with NIS pupils indicated that he believed that there was no scientific accuracy to the non-standardised assessments.

“níl aon chruinneas ann...ní fianaise ó cheart atá os do chomhair amach, is fianaise scéalach í mar gheall ar nach bhfuil aon chaighdeánú déanta ar na measúnaithe” (participant 4)

The participant brought this question into the wider sphere and made the point that many native speakers are tested in English by EPs who do not speak Irish. While the participant has developed his own non-standardised methods of testing, and can utilise his experience and knowledge of bilingualism and the Irish language, NIS pupils who are assessed in English suffer a double injustice.

“Tá leatrom á dhéanamh orthu, agus tá sé feicthe agam tríd síos na blianta, tá thart ar scór bliain caite agamsa sna bunscoileanna, agus tá tástálacha ó shíceolaíthe feicthe agamsa agus tá siad skewed go hiomlán – uimhir a haon, bheadh an tástáil déanta trí Bhéarla, an IQ déanta trí Bhéarla mar gheall nach raibh aon Ghaeilge ag an siceolaí agus is í Gaeilge an teanga a bheadh ag an bpáiste. Bheadh na tástálacha Béarla, na tástálacha abair WYATT déanta ar an bpáiste sin, agus ar ndóigh bheadh na scálaí ar fad depressed mar gheall air. Ní bheadh aon iontafacht ag baint leis cé go bhfuil an cleachtas sin ag dul ar aghaidh agus is mór an scannal é sin go bhfuil sé fós ag dul ar aghaidh.” (participant 4)

The participant noted that the system does not give any recognition to the fact that an NIS child should be assessed through Irish, by a native Irish speaker.

“Níl aon aitheantas sa gcóras go gcaithfidh cainteoir dúchais an jab sin a dhéanamh” (participant 4)

The participant believes that the practice of diagnosing a child with dyslexia without standardised assessment tools raises ethical questions, which are not being addressed.

“tá ceisteanna móra eitice ann mar gheall nach bhfuil na huirlisí seo ann. Níl na ceisteanna seo á phlé.” (participant 4)

In addition to that, it raises questions of equality, both on the part of the child being assessed without the appropriate tools, and on the part of the educational psychologist who has to make a decision for which he or she has little evidence-based support.

“Maidir le hainilís nó tástáil a dhéanamh ar pháiste gur Béarla a theanga, agus tástáil a dhéanamh ar pháiste gur cainteoir dúchais Gaeilge é nó í, tá an siceolaí faoi mhíbhuntáiste. Tá easpa comhionannais ann ó thaobh chleachtas an tsiceolaithe” (participant 4)

4.7.4 Developing standardised assessments for Irish

Immersion pupils

The participants were then asked what skills would EPs need have in order to carry out assessments for dyslexia through Irish in the case of immersion pupils and NIS pupils. In relation to the skills that an educational psychologist would need, the participants considered that the following would be needed:

“a really good knowledge of the phonics system in Irish” (participant 1)

“[knowledge of] word structure” (participant 3)

“fluency in the Irish language, of course” (participant 2)

The skills that they felt were necessary include language skills, as well as knowledge of the phonological and orthographic systems of the Irish language. In terms of assessment measures, all of the participants considered that language-specific assessment measures would need to be adapted.

“I think the most important ones which would need to be changed and adapted would be the phonics ones – the CTOPP – so that they correspond to the Irish phoneme sounds.” (participant 1)

The Comprehensive Test of Phonological Processing (CTOPP) is a norm-referenced test of phonological processing skills, and includes phonemic awareness tasks, digit span tasks, non-word repetition tasks, as well as rapid naming tasks (Dickens, Meisinger & Tarar, 2015). The participants also said that accurate norms for all measures would also be needed.

“it would be really important for norms, accurate norms, to be gathered for the working memory and the rapid naming [measures]” (participant 1)

NIS pupils

In relation to the skills needed by the educational psychologist, participant 4 considered that native Irish speakers should be employed to assess NIS pupils. In relation to the assessment tools which would be necessary in order to provide an appropriate assessment to NIS pupils, participant 4 note that while there are currently no standardised assessment tools the most basic ones he would need are standardised literacy tools.

“Fiú amháin dá mbeadh ceann litriú agus ceann word reading ann, d’fhéadfá seasamh leis an gcinneadh. Dá mbeadh ceann triail tuisceana ann, chuirfeadh sé sin go mór leis.” (participant 4)

The researcher posed a question to the participant in relation to a perceived issue of collecting normative data in the relatively small population of NIS pupils, and the participant made the point that the feasibility of establishing norms the population has not yet been researched.

“níl an taighde déanta an bhfuil a dóthain acu ann. Agus an dara rud, d’fhéadfaí dul agus eolas de chineál éigin a chur le chéile idir lucht na Gaeilscoile agus na cainteoirí dúchais – bheadh rud éigin agat” (participant 4)

The participant indicated that, while the population may not necessarily be big enough to parallel the reliability of the tools for English speakers, an Irish-language tool with reference data for the existing population would be a great improvement on the current state of affairs.

“Go mbeadh uirlis de chineál éigin ann, go bhféadadh mise mar shiceolaí seasamh leis seachas mé ag úsáid mo chuid tuairimíochta.” (participant 4)

The participant added that he believed that reason why this has not yet been done stemmed from the fact that people do not accept that there are native Irish-speaking children who come to school with no English, only Irish, and that English assessment tools are wholly inappropriate for these children.

“Má théann tú ar ais agus má dhéanann tú ailinís ar an gcúis a bhfuil an meon sin ann, is é mo bharúil é, ní thuigeann agus ní fheiceann agus ní ghlacann daoine leis go dtagann páistí isteach geata na scoile sna naoionáin bheaga agus gan acu ach Gaeilge agus níl Béarla acu.” (participant 4)

In essence, this participant believed that the development of assessment tools which are appropriate for Irish speakers was a question of whether there was the political will to make it happen, and whether those who had the power to do so understand the situation.

“Is í an cheist ná an bhfuil an toil ann? An bhfuil an tuiscint ann?” (participant 4)

4.7.5 Conclusion

These findings indicate that different methods exist in assessing children who attend IME. Participants who assess immersion pupils use the standardised assessments for English speakers and take the language profile of the child into account in the formulation. It is apparent that many native Irish speakers have also been assessed using standardised assessments for English. In contrast, one participant uses non-standardised assessment tools which he developed for Irish. It was highlighted that the absence of appropriate assessment tools raises ethical questions and issues of equality. Participants considered that the development of standardised tools for Irish would be welcome although issues were raised in relation to the feasibility of collecting normative data.

4.8 Discussion

4.8.1 Introduction

The purpose of the study was to establish how children in IME are currently assessed for dyslexia, and to gain insight into the experience and opinions of EPs in relation to the suitability of these tests for the populations involved. In this section, the findings from § 4.7 are discussed.

4.8.2 Current practice in the assessment of pupils in IME for dyslexia

These findings extend the findings of Ní Chinnéide (2009); there are currently no standardised assessments for Irish in the Republic of Ireland, and students in IME are still typically assessed through English, using assessment materials which are designed for monolingual English speakers. Two differing methods of practice were reported; EPs who typically work with immersion pupils assess the children through English using standardised assessment measures, and a level of insight was gained into the way in which these EPs differentiated between IM pupils and English-medium pupils. One participant who has experience working with NIS pupils assesses children through Irish using self-developed assessments, although it is noted that NIS pupils are commonly assessed through English due to a lack of official recognition that this practice is fallacious.

EPs working with immersion pupils

The participants indicated that the language background of the child was taken into account in developing the formulations. In particular, two participants made reference to the child's level of exposure to the written language when interpreting assessment results. One of these participants also mentioned that, in the case of a bilingual child, the predominant language is taken into account.

EP working with NIS pupils

One of the participants, a native Irish speaker, reported translating the English version of the IQ test to Irish, and using grade-appropriate readers and word frequency lists to assess children who are native Irish speakers. Because these assessments are non-standardised assessments, there is no normative data to guide and support him in making a decision, and decisions are made based on his previous experience with the population, and his knowledge in the area of bilingualism. Depending on the level of exposure a child has had to English, he may be able to use verbal tests (such as PA tests) in English to add to the assessment, but this is sometimes a pointless exercise due to the child's dominance in Irish.

4.8.3 Accuracy of current practice

There was evidence of some difference in the perceived accuracy of the current practice; while the EPs who work with immersion pupils noted issues which affect the validity of their assessments of children in this population, it was noted that their English proficiency gave them a solid foundation for the verbal assessments. In contrast, the EP working with NIS pupils felt that the lack of standardised assessment tools meant that there was very little scientific weight in current practice.

EPs working with immersion pupils

The issues which the EPs brought up in relation to assessing IME populations reflect the findings in the literature; the level of exposure a child has to a language, or literacy instruction in a language affects their performance on the measures typically used in dyslexia assessments. It was mentioned that IM pupils may have a lower word reading ability than expected due to the language of schooling and level of exposure to English text. In relation to bilingual students more generally, one participant indicated that there was uncertainty when a child performs cognitive tasks such as rapid naming and working memory tasks in their non-dominant language; it is unclear whether their performance is a reflection of their cognitive ability or an artefact of performing the tasks in a non-dominant language. Two of the three participants noted that it was NIS pupils who are most disadvantaged by the current practice.

In their discussion of how they overcome issues in relation to interpreting results in these populations, it was not apparent that they were afforded any support in terms of guidelines on dealing with such

cases based on the literature. Some data exists on populations in IME in relation to word reading ability and vocabulary from one longitudinal study (Parsons & Lyddy, 2016), and while this will need to be supported by other studies, it is indicative of general trends in the population. In addition to this, there is substantial data available on the performance of bilinguals and L2 speakers on tests of PA, working memory and rapid naming. While the EPs who participated seemed to make intuitive decisions based on each child, it is possible that evidence-based guidelines would assist them in the process of diagnosis.

EP working with NIS pupils

It is evident that for native Irish speakers, the lesser exposure to the English language, as well as their delayed development in English literacy renders the standardised English assessments inaccurate. The participant said that he had seen many NIS pupils assessed using English assessment measures and that the results were not representative of their cognitive ability, and were entirely skewed. This is in line with what would be expected, given the data from Parsons & Lyddy's (2016) study. The lack of official recognition that NIS pupils should be assessed by an EP who is a native speaker is an additional failure of the system, over and above the lack of standardised assessments. In relation to the participant's own practice, he felt that the lack of standardised assessments meant that he had no evidence-based support for his decisions. He highlighted the ethical issues involved in diagnosing a child with a specific learning disability in this context. The participant also emphasised the equality issues that this raises on both the part of the child, who is not assessed with the same reliability as their English-speaking peers, and on the part of the psychologist, who is not afforded any of the basic support an English-medium EP is in making these important decisions.

4.8.4 Adaptation of assessment material for Irish language populations

In relation to the skills which would be needed by EPs administering Irish language assessments, participants working with IM students considered that the professional carrying out the test should have fluent Irish, and the EP working with native speakers said that assessments should be carried out by a native speaker. This is in line with the considerations provided in the literature review, where it was considered that professionals administering tests should be from the target population; in this case, IM students should be assessed by fluent Irish speakers, and native Irish speakers should ideally be assessed by native Irish speakers. In addition, the participants put an emphasis on the importance of letter-sound knowledge and word structure in Irish, in other words, a good knowledge of the phonology and orthography, and how the two relate.

In relation to the development of standardised assessments for Irish, it seems that the priorities of EPs working with immersion pupils and the EP working with NIS pupils were somewhat different. The participants working with immersion pupils considered that it would be important that the phonological processing component of the assessment – the CTOPP – be adapted for Irish, while the EP working with NIS pupils considered that the most urgently needed tools were standardised assessments in literacy – word reading and spelling. The participants working with immersion pupils acknowledged that accurate norms would have to be provided for all assessments, and one participant indicated that she had reservations in relation to the reliability of such norms, given the limited size of the population involved. This is a valid reservation; English-language assessments are normed on large populations, however the work of Gathercole and colleagues show that assessments can be successfully normed in smaller minority language populations. As mentioned in § 4.4.5, normative data from about 200 members of each target population (those from Welsh-speaking homes, English- and Welsh-speaking homes, and English-speaking homes) was gathered to standardise a vocabulary test for the Welsh population (Mueller Gathercole, Mon Thomas, & Hughes, 2008). The participant

working with NIS pupils indicated that there has been no research carried out on whether the size of the native speaker population was adequate to provide normative data, and he noted that any reference data would be helpful, regardless of whether it was statistically large enough to be referred to as normative data.

4.9 Conclusion

The aim of this chapter was to examine (a) the current practice of EPs in relation to diagnosing dyslexia in populations in IME pupils (b) the efficacy of this practice, and (c) the viability and necessary considerations for developing standardised assessment tools for Irish. A review of the literature was undertaken which showed that the literacy development of immersion pupils who begin to read in Irish, and of pupils in Gaeltacht schools differ from their English-medium peers. It also demonstrated that bilingual children perform differently to monolinguals on cognitive tests. This indicates that assessing IME pupils against norms established for monolingual English speakers would be inaccurate.

A qualitative study was then undertaken, in which EPs who work with immersion pupils and NIS pupils were interviewed. It is perhaps evident that the experience of the three participants who assess IM pupils differs from that of the participant who assesses native Irish speakers. While assessing IM pupils using English language norms presents challenges for EPs, the lack of standardised assessment tools is particularly unsuitable for native speakers, and infringes on their equality of education. It is notable that while concerns were raised about the ability to collect normative data for the populations in question, standardised tests were developed for similar populations in Wales. In addition, it was noted by one participant that any reference data would be a welcome support in making decisions on diagnoses.

Chapter Five:

Designing Reading Interventions in the Irish Language

5.1 Introduction

In this chapter, research relating to current practice in providing reading interventions to those with dyslexia in IME is examined. This research shows that while learning support is provided for English literacy, it is rarely provided for Irish literacy, and this is in part due to a lack of guidance in how to provide literacy instruction in Irish. In light of this, international research is examined in order to establish the elements of effective reading interventions; a particular effort is made to examine findings from various languages and to analyse cross-linguistic differences in efficacy. Having discussed these findings, considerations for designing interventions for the Irish language are discussed, and a summary table is provided with some examples of how such interventions might be implemented. Longitudinal research is necessary to establish the efficacy of reading interventions in the Irish language for immersion pupils and for native Irish speakers.

In synthesising information on interventions which primarily describe group differences rather than within-group variation, it is very easy to lose sight of the individual. It is important to emphasise from the outset that people with dyslexia are not a homogenous population; they have different cognitive deficits (Pennington, 2006), and vary in their response to intervention (Snowling, 2013). The primary factors to take into account when planning a training programme or intervention are the needs of the individual and the deficits they have; this should include an assessment of cognitive and neuropsychological processes, and not just an assessment of behavioural characteristics (Hale et al, 2001).

5.2 Current practice in relation to literacy support in Ireland

In recent years, trends in the provision of education for those with dyslexia have moved away from an IQ discrepancy approach towards an approach based on Response to Intervention (RTI) in the US (Berkeley, Bender, Gregg Peaster & Saunders, 2009) and in the UK (Rose, 2009). RTI developed in response to the inadequacy of the IQ discrepancy approach, which was seen as a wait-to-fail approach, as children had to fall significantly behind peers before they were identified as having literacy difficulties (Fuchs & Fuchs, 2006). RTI is generally a 3-tiered approach which starts in the classroom; (1) children are provided effective literacy instruction, and their progress is monitored; (2) if they do not respond to this instruction then they are provided with different or more intensive instruction, and their progress is monitored; (3) those who still do not respond qualify for more specialised instruction/special education (Fuchs, Mock, Morgan, & Young, 2003).

In Ireland, the National Educational Psychological Service (NEPS) developed guidelines for an approach which is based on similar principles as RTI, which advocated a Continuum of Support model for supporting children with Special Educational Needs (DES, 2007). It is a three-tiered system which starts

in the classroom where children are monitored and receive support in the classroom for any emerging SEN, their progress is monitored and it may be decided that school-based support staff should be involved, if the child's response is limited then more specialised support is provided. This model, called the Single Allocation Model, was tested in pilot schools in the 2015-2016 school year and was deemed successful, prompting its rollout in all schools from September 2017 in replacement of the General Allocation Model (DES, 2017a). The proposed advantages include the provision of support as soon as needs emerge without the need for diagnosis, and that it will not be necessary to label children (DES, 2017b).

While the proposed advantages are attractive, it has been noted in the international literature that the efficacy of RTI models was established in small-scale settings using highly-trained professionals (Fuchs & Mellard, 2007). RTI approaches have also come in from scathing criticism from scholars in the field of education, psychology and literacy research on many fronts, including the lack of empirical support for the model, the inadequate specification of instructional, identification methods and measurement tools, and concerns about teaching standards and the integrity of interventions, among other things (Hale et al, 2010; Reynolds & Shaywitz, 2009; Kavale, Holdnack, & Mostert, 2005). The RTI model depends on quality instruction and requires expertise from teachers in the identification and devising of interventions by classroom teachers, and even avid proponents of the model state that it requires "the specification and implementation of an ambitious professional development agenda" (Fuchs & Mellard, 2007, pp.6).

In relation to dyslexia, this agenda would need to include information on dyslexia at the cognitive and behavioural level, as well as information on what interventions are effective and the skills needed to implement them. The guidelines for the implementation of the Single Allocation model do not make any specific requirements or recommendations in relation to teachers' professional development, and pass the onus onto educational leaders and teachers themselves to acquire these skills (DES, 2017a). The guidelines acknowledge that the quality of instruction is the most critical factor in a child's educational experience, and also gives primary responsibility to the classroom teacher for all pupils, including those with SEN (DES, 2017a). In light of the serious responsibilities a teacher holds to those with SEN, it is a matter of concern that there is no adequate professional development agenda in place in this regard.

Recent studies highlight the need for professional development for teachers in order to improve their understanding of dyslexia. A study by Bell, McPhillips and Doveston (2011) investigated the conceptualisation of dyslexia in Ireland and England by learning support teachers, resource teachers and mainstream teachers. While they found that the Irish respondents had a clearer conceptualisation of dyslexia than their English counterparts, there was a lack of understanding of how phonological processing skills contribute to reading difficulties, and the authors recommended that this element be prioritised in pre-service and in-service teacher training. Among mainstream teachers, the conceptualisation of dyslexia tended to be limited to the behavioural level, and the cognitive deficits involved were not well understood. The authors concluded that investment in this area should target the professional development of teachers, rather than school-based interventions targeting specific learners.

5.2.1 Current practice in relation to Irish literacy support in IME

It is estimated that about 17% of pupils in the sector experience SEN (Ní Chinnéide, 2009). The most prevalent SEN in the IME sector is SLD, the category into which dyslexia falls (Barrett, 2016). In spite of this, Irish is the least supported subject for children with SEN in the IME sector (Barrett, 2016), and

respondents cited a lack of guidelines on literacy instruction in Irish, as well as time constraints, as factors in the low levels of support in this respect. As stated in Chapter Three, shortcomings in pre-service training have led to a lack of awareness of the letter-sound rules among teachers of Irish. This is concerning, particularly in light of the responsibility which teachers have in the Single Allocation Model to provide learning support for those with SEN.

In the only study available concerning the experience of dyslexic students in IM primary schools, Ní Chiaruain (2009) reported that while learning support was provided in English for those with dyslexia, none was provided in Irish in the IM school in which her study took place, although the learning support teacher and the principal of the school agreed that support should be provided in both Irish and English. Ní Chiaruain (2009) reported that staff at the school were in agreement that professional advice was needed in relation to dyslexia in IME. She also recommended that the DES issue comprehensive guidelines in relation to phonologically-based literacy instruction in Irish. However, the very limited amount of research in this area affects the ability to provide appropriate guidelines for teaching and non-teaching professionals (COGG, 2010). The concept of a Common Underlying Proficiency (CUP) often forms part of the discussion on literacy instruction in immersion education; the main tenet of the CUP is that instruction which promotes proficiency in one language of a bilingual pupil will also promote proficiency in the other language (Cummins, 1981). It is clear from the findings of Ní Chiaruain (2009) that the learning support the children received in English did not transfer to Irish, and they were unable to use a phonological decoding strategy to decode words. Grabe (2009, pp.145) makes the point that one of the assumptions underlying the CUP is that reading abilities and their developmental pathways are the same across languages, but “there is now strong evidence that this is not likely to be true for specific subskills across reading”. Different orthographies require different decoding strategies, and explicit literacy instruction in a language is necessary to promote proficiency in that language.

5.3 Elements of effective reading interventions: evidence from different languages

The level of disability which a child shows at any time is an interaction between the degree of impairment which the child has and the strength of instruction the child has received (Torgesen, 2006). This section focuses on maximising the strength of instruction which a child receives, in order to minimise their level of disability. It is structured in terms of lower-level skills and higher-level skills. Lower-level skills are those which can become heavily automated (Grabe, 2009), including decoding, spelling, automatic word recognition and morphological processing. The higher-level skills – fluency and comprehension – are built on efficient lower-level skills. The research on intervention in dyslexia is heavily weighted towards the lower-level skills, as it is deficits in these skills which seem to inhibit the higher-level skills.

Another major factor which moderates the level of disability a child has is the writing system of a language, this is discussed in §2.3. Language-dependent differences in the response or efficacy of intervention are pointed out, but research is needed on the manifestation of dyslexia in the Irish language in order to provide optimal support to pupils in IME. Practical characteristics of interventions, such as the duration, will not be discussed as these depend on multiple factors such as the language, the child and the resources available. However, reviews of the literature tend to recommend small groups or 1-to-1 tuition for those with dyslexia (Vaughn, Gersten & Chard, 2000; Singleton, 2009; Foorman & Torgesen, 2001). In relation to technology, the question is not about efficacy, but how

technology is applied to specific issues in reading instruction (NICHD, 2000); some tasks are better suited to computer-assisted instruction/practice than others..

5.3.1 Lower-level skills

Decoding accuracy

Phonics is a teaching approach which focuses on the correspondences between letters and sounds (Torgesen, Brooks & Hall, 2006). In order to learn letter-sound correspondences, a child must be able to (a) distinguish between the letters of the alphabet; and (b) distinguish between the phonemes of the language. It is for this reason that reviews of methodologically-sound intervention studies for poor readers recommend explicit training in phonemic awareness and systematic phonics instruction, as part of a larger reading programme including comprehension, fluency and vocabulary training (Scammacca, Vaughn, Wanzek & Torgesen, 2007; Vaughn & Roberts, 2007; Singleton, 2009; Torgesen, Brooks & Hall).

Phonemic awareness training is primarily auditory in that it involves the categorisation of speech sounds, however it is more effective when letters are included to provide a concrete representation of the sound (Foorman et al, 2003). The efficacy of phonemic awareness training had been proven statistically; in a meta-analysis of studies (Ehri et al, 2001a), it was found that phonemic awareness is effective in improving reading accuracy, and is more effective when letters are included⁹. In a separate meta-analysis it was also found that phonics training has a small to moderate effect on reading accuracy¹⁰ (Ehri et al, 2001b). Torgesen, Brooks and Hall (2006) refined the methodology used, and still found that phonics instruction has a small, but statistically significant effect on reading accuracy¹¹. These meta-analyses contain studies of heterogeneous populations, and they have consistently shown that PA and phonics interventions produce larger effect sizes in (younger) at-risk readers than in “reading-disabled” or older readers (Ehri et al, 2001a; Ehri et al, 2001b; Torgesen, Brooks & Hall, 2006). It is partly because of this that early intervention for those at risk of reading failure is seen as best practice (NICHD, 2000; Rose, 2009; DES, 2017a). However, while the optimum time for PA and phonics interventions may be in the first years of schooling, it is still effective for older readers with difficulties. A review of thirteen studies which provided intervention (phonemic awareness + phonics) to older children (9yr – 12yrs) with moderate to severe word-reading difficulties, showed that results were quite consistent across studies, producing a small effect size on decoding and reading accuracy (Torgesen, 2005). Torgesen concluded that it was possible for most older students with moderate to severe reading disabilities to improve their reading accuracy, but fluency issues are persistent in these readers.

Decoding speed

While accuracy has been the main concern of interventions in English, increasing reading speed is the main goal of interventions in more transparent orthographies (Tressoldi, Vio & Iozzino, 2007) as a slow rate of reading, as opposed to inaccuracy, is the most pertinent characteristic of dyslexia in transparent orthographies (Landerl, Wimmer & Frith, 1997; Serrano & Defior, 2008; Davies, Cuetos & Glez-Seijas, 2007). Children who learn to read transparent orthographies have a much smaller number of letter-sound correspondences to acquire in comparison to children who read in English, so these

⁹ Effect size (ES) of PA training without letters: $d = 0.38$; ES of PA training with letters $d = 0.67$

¹⁰ ES of phonics training on reading accuracy: $d = .41$ immediately after; $d = .27$ follow-up

¹¹ ES of phonics training on reading accuracy: $d = .27$ using a fixed effects model; $d = .38$ using a random effects model)

are learned readily, however it seems that the letter-sound correspondences are not integrated to the extent of automatisation which results in slower, less fluent reading. Recent studies using computer training programmes to train the automatic integration of symbol(s) and sound(s) under time constraints, had promising effects on the reading speed of Finnish poor readers (Saine, Lerkkanen, Ahonen, Tolvanen & Lyytinen, 2011) and Dutch dyslexic readers (González et al, 2015).

Spelling

There has been debate in the literature in relation to whether spelling comes about naturally due to exposure to print, or whether it should be formally taught; however, Graham and Santangelo (2014) conducted a meta-analysis and found support for formal spelling instruction over implicit approaches, with a moderate weighted mean effect size of 0.43. While phonics training improves reading accuracy, it does not have a significant effect on spelling (Torgesen, Brooks & Hall, 2006). Because spelling is a productive skill, it is likely that spelling needs more well-specified and automatic representations of letter-sound correspondences than reading requires. A meta-analytic review found that teaching spelling using the grapheme-phoneme rules combined with production activities (using letter tiles to write words containing learned rules), produced large effect sizes on reading ($d = 0.84$) and moderate effect sizes on spelling ($d = 0.60$) in younger at-risk groups and children with reading disabilities.

In addition to using letter tiles and emphasising productive skills, Darch (2000, 2006) found that teaching students with learning disabilities¹² a rule-based method, encompassing phonemic, morphological and context-dependent rules, was highly effective in improving spelling skills in a treatment group (compared to a control group who completed traditional spelling training). Masterson and Apel (2010) recommend analysing the origin of a child's spelling mistake to provide tailored interventions depending on the type of mistake; for example phonological mistakes (where grapheme-phoneme rules are not implemented) morphological mistakes (e.g. spelling 'attention' as **attenshun**) or semantic mistakes (e.g. mixing up 'their' and 'there') can be dealt with using different strategies.

Sight words

A sight word is a word which is read from memory (i.e. is not decoded). Acquiring a sight word vocabulary is dependent on the ability to decode (i.e. map letters to sounds) in an efficient manner (Ehri, 2014), as well as on gaining sufficient reading experience. Ehri (2005) has proposed that a sight word is learned in a connection-forming process which binds the pronunciation, the visual form of a word and its meaning in memory, and that this develops as a result of decoding the word a number of times. Decoding a word four to six times seems to be sufficient to read it as a sight word (Share, 1999¹³; Kwok & Ellis, 2015¹⁴) in typically-developing readers. Acquiring a sight vocabulary facilitates spelling as it allows readers to spell from memory (Ehri, 2014).

There is evidence that while dyslexic readers can store words as sight words in the mental lexicon, it takes much more exposure to the word in order to do so. In a study by Share and Shalev (2004) dyslexic readers, garden-variety poor readers and normal readers read passages which contained novel words, they were subsequently tested on their ability to spell these words or recognise their spelling. It was found that dyslexic readers and poor readers were less successful than the control group at storing

¹² Discrepancy-based: students had at least average potential and a severe discrepancy in one academic area, and all were bad spellers

¹³ Young readers of Hebrew

¹⁴ Adult English-speakers

the novel word as a sight word, and that their ability to do so was linked to their decoding ability. In another study (Rothe, Cornell, Ise & Schulte-Körne, 2015) which involved listening to a word and choosing between the correct spelling or a pseudohomophone (e.g. rain – rane), German dyslexic readers performed more poorly than normal readers, however they still reached a high level of accuracy (86.6% vs. 98.8%). In addition to this, Reitsma (1983) examined orthographic knowledge in dyslexic readers of Dutch and typically-developing readers and found that while the typically-developing readers incorporated new unfamiliar words into their mental lexicon after 4 – 6 times, readers with dyslexia did not, however very familiar words did seem to have been acquired as sight words.

The implication of these findings for intervention is that dyslexic readers are likely to require many more exposures to a word to be able to read it automatically as a sight word, and stories which include multiple repetitions of the same word may aid dyslexic readers in this endeavour. Acquiring a sight vocabulary avoids a major “bottleneck” in the reading process (Torgesen, Wagner & Rashotte, 1997), and allows for the development of fluency and comprehension.

Morphological Awareness

A recent review of studies on the role of morphological awareness (MA) in learning to read concluded that in alphabetic languages, MA is only weakly related to decoding, but is more important in later years as the focus moves towards comprehension (Kuo & Anderson, 2006). The role of MA seems to be script-dependent, however, as demonstrated by a study investigated the role of MA in children learning to read Chinese, Korean Hangul and English (McBride-Chang et al, 2005)¹⁵.

The weak relationship between MA and decoding in alphabetic languages is also supported by the outcomes of intervention studies; Goodwin and Ahn (2010) carried out a meta-analysis of MA training and found that it had a small but significant effect on spelling, reading comprehension and vocabulary, but not decoding. The average mean effects (averaged across non-reading measures, such as MA/PA, and reading measures) were small for “reading-disabled” students, but more promising for struggling readers and high for students with speech and language impairments¹⁶. However, another meta-analysis (Bowers, Kirby & Deacon, 2010) that computed the mean effect size for only lexical measures (vocabulary, word reading accuracy and speed, spelling, etc.) found that “less able”¹⁷ readers benefitted more than typical readers. The authors suggest that morphological information may generate richer lexical representations of words, and help bind semantic, phonological and orthographic information in lexical representations (based on the lexical quality hypothesis (Perfetti & Hart, 2002).

Arnbak and Elbro (2000) conducted a study involving MA training with Danish dyslexic readers, and found that while it did not significantly improve their decoding ability, it had a significant positive impact on their spelling scores in relation to the control group. The authors suggest that awareness of the morphemes in words allowed them to segment them in to smaller units that they knew how to

¹⁵ The children learning to read Chinese consisted of two cohorts; one in Beijing who learned to read Mandarin using Pinyin, a phonemic coding system; and one in Hong Kong who did not receive any phonemic or phonics instruction. The Korean Hangul script is an alphabetic syllabary which involves blending phonemes, but has a morphological structure closer to Chinese. They found that MA correlated with word reading in Chinese and Korean, but not in English, and PA correlated with word reading in English and Korean, but not Chinese.

¹⁶ Effect sizes: “reading-disabled” students ($d = .17$); struggling readers ($d = .46$); students with speech and language impairments ($d = .77$)

¹⁷ This included studies in which participants has a formal diagnosis of dyslexia or speech and language impairment, as well as informal measures for grouping reading ability.

spell. Carlisle (2003) argues that children with reading disorders may find morphemes (e.g. basewords, prefixes) easier to recall than orthographic units as the morphemes have an inherent semantic meaning. In terms of approach, a problem-solving “word detective” approach, in which students are given word families containing the same morpheme and asked to figure out its meaning, is well suited to MA training (Bowers, Kirby & Deacon, 2010).

5.3.2 Higher-level processes

Fluency

The level of fluency a reader has depends on multiple factors including (a) extent of sight word vocabulary and speed of accessing it; (b) decoding accuracy and speed for non-sight words; (c) ability to use context to decode words (somewhat dependent on vocabulary knowledge); and, (d) speed of processing meaning at the word-level and passage-level (Torgesen & Hudson, 2006). It therefore depends on the skills discussed thus far – phonemic awareness, grapheme-phoneme mapping, and acquiring a sight word vocabulary – being acquired to a sufficient level to allow for fluency and comprehension.

In relation to the pervasive and persistent deficits in fluency experienced by children who have been struggling to read for a number of years, Torgesen (2005) considers that the most important factor involved is the huge lack of practice poor readers get in comparison to typically-developing readers. Stanovich & Cunningham (1998) talk about the “Matthew effect” of reading practice, in which good readers get more practice and their reading skill thus increases (“the rich get richer”), while poor readers who have a less rewarding initial reading experience acquire less practice and their reading skill continues to lag in relation to their peers (“the poor get poorer”) which their empirical results had previously demonstrated (Cunningham & Stanovich, 1997). Because it takes readers with dyslexia longer to store a word as a sight word, it is likely to take a greater volume of reading in order to develop fluency than it would for a typically-developing reader.

Repeated reading is the most researched form of fluency training, and involves a pupil reading a passage (at a suitable reading level) multiple times until a desired reading rate (measured in words per minute) is achieved, and the same process is repeated with another passage (Meyer & Felton, 1999). Therrien (2004) conducted a meta-analysis of repeated reading interventions and found that it produced a large effect size of on the fluency of “learning-disabled” students¹⁸ and a small-moderate effect size on comprehension when reading a passage other than the one practiced.¹⁹ However on closer inspection, some of the studies involved only used repeated reading as part of a wider fluency intervention (e.g. Mercer Campbell, Miller, Mercer, & Lane, 2000). There are three elements which increase the efficacy of fluency interventions; providing a performance criterion (i.e. a given amount of words per minute as a goal) rather than a fixed number of readings (b) giving corrective feedback (Thierren, 2004), and (c) teachers providing a model of reading by reading the text aloud first (Chard, Vaughn & Tyler, 2002). While performance criterion will of course differ across languages, and with L1 and L2 readers, a guide to implementing repeated reading (Thierren & Kubina Jr., 2006) recommend 94 words per minute at second grade, and 114 words per minute at third grade for English readers.

It is not clear why repeated reading works as a practice (Grabe, 2009, pp.296). However, it seems that the basis for improvement lies in increased word recognition, as it was found that there was little transfer of reading speed gains to other passages unless there was a high degree of overlap between

¹⁸ IQ and achievement discrepancy used to identify them

¹⁹ ES of .79 on fluency; ES of .41 on comprehension

the vocabulary in the passage (Rashotte & Torgesen, 1985). This theory was supported by Thierren and Kubina (2007) who also emphasise the importance of repeated reading being contextual (i.e. in a passage) rather than in word list, and suggest that the importance lies in the fact that phrases and linguistic patterns are repeated in connected text and they become familiar. Torgesen (2005) makes the point that while repeated reading may result in fluency gains, there is no evidence that it can bring dyslexic readers to within normal ranges of fluency.

Comprehension

Fluency and comprehension are interlinked: fluency is both necessary for comprehension, and a consequence of comprehension (Sweet & Snow, 2003). Studies have found that people with dyslexia in third-level education perform worse than controls in measures of reading comprehension when sentences are complicated (Wiseheart, Altmann, Park & Lombardino, 2009) or when inferential rather than simple questions are asked (Simmons & Singleton, 2000). However, these studies failed to control for fluency in reading; given the persistence of fluency deficits in those with dyslexia, it is perhaps more likely that this underpinned their poorer comprehension skills. It does not seem that people with dyslexia have any fundamental issue with comprehension; studies which examine the ability of dyslexic children to understand complex spoken sentences have found no difference between their performance and the performance of control groups (Robertson & Joanisse, 2010; Shankweiler et al, 1995).

5.4 Individuals who are not responsive to intervention

There are a small group of pupils who are nonresponsive to typical interventions, estimated at between 2-6% of the population (Torgesen, 2000)²⁰. Analysis of intervention studies have shown that those who respond poorly to intervention are characterised by lower scores on tests of phonemic awareness, rapid naming, as well as having problem behaviour (Ron Nelson, Benner & Gonzalez, 2003). Al Otaiba and Fuchs (2006) also found that problem behaviour was significantly correlated with poor responders (along with poor rapid naming and vocabulary), and stated that non-responsiveness to early intervention may indicate the presence of multiple disorders, and suggest developing interventions to tackle both reading issues and behavioural issues. Behavioural problems distract children from focussing on the task-at-hand, and Torgesen et al. (1999) found that behavioural problems simply made it difficult for the children to profit from the intervention they received.

5.5 Effective reading interventions for L2 learners

The most prominent variable in a child's acquisition of literacy is individual variation in ability, regardless of whether they are learning to read in their first or second language (Bialystok, 2007). If a child has a cognitive deficit which prevents the integration of auditory objects (phonemes/spoken words) and visual objects (grapheme/written word), this will exist regardless of the language. In addition to this, there is evidence that the orthographic depth of a language has a larger effect on reading achievement than whether a child is reading in a first or second language, regardless of whether the reader is typically-developing or dyslexic; children learn to read in a shallow L2 orthography faster than a deep L1 orthography (Geva, Wade-Woolley & Shany 1993). Poor readers who are native English speakers perform better reading in Welsh, their second language, than in English, their first language (Spencer & Hanley, 2003).

¹⁹ Based on English-speaking populations

5.5.1 Reduced oral language proficiency: deficits in phonemic awareness and vocabulary

An in-depth look at all of the factors which differentiate learning to read in a first language from learning to read in a second language is beyond the scope of this dissertation (but see Grabe (2009), particularly Chapter 7), however the most important difference is the difference in oral proficiency and exposure to the oral language. Spoken language proficiency is an important pre-requisite for reading, and it seems that the two areas which this manifests in children learning to read in a second language is in phonemic awareness, primarily affecting spelling, and vocabulary, primarily affecting comprehension. It has been found that the reduced vocabulary²¹ of non-native speakers affects both lexical access and reading comprehension, and that L2 reading comprehension is more dependent on vocabulary knowledge than L1 reading comprehension (Verhoeven, 2000; Droop & Verhoeven, 2003). The authors suggest that having a large store of high frequency sight words will help to combat this issue.

In a study of second language Dutch speakers and native Dutch speakers learning to read Dutch, Verhoeven (2000) found that while the decoding skills of non-native speakers were equivalent to their native speaker counterparts by their second year of schooling, their spelling lagged behind their peers. This is attributed to a reduced level of discrimination between phonemes in the L2, which hinders phoneme-grapheme mapping. Similarly, Geva, Wade-Woolley, and Shany (1993) examined the literacy skills of native English speakers learning to read English and Hebrew; they found that their decoding skills were better in Hebrew than in English, which was attributed to the more transparent orthography in (pointed) Hebrew. However, their spelling was poorer in Hebrew, their second language, than in their L1. Geva suggests that this came about due to a combination of less defined phonological representations in their L2, combined with opaque orthographic elements. It may be important to note that the children in these studies were instructed by native English speakers in English and native Hebrew speakers in Hebrew (Geva, Wade-Woolley and Shany, 1993; 1997), and it is tentatively suggested here that the issue of less defined phonemic representations may be exacerbated where speakers without the full phonemic repertoire are teaching literacy.

It is perhaps unsurprising, then, that effective interventions for children learning to read in their L2 can be provided using the same techniques as for those learning to read in their L1, with an extra emphasis on oral language skills. It is worth mentioning the exemplary interventions studies of Vaughn and her colleagues, who carried out successful interventions with Spanish-English bilinguals learning to read in English who had very low oral proficiency in English, and poor results on screening tests in both languages; the same intervention was carried out on English literacy in one study (Vaughn et al, 2006a), and in Spanish in another (Vaughn et al, 2006b), and the third study is a replication of both (Vaughn et al, 2006c). Significant gains were made on reading and literacy-related measures in comparison to control groups, and the positive effects were still evident at follow-up (Cirino et al, 2009). The interventions consisted of explicit teaching of phonemic awareness, letter-sound correspondences, word recognition, connected text fluency, vocabulary, and comprehension strategies. In addition, there was an oral language component consisting of a storybook routine to build vocabulary knowledge and comprehension (see Mathes et al, 2007 for a comprehensive guide to the intervention design). Teachers were provided with a lot of materials including stories, student activity books, a puppet with a fully articulated mouth, and cards to track progress.

²¹ In this case, the second-language participants had a greatly reduced vocabulary, more than 2SD below their native-speaking peers (Verhoeven, 2000).

5.6 Applying the elements of effective reading interventions to the Irish context

There are various ways in which the characteristics of the Irish language – the orthography, phonology and morphology – and the context affect how the elements of effective interventions can be applied. These are discussed below:

5.6.1 Phonemic awareness

As discussed in § 5.5, there are two main ways in which the lesser exposure of second language learners may affect reading development; phonemic awareness and vocabulary. Vocabulary can be increased using similar tactics, across languages, however the importance of phonemic awareness in Irish warrants further discussion.

The process of developing explicit awareness of the sounds of Irish differs for native speakers and second language learners. Children typically have implicit awareness of the sounds of their first language, and this can be made explicit through instruction by a teacher who has good knowledge of the sound system of Irish. This implicit awareness may be lacking in second language learners if they are not exposed to the native sounds of a language. Even if they are exposed to the phonemes of the language, they are not acquired with the same ease as those of the first language.

Theories in the field of second language phonology show that sounds of the second language are perceived in terms of those of the first language. According to Flege's Speech Learning Model (Flege, 1995), phonetic categories are created early in childhood for contrastive sounds of the native language. When a person is exposed to a second language, a new phonetic category may be established if the person identifies some phonetic difference between the new L2 sound and the sounds of their L1. However if the new L2 sound is similar to a sound in the L1, particularly if it is an allophone of a phoneme in the L1 (i.e. if it is a non-contrastive sound), then the new sound will be assimilated to an L1 category. Similarly, The Perceptual Magnet Effect (Kuhl & Iverson, 1991) states that native language experience warps the perceptual space in such a way that L2 sounds are perceived in terms of L1 phonetic categories. The magnet effect draws L2 sounds towards L1 phonetic categories. Because some of the consonantal contrasts in Irish are allophones (non-contrastive) in English, and because distinguishing between these contrasts is integral to understand the writing system, it is particularly important that they are emphasised in phonemic awareness training. To this end, phonemic awareness training should be as explicit as possible, and include discussion of where the articulators are placed during pronunciation of different phonemes if necessary.

5.6.2 Phonemic awareness and the orthography of Irish

The two series of consonants (a palatalised series and a velarized series) are represented systematically in the Irish orthography. Interpreting the consonant quality is dependent on the neighbouring vowel grapheme; the same consonant letter is used in the case of both the palatalised and velarised consonant, and the neighbouring vowel grapheme disambiguates them from one another. The graphemes <e> and <i> indicate that the consonant is palatalised, while graphemes <a>, <o>, and <u> indicate that it is velarised. It is necessary here to make the distinction between vowel **sounds** and vowel **graphemes**; a vowel sound is the phonological articulation of the vowel, while the vowel grapheme is a letter which usually represents a vowel sound, but which may also only signal consonant quality in Irish.

This is illustrated as an example in the table below, which shows a set of minimal pairs consisting of a palatalised consonant and a velarised consonant with the front vowel /i:/ (<í>). As the palatalised

consonant is indicated by the <i> grapheme, there is no need to add in vowel graphemes and the word /tʲi:/ is represented in the writing system as **tí**. In the case of the velarised consonant, the vowel grapheme <u> is written beside the consonant to indicate that it is velarised, however is it not articulated; therefore /tʲi:/ is represented as **tuí**.

| | Palatalised | Velarised |
|------------------------|-------------|-----------|
| Phonetic Transcription | /tʲi:/ | /tʲi:/ |
| Orthography | tí | tuí |

5.6.3 Phonics

This system has an important implication for decoding; as the consonant quality can only be deciphered in the context of the neighbouring vowel, a letter-by-letter approach to decoding is not feasible. In order to select the correct consonant to pronounce, the reader must be aware of the vowel grapheme beside the consonant. Russian has two series of consonants also, and in the writing system the vowel grapheme beside the consonant must be taken into account in order to pronounce the consonant. This has led to a syllabic method of teaching (Kerek & Niemi, 2012; Elkonin, 1988). In this method, the consonant-vowel syllable is the basic unit which is emphasised, as opposed to the single letters in an alphabetic phonics method of teaching. Using syllabic minimal pairs is a good way to bring about awareness of the consonant contrasts, and also to show how consonants are represented in the writing system.

5.6.4 Morphological awareness

Irish has a richer morphology than English, and this has various implications. As mentioned in §5.3 the contribution of MA to foundation reading ability depends on the script. This relationship has not yet been studied in Irish, but because Irish is morphologically-rich, training in MA is likely to be more beneficial and contribute more to reading skills than it does in English. Another consideration in this area is in relation to acquiring a sight word vocabulary. Nouns in Irish are inflected for case and gender as well as number. This provides less exposure to any given form of a noun, and requires more forms of a noun to be learnt; for example, the word 'woman' in Irish is **bean** /bʲanʲ/ in the nominative singular, and **mná** /mʲn̪a:/ in the genitive singular. Adjectives following nouns in Irish are also inflected for number, case and gender. Due to the lack of research on initial mutations, it is not known whether exposure to words which are subject to lenition or eclipsis (i.e. **an bhean** /ənʲ vʲanʲ/, **ag an mbean** /əj ənʲ mʲanʲ/) would be equivalent to exposure to the lemma **bean**, /bʲanʲ/. Two of the primary factors implied in a reader's representation of morphology are frequency and transparency (Carlisle, 2003). Bybee (1995) suggests that inflected high frequency word forms may be stored as intact whole words whereas the base form of a low frequency word may be stored separately from inflections and combined as needed, and this has been supported empirically (Lehtonen & Laine, 2003).

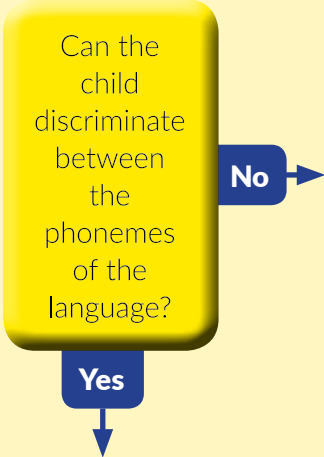
5.7 Conclusion and summary table

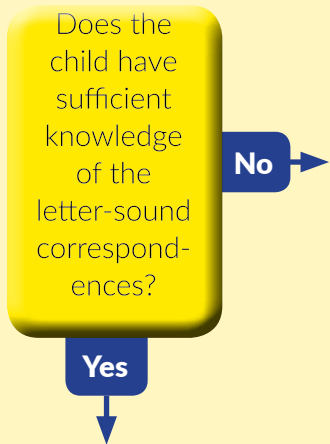
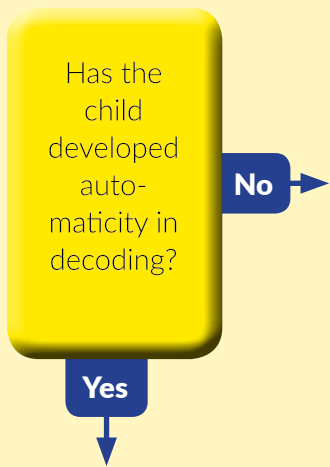
At the start of this chapter, research on the provision of support for those with dyslexia reported that Irish literacy was rarely supported, due to time constraints and a lack of guidelines in relation to Irish literacy instruction. In response to this, international literature was examined, and the elements of effective reading intervention in L1 and L2 readers were established. Based on the characterisation

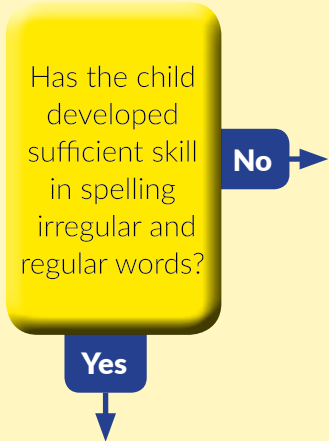
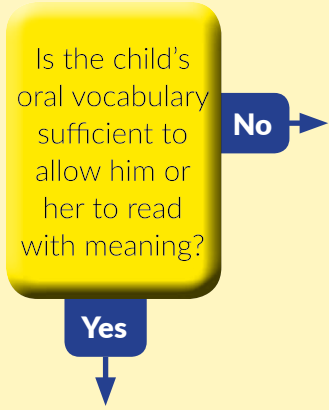
of Irish provided in Chapter Three, considerations were provided for developing reading interventions in Irish. The table below shows the elements of effective interventions discussed in § 5.3, and how they can be applied in the Irish context, keeping in mind the considerations discussed in § 5.6. Certain effective intervention studies which provided detail of the intervention instruction (Mathes et al, 2007; Gonzáles et al, 2015; Bowers & Kirby, 2010; Thierren & Kubina Jr., 2006) were particularly helpful in developing examples for the table. As previously discussed, the areas of phonemic awareness and vocabulary are of increased importance for those who are not native speakers of Irish.

While some of the elements of the intervention will occur in a fixed sequence (e.g. decoding accuracy will occur before decoding fluency), other elements are not necessarily in a strict sequence or even temporally distinct (e.g. morphological awareness and spelling). The examples given are illustrative and not exhaustive. For example, in the decoding accuracy phase, the examples relate to fostering awareness of the consonantal contrasts and how they are represented in the orthography. This is done in a simple way with simple syllabic minimal pairs where possible, using a long vowel which emphasises the consonantal contrasts. Closed syllables, alternative spelling patterns and multisyllabic words can be taught when the basic principle has been mastered on simple material.

Table 4 Elements of effective interventions applied to the Irish context

| Criteria | Guide to Intervention |
|--|--|
| Phonemic Awareness | |
|  <p>Can the child discriminate between the phonemes of the language?</p> <p>No →</p> <p>Yes ↓</p> | <ol style="list-style-type: none"> Background <ol style="list-style-type: none"> Teach the vowel sounds Concentrate on one long vowel sound (e.g. í) Introduce the difference between velarized (“leathan”/“broad”) and palatalised (“caol”/ “slender”) consonants in the context of a syllabic minimal pairs (e.g. <i>tí</i> & <i>tuí</i> / <i>sí</i> & <i>suí</i>), with pictures of the words where possible. Receptive skill <ol style="list-style-type: none"> Ask if the words are the same or different Ask what vowel sound is in the word Ask if the initial sounds are the same or different If possible, show pictures of the two words and ask the child to choose which picture represents the word. Productive skill <ol style="list-style-type: none"> Point to a picture of one of the syllabic minimal pairs and ask the child which one it is. Phonics |

| Criteria | Guide to Intervention |
|---|--|
| Phonics | |
|  <p>Does the child have sufficient knowledge of the letter-sound correspondences?</p> <p>No →</p> <p>Yes ↓</p> | <ol style="list-style-type: none"> Background (introduce sounds already practiced in phonemic awareness stage) <ol style="list-style-type: none"> Teach a vowel grapheme e.g. í Explain that it is a slender vowel and colour code it in yellow Introduce the syllabic minimal pairs taught in the phonemic awareness stage Explain that the broad and slender consonant is written with the same letter, but colour code the slender consonant yellow, and the broad consonant green Explain that a broad consonant (in green) does not like to be beside a slender vowel (in yellow), so we put a broad vowel in as a “cushion” between the broad consonant and slender vowel. Exercises <ol style="list-style-type: none"> Say one of the minimal pairs and ask the child to choose which spelling represents the word. Spell one of the minimal pairs with letter tiles and ask the child to read the word. |
| Developing Automaticity | |
|  <p>Has the child developed automaticity in decoding?</p> <p>No →</p> <p>Yes ↓</p> | <ul style="list-style-type: none"> The aim of this stage is to move from controlled processing to automatic processing of letter-sound correspondences. It involves practicing the letter-sound correspondences which have already been learned, within the context of words and under time constraints. <ol style="list-style-type: none"> Background <ol style="list-style-type: none"> Revise a small set of letter-sound correspondences which have already been learned. Exercises <ol style="list-style-type: none"> Gather a set of words which all contain one of the letter-sound correspondences in focus. Take one word at a time, and ask the child to decode it syllable-by-syllable, and blend it together. (c) Repeat this multiple times with each word, decreasing the time allowed to decode each word and increasing the complexity of the word that follows. |

| Criteria | Guide to Intervention |
|---|---|
| Spelling | |
|  <p>Has the child developed sufficient skill in spelling irregular and regular words?</p> <p>No →</p> <p>Yes ↓</p> | <ul style="list-style-type: none"> An analysis of spelling errors may show that the child has difficulty in phonemic awareness (where there are consistently too few letters/the wrong letters), a lack of knowledge of the grapheme-phoneme rules (where spelling is intelligible but simplified), interference from English grapheme-phoneme rules, etc. Spelling can be enhanced by concentrating on the origin of the spelling mistakes, and general spelling interventions may include: <ol style="list-style-type: none"> Practicing letter-sound rules and doing production activities such as writing or using letter tiles to spell words. Teaching context-dependent rules, or allowing them to discover the rule if possible. For example, the child can be given a group of words which contain double consonants, and a group of words which contain the same vowel beside single consonants, to see if they can deduce that the double consonants make the vowel longer e.g. <i>poll</i>, <i>ann</i>. Teaching morphological rules: see <i>Morphological awareness</i> below. |
| Vocabulary | |
|  <p>Is the child's oral vocabulary sufficient to allow him or her to read with meaning?</p> <p>No →</p> <p>Yes ↓</p> | <ul style="list-style-type: none"> The aim of this phase is to increase oral vocabulary, and it is particularly important for L2 learners. <ol style="list-style-type: none"> Choose a storybook which can be read over a number of days, and pick out target words which the child will learn in each session. Explain the meaning of the words at the beginning of the session, and ask the child to listen out for these new words and see if he or she can identify what they mean as the words come up. When the passage has been read, discuss what happened and try to elicit the new vocabulary items. |

Sight Words

Does the child have a large enough sight word vocabulary to allow him or her to read fluently?

No →

Yes ↓

- The aim of this phase is to acquire a large sight word vocabulary in order to facilitate reading fluency and comprehension.
- This requires a lot of exposure to text; to recognise a word automatically, the word must be decoded several times. The number of exposures required is increased for those with dyslexia.
 - (a) Choose target words (2 or 3 per session) and find text passages which contain the word multiple times.
 - (b) Ask the child to read the passage aloud and check that the target words are decoded accurately.
 - (c) After multiple readings, choose a new passage with the same target words.
 - (d) Revise the same target words at the start of the next session.

Can the child use morphemic information to aid in spelling and comprehension?

No →

Yes ↓

- The aim of this phase is to provide awareness of the morphemes which make up words, in order to facilitate decoding, spelling and comprehension. Exercises include:
 - (a) Playing “word detective” games: the child is given a group of words with the same prefix (e.g. *neamh*) or suffix (e.g. *-ach*) and deduces what the morpheme tells us about the words. Alternatively, the group of words can have the same root (e.g. *múineadh/múinteoir*) and the child identifies the root.
 - (b) Fostering awareness of the sound changes and orthographic changes which come about as a result of the eclipsis (*urú*) and lenition (*séimhiú*). For those with dyslexia, the rules should be taught explicitly. In a group, this can be practiced in context by hiding items around the classroom/outdoor space, and asking the children to find them and write down where they were found (e.g. faoin **m**bord/ar an **g**cathaoir), or asking them to write clues for the game (e.g. tá sé gar don **ch**rann)

Morphological Awareness

Does the child have a large enough sight word vocabulary to allow him or her to read fluently?

No

Yes

- The most important factor in increasing fluency and comprehension is reading experience. Repeated reading is effective in increasing fluency and comprehension.
 - (a) Choose a passage at an appropriate level of difficulty for the child, and mark the number of words at different stages on your copy of the passage.
 - (b) Read the passage aloud for the pupil.
 - (c) Ask the child to begin reading and begin a timer. If there is a pause (3 seconds or more), provide the word for the child and ask the child to repeat it back and continue reading.
 - (d) When the times ends, record the correct words read per minute.
 - (e) Provide feedback and the correct pronunciation of words missed.
 - (f) Start the process again: the passage can be read up to four times

Chapter Six:

Conclusions and Recommendations

The aim of this research was to analyse the efficacy of dyslexia assessments and reading intervention in Irish, and to provide considerations for the improvement of current practice. In order to establish the efficacy of current practice, the validity of using standardised assessments in Irish-speaking populations was examined theoretically, and a qualitative study was undertaken with EPs. In light of previous research which indicates that learning support is rarely provided in Irish literacy to children with dyslexia, due in part to a lack of guidelines, a review of the literature in different languages was undertaken, and language-specific and universal features of effective reading interventions were taken into account. Then, suggestions were made for implementing a reading intervention in Irish for those with dyslexia.

It was deemed necessary to provide background information on (a) dyslexia and (b) the Irish orthography in order to achieve the aims discussed above. To this end, a characterisation of dyslexia was provided in Chapter Two and it was concluded that the most likely cause of dyslexia at the cognitive level is poorer integration of orthographic and phonological information. In Chapter Three, a description of the Irish orthography was given, and it was concluded that while Irish is more consistent than English, it is still very complex; this puts Irish at a similar level of orthographic depth as French and Danish.

This concluding chapter summarises the findings of this study and provides recommendations in light of these findings. It is hoped that these may provide the starting point for language-specific studies in the area of assessment and intervention for dyslexia.

6.1 Conclusions

The conclusions, resulting from the findings of this study, are structured around the questions laid out in Chapter One.

How are immersion pupils and NIS currently assessed for dyslexia?

A previous study had examined the practice of EPs in Northern Ireland and found that IM pupils are typically assessed using standardised assessment tools developed for monolingual English speakers. A qualitative study was carried out in order to provide insight into the methods which are currently used to diagnose IM pupils in the Republic of Ireland with dyslexia. This was achieved by interviewing four EPs; three had experience assessing immersion pupils for dyslexia, while one had experience assessing NIS pupils for dyslexia. It emerged that there were differing methods of practice among the participants. While the EPs who assess immersion pupils use standardised tests for English and take the child's exposure to language and literacy into account in their formulation, the EP who assesses

NIS pupils translated the English version of the IQ tests and has developed his own methods for assessing literacy in Irish. In this case, he has no normative data to support his decision in

diagnosing a child. It was noted that NIS pupils are often tested in English by other EPs, which results in an unreliable diagnosis. This practice occurs due to the fact that there is no official recognition that a native Irish speaker should assess NIS pupils.

How effective is the current practice in identifying dyslexia in immersion pupils and NIS pupils?

The literature review indicated that the trajectory of literacy development in English differs for those in IME in comparison to their peers in English-medium education; the word reading of immersion pupils who learn to read in Irish first is delayed somewhat, and the non-word reading and word reading of Gaeltacht pupils are significantly delayed. This raises questions in relation to the validity of literacy tests which may be used in dyslexia assessments for these groups. It was also evident from the literature review that bilingual and emergent-bilingual populations perform differently to monolinguals on some cognitive tests included in dyslexia assessments. In relation to the perceptions of the EPs who participated in the study, the three EPs who test immersion pupils and bilingual children noted that there were certain issues assessing these groups, relating to word-reading tests and some cognitive tests. However, in the case of immersion pupils, they felt that their English proficiency gave them a good basis to perform verbal tests. It was noted by these EPs that NIS pupils are the most disadvantaged when it comes to the current practice. The EP who assesses NIS pupils felt that there was no scientific accuracy in the current practice, and there was no evidence-based support for his decisions. Instead, he relied entirely on his experience in the field, and his knowledge base in relation to bilingualism and the Irish language. He said that this practice raised ethical issues for him as a psychologist, and also pointed out the lack of standardised assessments for NIS pupils was an equality issue. The Single Allocation Model which is being introduced by the government in the coming academic year places more responsibility on the class teacher to identify SEN and devise reading interventions for those with dyslexia, and relies heavily on diagnostic assessments and standardised assessments to inform this plan. It is likely that the literacy development of NIS pupils with dyslexia will be further compromised by the lack of appropriate tools in this area.

What skills and assessment tools would be necessary in order to provide appropriate assessments for dyslexia in Irish?

The question of developing standardised assessments was examined and considerations for this, informed by the literature, were provided. The EPs working with immersion pupils said that standardised assessments in literacy-related measures would be welcome, but had reservations in regard to the ability to gather normative data due to the limited size of the population in question. The EP working with NIS pupils made it clear that the research has not been done to establish whether the population of NIS pupils is large enough to provide normative data, and that regardless of whether it was statistically large enough, reference data for the population that does exist would be a great improvement on the current situation. It was established in the literature review that standardised tests have been developed in minority language populations, and that in the case of a standardised vocabulary test, normative data was gathered on about 200 people per population involved (Mueller Gathercole, Mon Thomas, & Hughes, 2008). In relation to the characteristics of the EPs carrying out assessments on these populations, it was considered that competent Irish speakers should assess immersion pupils, while native Irish speakers should assess NIS pupils.

What elements should an effective reading intervention for both L1 and L2 speakers of Irish contain?

An effective reading intervention in Irish for a child with dyslexia should focus on encouraging integration of the sound and the letter(s) that represent it, with an aim to achieving automaticity. There are certain pre-requisite skills before this can happen; the child needs to be able to discriminate

between the phonemes of a language (phonemic awareness) and recognise the letters of the alphabet. Where the child is not a native Irish speaker, phonemic awareness training needs to be more explicit and show that some sounds which are non-contrastive in English, are contrastive in Irish. Syllabic minimal pairs can help to show the difference between the two series of consonants (e.g. *tuí*, *tí*), while minimal pairs which differ in long and short vowel sounds can emphasise the effect of a *síneadh fada* on a vowel. Then practice in decoding and spelling is necessary to re-enforce the link between letters and sounds.

In moving on from basic decoding skills, the elements which should be fostered are oral vocabulary, sight word vocabulary, and MA. Developing oral vocabulary is particularly important for non-native Irish speakers who have less exposure to the language; storytelling provides a good context for this development. In relation to MA, its contribution to literacy development varies depending on the script of a language and is likely to be more important in Irish than in English. A rule-based approach to MA and spelling might suit children with dyslexia more than an implicit exposure-driven approach. Finally, a large sight vocabulary is needed to develop reading fluency. This requires much exposure to text, and a child with dyslexia will need to decode a word more times than a typically-developing child in order to store it in memory.

Deficits in decoding and in sight word vocabulary may hinder reading fluency and cause comprehension issues. Where fluency is an issue, the lower-level skill(s) which are hindering fluency development should be identified and worked on. In addition, repeated reading can be used to improve these higher-level processes.

6.2 Limitations

This study has several limitations. The sample size of the qualitative study was small, and while it gave insight into current practice, a larger sample size would be needed in able to generalize these findings to the larger populations of EPs. Furthermore, there was little previous research relating to the population in question with which to ground the discussion. In addition, due to lack of research in the Irish language, considerations relating to the implementation of effective interventions are quite preliminary. However, it is hoped that they will offer a starting point for research in the area.

6.3 Recommendations

- There are evidently various issues in Irish literacy instruction, including a poor awareness among teachers of the sounds of the language, a lack of knowledge of the letter-to-sound rules in Irish, as well as a culture of diminished value of the teaching of Irish literacy. Training in relation to these essential cornerstones – phonemic awareness, phonics and motivation – should be included as part of pre-service training for new teachers, or as part of a programme of continuous professional development for current teachers.
- In light of the new Single Allocation Model of provision for SEN, which places more responsibility on class teachers for identifying and devising reading interventions for those with dyslexia, training should be provided in relation to identifying dyslexia at an early stage in bilingual and emergent-bilingual pupils, as well as in relation to implementing effective reading interventions for the Irish language.

- It is evident that the current practice of identifying dyslexia in IM populations is not optimal for immersion pupils, and completely inaccurate for NIS pupils. Standardised tests of word reading and non-word reading should be developed and normative data gathered from the relevant populations. In addition to this, the cognitive tests used in dyslexia assessments should be adapted for Irish and normed on immersion pupils and NIS pupils.
- While these tests are being developed, EPs and educators should be provided with guidelines for assessment based on the current state of knowledge in relation to literacy development of IME pupils and the cognitive development of bilingual and emergent-bilingual children.
- Longitudinal studies should be undertaken which chart the typical trajectory of literacy development in NIS and immersion pupils in detail, including the emergence of phonemic awareness, the strategies employed in reading and spelling, the emergence of MA etc. A comparative study tracking groups exposed to different methods of literacy instruction may provide insight into the most effective ways of teaching literacy to IME populations.
- A longitudinal study of the efficacy of a reading intervention in Irish should be carried out in order to provide guidelines for learning support in the Irish language. This should include an evidence-based reading intervention for Irish, and chart the literacy development and cognitive development (PA, working memory) of NIS and immersion pupils with dyslexia in comparison to well-matched controls.

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Appendix 1

Atypical activation of brain regions

Due to the small number of participants in individual studies, this appendix, on which **Figure 1** in Chapter Two is based, is grounded in two meta-analysis - one quantitative (Richlan, Kronbichler & Wimmer, 2009), and one qualitative (Paulesu, Danelli and Berlingeri, 2014) – and a range of literature is used to interpret the significance of the activation patterns. The drawback of meta-analysis is that different criteria are used to select participants and different tasks are used to elicit activation, nevertheless the convergence between studies is promising.

Visual Word Form Area (Temporal Lobe)

Both the quantitative and qualitative meta-analyses support the dysfunction or lower activation in the Visual Word Form Area (VWFA) (Richlan, Kronbichler & Wimmer, 2009; Paulesu, Danelli and Berlingeri 2014). Kronbichler et al (2004) suggest that the VWFA is involved in whole word recognition, while Devlin et al (2006) suggest that this area is involved in linking sensory input to stored phonological and semantic representations. This area is not just involved in processing linguistic stimuli, and it is interesting to note that there is reduced activation in this area in people with dyslexic during picture naming (McCrory, Michelli, Frith & Price, 2005).

Inferior and middle temporal gyrus (Temporal Lobe)

Paulesu Danelli and Berlingeri (2014) found evidence of underactivation in the lateral inferior temporal multimodal region and the left middle temporal gyrus in dyslexic readers. Similarly, regions of underactivation were found in the inferior and middle temporal gyrus by Richlan, Kronbichler & Wimmer (2009). The lateral inferior multimodal region has been referred to as a “convergence zone” for the linkage of phonological, orthographic and semantic information, and activation is stronger for alphabetic rather than phonological tasks (Cohen, Jobert, Le Bihan & Dehaene, 2004). The inferior temporal gyrus, and the posterior part of the middle temporal gyrus are thought to support visual-semantic linkage (Vigneau et al, 2006).

Superior Temporal Sulcus (Temporal Lobe)

The quantitative meta-analysis found maxima of underactivation in posterior parts of the left superior temporal gyrus/sulcus (Richlan, Kronbichler & Wimmer, 2009). This does not seem to be supported by the qualitative meta-analysis, at least for reading-related tasks (Paulesu Danelli and Berlingeri, 2014). The superior temporal gyrus is involved in speech processing (Carreiras et al, 2009), and plays a central role in the integration of letters and speech sounds (Van Atteveldt, Formisano, Goebel & Blomert, 2004). Vigneau et al (2006) suggest that the posterior part of the superior temporal sulcus is also involved in the working memory network for reading.

Supramarginal gyrus (Parietal Lobe)

The qualitative meta-analysis (Paulesu, Danelli & Berlingeri, 2014) found that clusters of activation in the supramarginal gyrus was associated with the controls but not the dyslexic readers in tasks

including reading, phonological processing and working memory. Similarly, the quantitative meta-analysis found maxima of underactivation in the supramarginal gyrus (Richlan, Kronbichler & Wimmer, 2009). The supramarginal gyrus is involved in auditory working memory processes (Gaab, Gaser & Schlaug, 2006). Vigneau et al (2006) found that the supramarginal gyrus was activated in working memory tasks but not rhyming tasks, and suggest it may be part of the phonological loop.

Inferior frontal gyrus (Frontal Lobe)

While Richlan, Kronbichler & Wimmer (2009) found that the inferior frontal gyrus was underactivated in dyslexic readers, this was not supported by the qualitative meta-analysis (but is supported elsewhere, e.g. in Turkeltaub et al, 2003). Areas of the inferior frontal gyrus (corresponding to Brodmann area 44/45 – pars opercularis/pars triangularis) are associated with semantic and syntactic processing of sentences (Vaessen et al, 2010). Hagoort (2005, pp.419) suggests that the inferior frontal cortex recruits information from the temporal lobe structures and “unifies them into overall representations that span multi-word utterances with phonological processing”.

Other regions

Paulesu, Danelli and Berlinger (2014) found clusters of activation associated with the basal ganglia, and areas of the right hemisphere, which was not supported by the quantitative meta-analysis. Neither meta-analysis found support for dysfunction of the cerebellum, or the magnocellular system.

The effect of orthography on patterns of brain activation

There is, to date, only one study which comparatively examines the brain activation patterns of typically-developing and dyslexic readers with different native languages; Paulesu et al (2001) examined French, Italian and English-speakers using PET and found the same areas of underactivation in dyslexic readers regardless of their native language. The most prominent area of underactivation in dyslexic readers was the left middle temporal gyrus, with additional regions in the inferior and posterior temporal cortex, and the middle occipital gyrus.

There are, however, many non-comparative studies which investigate patterns of under- and over-activation in dyslexic readers and controls in languages other than English, and these studies were the subject of a meta-analysis by Martin, Kronbichler & Richlan (2016). They found a universal deficit in the left occipito-temporal cortex for shallow and deep orthographies, present in both studies relating to adults and children, with particular underactivation in the Visual Word Form Area, thought to link visual information to stored phonological and semantic information.

However, in contrast to Paulesu et al's (2001) cross-linguistic study, the meta-analysis found different patterns of underactivation in shallow and deep orthographies. There was more pronounced underactivation in dyslexic readers of shallow orthographies in the supramarginal gyrus, which is involved in phonological/auditory memory processes. While the right temporal sulcus has a higher convergence of underactivation in dyslexic readers of deep orthographies - an area involved with the integration of speech and letter sounds – interpreted by the authors of the meta-analysis to reflect the more severe deficits in letter-sound integration in deep orthographies (Martin, Kronbichler & Richlan, 2016).

Appendix 2

The genetic basis of dyslexia

Heritability of dyslexia

The heritability of dyslexia has been supported by statistical analysis of heritability based on twin studies. For example, Gayán and Olson analysed the heritability of reading-related skills (such as phonological awareness and word recognition) in a sample of 515 twins and found that more than half of the variation exhibited was due to genetic factors, with shared environment having a smaller but significant influence (Gayán & Olson, 2001). The authors state that there it is unlikely that there is one single genetic pathway to dyslexia (Gayán & Olson, 2001, pp. 503), and this assertion is supported by the findings of genetic linkage and genetic association studies. In addition, the causal path between genes and the characteristics of dyslexia is “variable and interacts crucially with environmental factors” (Oliver, Johnson, Karmiloff-Smith, & Pennington, 2000, pp.3).

This field of research into the genetic basis of dyslexia is a relatively young one, and while these findings are promising, certain methodological issues have been highlighted. For instance, it has been highlighted that the sample sized used in many of the studies is relatively small and may not have the statistical power required to detect genes with small effect sizes (Skiba, Landi, Wagner, & Grigorenko, 2011). Crucially, it has also been noted that the inclusion criteria differ across studies meaning that samples are non-homogenous (Skiba, Landi, Wagner, & Grigorenko, 2011), this is a cause for concern at every level of research on dyslexia.

Chromosomal regions and candidate genes

Nine chromosomal regions have been associated with dyslexia through genetic linkage studies. Of these nine regions, the most reliably replicated regions are DYX1 and DYX2 (Mascheretti et al, 2017). It is interesting to note that evidence has been found for linkage with ADHD on regions which coincide with DYX1 (Bakker et al, 2003) and DYX2 (Willcutt et al, 2002), meaning that genes in these regions may contribute to the comorbidity between these disorders (Schumacher et al, 2007).

Candidate genes have been discovered for four of the nine chromosomal regions; DYX1, DYX2, DYX3 and DYX5. The candidate genes on DYX1, DYX2 and DYX3 are discussed below, however the candidate genes on DYX3 will not be discussed here as little is known about them, and neither will candidate genes which are not connected to one of the nine established chromosomal regions. The reader is referred to Mascheretti et al (2017) for a comprehensive review of the neurogenetics of dyslexia.

DYX1: DYX1C1 and CYP19A1

DYX1C1 was identified as a candidate gene for dyslexia as the gene was found to be disrupted by a translocation²² in a father and three children all of whom had profound reading problems or were

²² Transfer of genomic material to a new site. Constitutes a ‘structural aberration’ and alters or abolishes gene expression

diagnosed with dyslexia (Taipale et al, 2003), however it has not been well-replicated (e.g. Scerri et al, 2004; Meng et al, 2005). The other candidate gene on DYX1 – CYP19A1 – was also identified as a candidate gene as it was disrupted at a translocation breakpoint in an individual with dyslexia (Nopola-Hemmi, Taipale, Haltia, Lehesjoki, Voutilainen, Kere, 2000). In a subsequent study involving CYP19A1, there was a moderate association between dyslexia and a number of Singular Nucleotide Polymorphisms (a common genetic variation involving a single nucleotide) or haplotypes (a number of genes inherited together from one parent) in three of the four cohorts tested by Anthoni et al (2012). CYP19A1 has been seen as particularly interesting as it is widely studied as a gene which regulates songbird singing behaviour (Kere, 2014). Indeed, the gene has also been associated with speech in humans; there was highly significant association detected between CYP19A1 and certain measures of speech and vocabulary in two of the cohorts tested in the study, although there was no association in three other cohorts (Anthoni et al, 2012). Cyp19a1 is also associated with cortical disorganisation in mice (Anthoni et al, 2012).

DYX2: DCDC2 and KIAA0319

The candidate genes in DYX2 – DCDC2 and KIAA0319 – are considered to have the most convincing evidence supporting them (Schumacher et al, 2007). DCDC2 has been linked with normal neuronal migration in humans (Meng et al, 2005), and Kiaa0319 is associated with normal neuronal migration in rats (Paracchini et al, 2006).

DYX5: ROBO1

The ROBO1 gene on DYX5 was first considered as a candidate gene in a Finnish sample after the identification of a translocation breakpoint which disrupted ROBO1 in one dyslexic individual, and subsequent test showed that the expression of ROBO1 was either absent or attenuated in members of a large Finnish family who had dyslexia (Hannula-Jouppi et al, 2005). Echoing these findings, a Singular Nucleotide Polymorphism, which is correlated with the expression of ROBO1 in brain tissue, was found to be significantly associated with dyslexia²³ in a Toronto sample (Tran et al, 2014). Deactivating the Robo1 gene causes malformations in the corpus callosum in mice (Andrews et al, 2006), and in the white matter structure in the corpus callosum of humans (Darki, Massinen, Salmela, & Matsson, 2017), which the authors suggest is relevant to the transfer of information between the hemispheres.

²³ Referred to as reading disability in the study

Appendix 3

English reading ability of populations in IME

English reading ability of students in Gaeltacht schools

The students included in the Gaeltacht group in the Parsons & Lyddy (2016) study showed a delay in literacy acquisition on tests of English word and non-word reading skills, in comparison to their peers in Irish immersion and English-medium schools. The Gaeltacht group lagged behind the other groups in non-word reading in the second and third year of schooling, but by the fourth year of schooling there was no significant difference between the groups, indicating that the Gaeltacht group had caught up with their peers. Non-word reading assesses the child's ability to read novel words which they have not previously encountered, by using letter-sound knowledge or other word reading strategies. In relation to word-reading ability, the Gaeltacht group did not catch up with the other groups by the fourth year of schooling, and their performance was significantly poorer than their English-medium peers at all timepoints. This indicates that for children in Gaeltacht schools, their literacy acquisition in English is significantly delayed in comparison to their peers.

There is a dearth of research on literacy acquisition of minority language students in a majority language who are not immigrants in the country of schooling. Research on literacy acquisition of minority language students in a second language is limited (Tembe, 2008), and mainly focuses on literacy attainment of immigrant children who speak a minority language in the home, and acquire literacy through English, particularly Spanish-speakers in the United States (Hammer et al, 2014). However, Wagner, Spratt & Ezzaki (1989) investigated literacy acquisition in Berber-speaking and Arabic-speaking children in Morocco (controlling for SES), where Arabic is the dominant language and the language which the children learn to read in. They found that while Arabic children performed significantly better than Berber children in the first year of schooling, the difference diminished until it was no longer significant by the fifth year of schooling. This is perhaps a promising finding for the literacy development of students in Gaeltacht schools.

Vocabulary level of students in Gaeltacht schools

Bilinguals are often reported to perform more poorly on tests of receptive vocabulary in each of their languages, particularly in words which are primarily used in the home (e.g. Bialystok, Luk, Peets, & Yang, 2010), however this is closely and directly linked to exposure in each language (Gathercole, Thomas, Roberts, Hughes & Hughes, 2013). The English vocabulary of the Gaeltacht group in the study (Parsons & Lyddy, 2016) was not disadvantaged in comparison to their English-speaking peers, and performed equivalently at all time points. However, as only between-group differences are reported, it is unclear how children from homes where only Irish or mostly Irish are spoken performed. When assessing vocabulary in individual cases, the level of language exposure should be analysed. In assessing exposure, the home language, the school language, the relative dominance of each language in the community, the language of social interactions and typical domains of usage of each language should be taken into account (Thomas, Gathercole & Hughes, 2013). In relation to Irish vocabulary, the Gaeltacht group far outperformed the other groups in the second and third year

of schooling. This indicates that the Gaeltacht group's total vocabulary (the sum of their vocabulary in each language) was larger than any of the other groups.

English reading ability of immersion students in Irish-medium schools

There were two groups of immersion students; one who commenced literacy instruction in English (ERF), and one who commenced in Irish (IRF). The group who commenced English literacy first performed at a similar level as English-medium pupils at all timepoints on measures of English word reading and non-word reading. The group who commenced Irish literacy first performed below the English-medium pupils on measures of word reading in the second and third year of schooling, but by the fourth year of schooling they performed at a similar level to their peers who commenced English reading first. There was no significant difference between the IRF group and the English-medium pupils on measures of non-word reading, however, showing an equal ability to apply letter-sound rules at all timepoints.

This shows that immersion pupils show different trajectories of literacy development in English depending on whether they commence literacy instruction in Irish or English. Those who commence English literacy first are comparable to English-medium pupils at all timepoints, while those who commence Irish literacy first show a delay in English word reading in comparison to their English-medium peers, however this disappears by the fourth year of schooling. This mirrors the trend in French immersion schools in Canada, where pupils' literacy acquisition in English is delayed in comparison to those educated through English, however the immersion pupils catch up with their peers within one or two years of literacy instruction in English (see Cummins, 1998 and Genesee & Jared, 2008).

Vocabulary level of immersion students in Irish-medium schools

All groups performed similarly on measures of receptive vocabulary in English at all time points, with the only significant difference being a small disadvantage for the Irish medium ERF group in comparison to the IRF group at Timepoint 2 (third year of schooling). While the Irish-medium immersion groups lagged behind the Gaeltacht group on measures of receptive vocabulary in Irish in the second and third year of schooling, by the fourth year of schooling they had caught up on this measure. The English-medium group showed a large significant disadvantage in relation to Irish receptive vocabulary at all timepoints.

Appendix 4

Translation of interview excerpts (from participant 4) from Irish to English

| Irish | English |
|---|--|
| Déanaim aistriúchán ar an leagan Béarla den IQ | <i>I translate the English version of the IQ</i> |
| Maidir leis an gcleachtas a bheadh agamsa, d'iarrfainn ar an bpáiste giota a léamh as leabhar a bheadh ar comhleibhéal leis an leis an léitheoir ranga, agus d'iarrfainn air an liosta minicíochta ó Chorpas Náisiúnta na Gaeilge - ar roinnt de na focail sin a léamh, agus thógfainn focail as an liosta sin freisin i gcomhair litriú. Arís, chaithfinn mo chuid súile ar na torthaí sin, agus thófaínnse cinneadh bunaithe ar mo chuid taithí, ach arís ní féidir braith orthu mar gheall nach bhfuil aon uirlisí caighdeánacha ann | <i>As regards my own practice, I'd ask the child to read a piece from a book which would be at the same level as the class reader, and I'd ask him to read some of the words from the frequency list of Corpas Náisiúnta na Gaeilge, and I'd take some of the words from that list too for spelling. Again, I'd have a look at those results, and make a decision based on my experience, but again, you can't depend on them because there are no standardised assessment tools</i> |
| Cuid de na tástálacha sa verbals, ní féidir glanaistriúchán a déanamh orthu, sa chás sin déanaimse cinneadh tomhaiste – an ndéanfaidh mé an tástáil nó an battery trí Bhéarla leis? Tarlaíonn sé ó am go céile, go bhfuil an gasúr chomh comparadach le Gaeile, ní bheadh ann ach cur amu ama | <i>Some of the verbal assessments, they can't be translated, so in that case I'd make a measured decision – will I do the test or the battery in English too? It happens from time to time that the child is so comfortable with Irish, it would just be a waste of time.</i> |
| Tá mo chuid comhleacaithe ag dul isteach sa chóras Béarla, agus tá na huirlisí acu, agus tá a gcuid tuairimí gairmiúla acu freisin, rud atá tábhachtach. Tá tuairimí gairmiúla agamsa, tá taithí agam ar an gcóras, tuigim an dátheangachas, tuigim an cainteoir dúchais, ach níl uirlisí agam, so níl aon eolaíocht an baint le mo bharúil ó thaobh ainilís chruinn bunaithe ar an eolaíocht a dhéanamh ar an disléicse | <i>My colleagues in the English language system, they have the tools, they have their own professional opinions too, which is important. I have professional opinions, I have experience of the system, I understand bilingualism, I understand the native speaker, but the tools don't exist, so there is no scientific basis for my opinion, in terms of making a science-based decision on dyslexia</i> |
| níl aon chruinneas ann...ní fianaise ó cheart atá os do chomhair amach, is fianaise scéalach í mar gheall ar nach bhfuil aon chaighdeánú déanta ar na measúnaithe | <i>It is not at all accurate...what's in front of you is not proper evidence, it's anecdotal evidence, due to the fact that there is no standardisation done on the assessments</i> |

| Irish | English |
|---|---|
| Tá leatrom á dhéanamh orthu, agus tá sé feicthe agam tríd síos na blianta, tá thart ar scór bliain caite agamsa sna bunscoileanna, agus tá tástálacha ó shíceolaíthe feicthe agamsa agus tá siad skewed go hiomlán – uimhir a haon, bheadh an tástáil déanta trí Bhéarla, an IQ déanta trí Bhéarla mar gheall nach raibh aon Ghaeilge ag an siceolaí agus is í Gaeilge an teanga a bheadh ag an bpáiste. Bheadh na tástálacha Béarla, na tástálacha abair WYATT déanta ar an bpáiste sin, agus ar ndóigh bheadh na scálaí ar fad depressed mar gheall air. Ní bheadh aon iontafacht ag baint leis cé go bhfuil an cleachtas sin ag dul ar aghaidh agus is mór an scannal é sin go bhfuil sé fós ag dul ar aghaidh | <i>They are being done an injustice, and I've seen it down through the years, I've spent about twenty years in primary schools, and I've seen assessments from psychologists which are entirely skewed – first, the assessment would be carried out through English, and the IQ done through English due to the psychologist not having Irish, Irish being the language of the child. It would be English assessments, the assessments such as WYATT, which would be done on that child, and of course all of the scales would be depressed because of it. It would be entirely unreliable though that practice still goes on, and it's a complete scandal that it still goes on.</i> |
| Níl aon aitheantas sa gcóras go gcaithfidh cainteoir dúchais an jab sin a dhéanamh | <i>There is no recognition within the system that a native speaker has to do that job</i> |
| Tá ceisteanna móra eitice ann mar gheall nach bhfuil na huirlisí seo ann. Níl na ceisteanna seo á phlé | <i>the absence of these tools raises major ethical questions. These questions are not being discussed</i> |
| Maidir le hainilís nó tástáil a dhéanamh ar pháiste gur Béarla a theanga, agus tástáil a dhéanamh ar pháiste gur cainteoir dúchais Gaeilge é nó í, tá an siceolaí faoi mhíbhuntáiste. Tá easpa comhionannais ann ó thaobh chleachtas an tsíceolaithe | <i>In relation to carrying out an analysis or assessment in an English-speaking child, and carrying out assessments with a child who is a native Irish speaker, the psychologist is at a disadvantage. There is a lack of equality as regards the practice of the psychologist</i> |
| Fiú amháin dá mbeadh ceann litriú agus ceann word reading ann, d'fhéadfá seasamh leis an gcinneadh. Dá mbeadh ceann triail tuisciana ann, chuirfeadh sé sin go mór leis | <i>Even if there were [standardised assessment tools] for spelling and word reading, you could stand by your decision. If there was one for comprehension, it would add to it a lot</i> |
| Níl an taighde déanta an bhfuil a dóthain acu ann. Agua an dara rud, d'fhéadfaí dul agus eolas de chineál éigin a chur le chéile idir lucht na Gaeilscoile agus na cainteoirí dúchais – bheadh rud éigin agat | <i>The research hasn't been done in relation to whether there are enough of them. And the second this is, some sort of information could be gathered between those attending a Gaelscoil and native speakers – you would have something</i> |
| Go mbeadh uirlis de chineál éigin ann, go bhféadadh mise mar shiceolaí seasamh leis seachas mé ag úsáid mo chuid tuairimíochta | <i>So that there would be some sort of tool there, that I, as a psychologist, could stand by, rather than using my own guess-work</i> |
| Má théann tú ar ais agus má dhéanann tú ailinís ar an gcúis a bhfuil an meon sin ann, is é mo bharúil é, ní thuigeann agus ní fheiceann agus ní ghlacann daoine leis go dtagann páistí isteach geata na scoile sna naoionáin bheaga agus gan acu ach Gaeilge agus níl Béarla acu | <i>If you go back and analyse why that attitude exists, it's my opinion that people do not understand, see or accept that children come in the schoolgate in Junior Infants and only have Irish, they don't have English</i> |
| Is í an cheist ná an bhfuil an toil ann? An bhfuil an tuiscint ann? | <i>The question is, is the will there? Is the understanding there?</i> |