Dyslexia and Multilingualism: Identifying and supporting bilingual learners who might be at risk of developing SpLD/dyslexia.

Research Report;

Dr Tilly Mortimore, Lynda Hansen, Dr Mim Hutchings and Anny Northcote
School of Education, Bath Spa University
Jill Fernando, Liz Horobin and Dr Kate Saunders
British Dyslexia Association
Professor John Everatt
University of Canterbury, New Zealand

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A: Introduction

1. Background to the project - bilingual learners and SpLD/dyslexia.

United Kingdom (UK) Government policy directives on diversity, equality and inclusion highlight the need to ensure access to education and qualifications for vulnerable groups.

The number of pupils in schools in the UK acquiring English as an additional language has increased year on year. In 2008 14.4% primary and 10.8% secondary pupils (in Wales and England) had a first language other than English (DCSF, 2008). In 2011 this had increased to 16.8% and 12.3% respectively. This means that increasing numbers of children are arriving in UK schools with little or no English. Since 2002 when the London borough of Westminster reported over 100 languages spoken in primary schools (Westminster NHS, 2002), the range of languages spoken in UK schools has steadily increased to over 240 (DCSF, 2008)

It must also be recognised that 4-10% of all school children (Singleton,1999) are predisposed to SpLD/dyslexia, defined as the following:

> A specific learning difficulty which mainly affects the development of literacy and language related skills…is present at birth and lifelong in its effects…characterised by difficulties with phonological processing, rapid naming, working memory, processing speed, and the automatic development of skills that may not match up to an individual's other cognitive abilities. (BDA, 2009)

SpLD/dyslexia is hard to identify in children learning English as a second language as there is a high risk of either attributing a learner's difficulties to second language acquisition, or schools not recognising a child's underlying abilities. This results in inappropriate application of SEN labels (Hall, 2001).

Difficulties with acquiring a second language can mask signs indicating risk of SpLD/dyslexia. The role played by oral language difficulties in the development of SpLD/ dyslexia has been highlighted (Snowling, 2010). Research (Ganschow and Sparks, 2000) confirms that strengths and weaknesses in the linguistic codes of phonology/orthography (sounds/letter patterns), syntax and semantics are transferred between languages. So learning a second language challenges dyslexic students because it requires those skills that are frequently compromised in dyslexia

- sequencing ability, phonological knowledge and both short and long-term memory (Wolf, 2008).

The processing differences associated with SpLD/dyslexia can also cause listening difficulties (Crombie & McColl, 2001) making a second language as complex, inconsistent and challenging as English, more difficult for dyslexic children to acquire (Ziegler et al, 2003).

In the UK, the literacy of school is English, but alongside the expectation for minority first language bilingual children to learn to read and write fluently in the majority language, many also become literate in language one. This usually happens outside mainstream schooling. Social and cultural differences, life experiences and political policy, play a significant role in the development of EAL and literacy, indicating the need for a holistic approach.

Whilst the majority of bilingual children are successful in their academic achievement, there are a number of issues around teaching these children in a way which supports their bilingualism. This is particularly the case when considering that language proficiency must quickly grow from basic conversational up to cognitive academic. There must also be structures put in place so that teachers know what to do when pupils' literacy skills give cause for concern, especially at stages such as Key Stage 2 which accelerates the demands put upon reading comprehension, spelling accuracy and writing skills.

The specific challenges encountered by dyslexic children are firstly difficulties linked with the rule systems of the second language and secondly coping with the new phonology and orthography that learning the language involves.

There has been little prior research to explore the impact of interventions for school children at risk of dyslexia who are learning English as a second language. The most beneficial strategy when dealing with dyslexic learners is direct, systematic, multi-sensory instruction (Moats & Farrell, 2005; Brooks et al, 2008). This strategy applies equally well to the rule systems of learning a second language (Sparks & Miller, 2000). This type of teaching is the predominant mode of support for dyslexic learners and this project aimed to fill a gap in the research by exploring the impact of a structured multi-sensory intervention programme, that incorporated language development and dyslexia-friendly strategies, on the literacy, written language skills and learning experiences of bilingual children in the UK identified by their teachers as being at risk of dyslexia.

2. The context of the study

This project has been ground breaking in several ways. It has combined expertise from two professional worlds, that of SpLD/dyslexia support and of those experts who support bilingual learners. It has located bilingual learners in both rural and urban schools, including children who speak between them over 40 languages. This is a challenge debatably specific to the United Kingdom. Previous studies exploring bilingual learners at risk of dyslexia have either focused upon urban contexts or else were based in schools in Europe and America containing only a handful of languages. This is arguably the first one to cover so many areas. It has also used a mixed methodology to identify both the quantifiable impact of an intervention upon literacy scores and to explore the experiences of the teaching assistants (TAs) who delivered the intervention. We also gathered the stories of some of the bilingual children and their parents.

Initially, following advice from the local Special Educational Needs (SEN) and Ethnic Minority Advisory Service (EMAS) teams, 125 schools, comprising a range of inner city and rural areas with high levels of bilingual learners, were invited to join the project by letter which contained a questionnaire to elicit information about the levels of expertise and context of the schools. The response was mixed, ranging from schools who failed to respond, through those who initially expressed interest and then withdrew, to schools who embraced the opportunity. Eventually 55 schools embarked upon the project. They represented Liverpool (7/20) approached , Manchester/Salford (18/ 41); Swindon (7/16) Bristol (7/28), Bath (1/2) & South West (2/9), and London (10) and comprised a range of inner city and rural areas with high levels of bilingual learners, covering the full range of Social and Economic status (SES). 43 first languages were represented (See Appendix 1 for language distribution).

Most of the schools who took part in the project had higher than average English as an Additional Language (EAL) populations ranging from 25% to above average and, in most cases, the multi-cultural, multi-lingual aspects of the school were clearly embraced as part of the school culture, with displays of wall charts and pictures giving words in each of the languages spoken by pupils. Many inner city schools were church schools. It was, predictably, noticeable that inner-city schools had a larger proportion of ethnic minority staff than did those in more rural areas.

In all cases, the commitment and enthusiasm of one key member of staff – usually the Special Educational Needs Co-ordinator (SENCo), but occasionally the head-teacher was crucial to the school deciding to participate in the project. The eventual success of the intervention programme depended upon the ongoing commitment of either the SENCo or TA responsible for delivering the intervention.

To inform the planning of the project, a thorough literature search was undertaken to establish issues around identifying risk of SpLD/dyslexia in bilingual learners, to explore the needs of these particular learners and to inform the choice of materials and activities.

B. Literature search

Chapter 1: The Bilingual Learner

Language is not only a tool for communication and knowledge but also a fundamental attribute of cultural identity and empowerment, both for the individual and the group. Respect for the languages of persons belonging to different linguistic communities therefore is essential to peaceful cohabitation. (UNESCO 2003)

Underachievement in certain Black and Minority Ethnic groups remains a cause for concern. However the complexities around assessing and supporting bilingual pupils are diverse and need to be considered within the context of such issues as cultural and linguistic backgrounds; previous educational experiences particularly if new to the UK system, as well as social and emotional development. Alongside these there is also the need to investigate the political dimension of how bilingual learners are perceived and catered for in the UK education system.

The bilingual context

When a child is said to be bilingual this does not necessarily indicate that the speaker is fully competent and fluent in at least two languages in a range of oral and literate contexts. It is more likely that children in UK schools may have varying levels of operating in two or more language domains. Being bilingual refers to having access to and using two or more languages on a daily basis, (Baker 2006, Martin 2009).

Bilingualism, is termed ‘simultaneous’ when children learn two languages from birth, usually the languages of parents and community. ‘Consecutive’ or ‘sequential’ bilingualism, common in the UK and for the project children is applied to those who begin to learn a second language on entering social contexts, such as education or work (Baker 2006) and language contexts are extended by older siblings and adults working outside the home.

Second (or additional) language acquisition (SLA) is set within a context in which the need to communicate is a powerful force. In schools where there is no bilingual programme to ensure maintenance of the first language (L1) it is likely that bilingual children entering British primary schools, will develop academic language and literacy proficiency in the majority language of the society (L2) possibly at the expense of such achievement in L1 (Cummins 2000).

According to Lambert’s model (1980 in Baker, 2006), societal and individual factors affect the individual’s acquisition of L2. These include motivation which is influenced

by both attitude to bilingualism and aptitude; bilingual proficiency may well develop if both languages have high status in the pupil's educational, family and community. Where there is no danger of one language replacing the other the result will be 'additive bilingualism' with positive cognitive and social outcomes. 'Subtractive bilingualism', however occurs when L2 takes precedence over L1 which can be seen as unimportant or a hindrance to learning the second language with consequently reduced self-esteem and loss of L1. This can lead to lower levels of cognitive development and L2 achievement. Subtractive and additive environments are crucial when investigating the learning of bilingual children and the nature of the environment of schools participating in the project was explored. Negative cognitive findings are more likely to be associated with minority ethnic groups learning in a subtractive environment. This must be considered when assessing and planning support for bilingual children who are causing concern with their language development, as any transfer of skills is affected by the context in which learning takes place.

Cultural and linguistic diversity (CLD)

Both linguistic and cultural backgrounds strongly influence an individual's acquisition of spoken and written language. Becoming literate encompasses an extensive and varied range of social practices; any learning difficulties need to be considered within the context of the child's cultural world (Martin 2009).

The impact of the individual's culture cannot be ignored in any consideration of children's cognitive skills. Rogoff (2003) suggests that learners will develop systems that reflect their socio-cultural context and the tools of their culture.

Knowledge and understanding of cultural and linguistic diversity is essential in any assessment of the learning of bilingual children. Imposing value judgements on unfamiliar cultural practices is an ethnocentric approach (Rogoff, 2003) which must be avoided. There is always the danger that assumptions made about a child's background may have a detrimental effect on their acquisition of English and their learning.

Developing Language Proficiency

Bilingual learners may be wrongly assessed as having specific needs in language rather than due consideration being given to second language acquisition (SLA). An analysis of psychological assessments of children acquiring EAL showed that teachers and psychologists assumed that children had overcome difficulties once they had achieved a level of conversational fluency (Cummins 1984, 2000). However these children were performing poorly on English academic tasks and further examination suggested that there was a gap of five to seven years between bilingual

children being able to achieve Basic Interpersonal Communication Skills (BICS) and Cognitive Academic Language Proficiency (CALP) (Cummins 1979).

This BICS/CALP distinction suggested that the concept of one global dimension of language proficiency was an oversimplification (Cummins 2000). The different aspects of conversational and academic aspects of language proficiency need careful consideration in any assessment of bilingual children's competencies in literacy assessments, both in terms of global and specific aspects of language proficiencies (Baker 2006). As speech, language and literacy difficulties may be closely intertwined, equally they may be exhibited differently in the different languages and contexts used by the bilingual child.

However a model which considers both communicative competence and academic language also needs to consider the bilingual child's competence in L1. According to the Threshold Theory, the more competent the child is in both languages, the greater likelihood of positive cognitive advantages (Baker 2006). If a bilingual learner's competence stays at the BICS level rather than moving on to the CALP level in both languages the higher threshold is harder to achieve.

The contexts in which children learn also have to be carefully considered. In Gregory's (1996) study, London Bangladeshi parents showed themselves to be committed to their children becoming literate in English, whilst at the same time wanting them to learn their community language, Bengali/Syhleti as well as reading the Arabic Qur'an at the Madressa.

The least comfortable context for the parents was the mainstream school which was very different from their own cultural familiarity of the home and community literacy practices. Other research (Blackledge,1994) shows that parents, fearful that their own English was poor, found communication with the school difficult, particularly when it came to understanding the guidance given. Social conditions, bullying and racism are all factors which can have a deep effect on bilingual children's learning.

This might seem rather a broadly brushed presentation of a highly charged aspect of British culture and schooling but there are many variations amongst bilingual children in our schools which cannot be ignored when working with children who may be showing cause for concern in their literacy. This project has attempted to recognise the breadth of bilingual children's experiences and the existence of many factors influencing their progress, the need to consider an additive model in considering linguistic and culturally appropriate approaches to any intervention is crucial.

Bilingual learners and the social context of reading

It is well researched that literacy practices are varied and not always reconciled to that of the classroom. For the emergent bilingual reader, such practices may well be bound with languages other than the majority societal language, involving different cultural dimensions from that of the reading classroom. The experiences children bring with them into the classroom must be considered for pedagogy to be effective. Families of children from different cultural backgrounds, may both perceive a different purpose to reading and teach the first language differently (Gregory, 1996). Some of this will be alien to the young child who then finds learning to read more of a challenge.

Bilingual children should also be able to use L1 in the classroom, particularly for storytelling, in which the narratives are embedded within a home culture with a set of literacy practices familiar to the children (Blackledge, 1994). However, this is complex as such children are learning to communicate and learn in more than one language each impacting on the other and in Blackledge's research the children expressed language preferences for different occasions. This supports Cummins's (1984) assertion that knowledge can be transferred between languages. The National Literacy Strategy recognised that identifying "points of similarity and differences between languages at word, sentence and text level" (1998 p 107) helps the bilingual learner, who mostly is able to recognise the way different language systems operate (Kenner 2000).

Cummins (1996) suggests that academic development is enhanced when children can establish a strong cultural identity in the classroom. Working with home languages is crucial and the danger that English, as the main language of the classroom, seems to replace the first language in school learning contexts could cause concern, particularly when the bilingual child is struggling in the additional language. The suggestion of a strong dialectical relationship between the L1 and L2 argues strongly for the *additive* context in which L2 should be seen as an *additional* language, enriching the child's linguistic repertoire. The project aimed to explore from this perspective the ethos of the schools involved.

The project recognised the importance of understanding culturally diverse communities (Cummins 2000) where children use more than one language and the extent to which academic difficulties may reside in the school and pedagogical approaches rather than within the child struggling with reading in L2. Acknowledging the role of the context in creating barriers to learning for all learners is central to the inclusive approach to education promoted by the project which would highlight the need for contexts to be adjusted to ensure the inclusion of all learners. From this perspective, an assessment of the bilingual learner's literacy may be insufficient if it only considers reading skills in English without understanding the wider context.

What happens when children read in a second or additional language?

Bilingualism, literacy development and the effects of bilingual enhancement

Chapter 2 explores the relationship between dyslexia, bilingualism and age appropriate reading development including the relationship between proficiency in L1 and learning to read in L2. Might literacy in L1 benefit literacy development in L2? Studies (Bialystok, 2001; Hutchinson et al, 2004; Schwartz et al, 2008) indicate general benefits to reading fluency and phonological awareness, particularly if literacy instruction starts early. Although there was some evidence of poorer skills in alliteration fluency and rhyme detection (Hutchinson et al, 2004). Early simultaneous bilingualism may promote the development of higher sound and phonological awareness which can be transferred across languages and may apply to sequential acquisition of an additional language as children start school. It may also be the case that a more regular syllabic and phonological structure in L1 facilitates phonological development in L2 (Loizou and Stuart, 2003). This could indicate that poor phonological skills would be an indicator of risk of poor literacy acquisition.

Researchers are not totally in agreement over the enhancing effect of bilingualism. Bialystok (2001) states that the relationship between bilingualism and development of phonological awareness may be complex, bidirectional and interdependent. She suggests that early literacy in L1 may be the critical factor in developing literacy in L2.

Words and vocabulary development

Words need to be interpreted on two levels; their *meaning* such as a dictionary definition, but also their *sense* which the word invokes for a particular person or social group (Vygotsky, 1934/86). Some words are very powerful. For example the word *holocaust* has a dictionary definition but it also conjures up a range of political, social and emotional senses depending on the background of the reader. The sense is located in the cultural experience. For the young reader “to ‘situate’ themselves in the ‘context’ of the reading raises the need to consider both the inner mental context and the outer social context” (Gregory 1996).

Vocabulary plays an important part in learning to read and in assessing children’s language proficiency. It is not simply a matter of acquiring new words for writing or technical words for the curriculum, but about, “developing a mental lexicon that is powered by semantic curiosity and the confidence to share ideas about the world” (McWilliam, 1998). Words change meanings depending on the context and the multiple meanings of words can show an understanding of the rich complexity of language (McWilliam, 1998). For bilingual children, even those relatively fluent in L2,

the ability to grasp multiple or metaphorical meanings of words in an additional language can be difficult. For all learners, the context will determine the understanding, a bilingual learner may bring diverse and contrasting implications which complicate their understanding and confound expectation of meaning.

Metalinguistic awareness and comprehension

Knowledge about language is greater when more than one language is known. Metalinguistic awareness plays a role in bilingual children's ability to generalise through applying linguistic understanding across languages (Durgunoglu et al, 1993, cited in Bialystok 2001). Bilingual learners do not have to relearn the language structure when acquiring a new language as they already know how language works. Bialystok (2001) sees this knowledge of one particular language as giving understanding of linguistic structure in others. Her studies (1993; 2001) indicated that bilingual US Spanish speaking children performed well in segmentation, blending and matching tasks and were able to use syntactic cues consistently to judge grammatical accuracy more successfully than monolingual children, as well as outperforming the monolingual children in reading English words and non-words. This suggested that the metalinguistic awareness automatically transfers and facilitates L2 reading.

Comprehension depends on being able to make sense of the text, drawing on semantic and syntactic knowledge, bibliographic cues and understanding of discourse, as well as being able to decode words and access lexical representations. The successful reader, can understand the literal meaning of a text, while being able to infer meaning from less visible cues such as background knowledge, memory and intertextuality, or the interrelations between different texts or stories.

Failure of comprehension (August et al 2006) can be due to poor automaticity in decoding words; lack of familiarity with key vocabulary, but primarily poor understanding of discourse, meaning a lack of background knowledge which may lead to an inability to read beyond the words on the page to infer meaning. It may be argued that bilingual children, relatively new to English and still developing communicative skills may have difficulties with some aspects of linguistic comprehension (Hutchinson et al 2003) when learning to read in L2 which could be exacerbated by multiple meanings within the text and the need for inferential reading. They attributed underachievement in L2 literacy to low levels of language fluency, particularly related to vocabulary and comprehension.

Bilingual learners and SEN

It is likely that the percentage of bilingual learners with SpLD will resemble any other group of learners. However the cultural implications for assessment of bilingual learners will be explored in more detail in Chapter 3

Much research into dyslexia and the acquisition of an additional language has hitherto run in parallel. An approach which considers social as well as linguistic backgrounds seems essential in assessing and supporting bilingual learners' acquisition of languages and development in literacy. The practices should be seen as a parallel discourse, rather than an opposing one, with the view that a greater body of inter-related research into bilingual children with reading difficulties would have a stronger impact on education policy on the achievement of bilingual learners.

Chapter 2. Dyslexia: the impact of language systems upon definitions, reading development and dyslexic differences

Introduction: Establishing definitions

The aim of the project was to identify bilingual children at risk of SpLD/dyslexia and trial appropriate interventions. It was therefore essential to agree a definition of dyslexia or specific learning difficulties (SpLD). The involvement internationally of so many people from so many disciplines and context has encouraged the proliferation of definitions driven by differing contexts, causal theories and purposes. Frith's (2002) explanatory definition had helped to reconcile controversies around the main causal theories - the phonological deficit, magnocellular deficit, dual deficit and cerebellar deficit and reflected the developing sense that dyslexic individuals may exist on a continuum of risk (see Snowling, 2005; Nation, 2005) where factors such as difficulties with speech and language, phonological processing, speed of processing, attention and memory combine with environmental and cultural factors to lead to what has been termed 'full blown dyslexia' (Snowling, 2010).

> The consensus is emerging that dyslexia is a neuro-developmental disorder with a biological origin, which impacts on speech processing with a range of clinical manifestations. There is evidence for a genetic basis and there is evidence for a neurological basis, and it is clear that the behavioural signs extend well beyond written language. There may be many different kinds of genes and different kinds of brain conditions that are ultimately responsible for the dyslexia syndrome, but in each case the symptoms have to be understood within the relevant cultural context (Frith, 2002,p. 48).

This definition can be criticised as conceptualising SpLD/dyslexia in terms of difficulties and deficits. However, the Dyslexia and Multilingualism project focuses upon identifying and supporting bilingual learners who risk academic failure due to dyslexic type differences. Their most vulnerable areas of processing are under pressure and they therefore are likely to experience any dyslexic *difference* as a *difficulty*.

This project operates at the level of understanding the learners' behaviour and how this might reflect cognitive and linguistic skills, their environment, their culture and the interaction between all four or these. In the United Kingdom the Rose Review (2009) adopted the following definition of dyslexia/literacy impairment, based clearly upon evidence from research.

> A learning difficult primarily affecting skills involved in accurate and fluent word reading and spelling. The main characteristics are difficulties in phonological processing, verbal memory and verbal processing speed. Dyslexia occurs across the range of intellectual abilities. It is best thought of as a continuum not a distinct category and there are no clear cut-off points. Co-occurring difficulties may be seen in:
> Aspects of language; Motor co-ordination; Mental calculation; Concentration and attention ; Personal organisation;
>
> But these are not by themselves markers of dyslexia. A good indicator of the severity and persistence of dyslexic difficulties can be gained by examining how the individual responds or has responded to well founded intervention. (Response to Intervention, RTI). (Rose Review, 2009, p.11)
>
> In addition to these characteristics, the British Dyslexia Association acknowledges the visual and auditory processing difficulties that some individuals with dyslexia can experience, and points out that dyslexic learners can show a combination of abilities and difficulties that affect the learning process. Some also have strengths in other areas, such as design, problem solving, creative skills, interactive skills and oral skills. (British Dyslexia Association, 2009)

The focus for definition across this monolingual English speaking population is upon phonological/verbal processing skills only. The only reference to bilingual learners acknowledges that, “those who are learning to read and write in English as an additional language can have these difficulties, which may be masked by (or mistaken for) a limited mastery of English” and “ the possibility that some will have literacy and dyslexic difficulties that must be identified and acted upon.” (Rose Review, 2009, p.36). Unlike the definition provided by the American International Dyslexia Association (IDA, 2002), where some states have adopted bilingual education programmes to cater for their more multilingual population, the Rose Review also excluded the contested (Siegel, 1989) use of a discrepancy between reading level and intelligence as an indicator.

The Rose Review (2009) definition focuses upon difficulties with accurate and fluent word recognition, word decoding and spelling predicated by a deficit in the phonological component of language – specifically in phonological processing, verbal memory and verbal processing speed. However, to establish whether this definition provides adequate criteria for identification across languages demands exploration of a number of questions relating to the characteristics of the different languages spoken by the children.

To what extent do the orthographies of languages vary?

International differences in learning contexts, including age of school entry, instructional methods, cultural differences in specific practices involved in use and acquisition of literacy have an impact upon the development of cognitive skills (Rogoff, 2003). However it is clear that different forms of language (Goulandris, 2003) and ways of communication promote different skills and it is important to consider relevant linguistic features of individual languages when understanding how normal reading skills might develop or be inhibited in that language.

Children included in the project spoke 43 languages, mostly alphabetic or semi-alphabetic. Languages may be logographic, syllabaric, alphabetic or phonemic. They may or may not involve word divisions. Habitual use of language may differ. Different forms may predominate. Usage over time may develop different cognitive skills (Burgoyne et al, 2009). English language is a complex 'outlier' in terms of orthography (Share, 2008) but has heavily influenced understanding of stage theories of reading development and 'dual route' models of reading which may not necessarily fit with other orthographies. It seems that the nature of an orthography influences the development of reading and the cognitive skills that underpin literacy.

Language forms develop and change over time. Processing these different systems has an evolutionary impact upon brain structures and function (Wolf, 2008). Some orthographies are much simpler than others. Seymour (2005a) suggests that there are two main factors that combine to comprise a simple or complex orthography, syllable structure and the level of transparency of the orthography. Transparent or shallow orthographies (henceforward termed 'transparent') are those where single phonemes map consistently on to single graphemes. Deep or opaque orthographies (henceforward termed 'opaque') are increasingly inconsistent until the most opaque orthography, English, has more than 120 graphemes to represent 44 phonemes (Davies and Richie, 2003).

Seymour's (2005a) table 3: 1 illustrates the continuum of complexity, indicated by orthographic depth and syllable structure across a range of languages. Further languages categorised in other studies have been added in italics.
Table 3:1 Adapted from Seymour's (2005a. p. 302) analysis of the nature of orthographies studied with non-European languages added in italics

	Orthographic depth	Shallow Transparent	Shallow	Deeper	Increased difficulty*	Deepest Opaque
Syllable structure	**Simple**	Finnish *Turkish* *Hungarian*	Greek Italian Spanish	Portuguese	French	
	Complex	*Czech* *Serbian/Croatian* *Voweled Persian* *Hebrew*	German Norwegian Icelandic	Dutch Swedish	Portuguese Danish	English

* at this point there is an increase of difficulty acquiring both word and non-word reading and an increased range of individual variability in reading skill.

Does the structure of a learner's first language affect the extent to which development of literacy will be challenged by the complex orthography and syllabic structure of English? Will this have implications for the identification of cognitive differences and the strengths and weaknesses in the learning profile children bring to the support programmes? An understanding of the impact upon the brain by the acquisition of reading skills may help to provide answers.

Reading development and the brain

Wolf (2008) stated:

> Reading in any language rearranges the length and breadth of the brain… there are multiple pathways to fluent comprehension, with a continuum of efficiency taking varied forms among the varied writing systems. (Wolf, 2008, p. 64)

There are however two contrasting hypotheses as to how the brain is affected across differing orthographies: firstly, a central processing mechanism underpinning reading skills where the same factors predict reading skill across all types of orthography (Cummins, 2000). Secondly the proposal that different scripts make different demands and have differing impacts upon the cognitive systems involved in the development of reading – hence factors that predict success in one system will not do so in another and differences in script demands will affect the rate of acquiring skills across orthographies and the cognitive changes accompanying literacy acquisition.

Currently, although research across international languages remains limited, Seymour's (2005b) study of European alphabetic orthographies suggests that two types of skill are involved in reading development across alphabetic scripts – logographic and alphabetic. Deep orthographies need dual development of both skills whereas shallow need development of unitary or a single set of alphabetic skills. Both types of skill can develop to different levels of proficiency and this contrast may be evident in individuals with dyslexia.

Seymour also suggests the existence of three interlinking systems within a language: the orthographic, morphographic (related to morphemes – the smallest unit of meaning in a language) and linguistic/semantic systems. These developing systems follow a staged process mapping the increasingly complexity of the visual symbols of the writing system on to the speech (phonology) and meaning (morphology and semantics) The balance between them may differ across different languages, affecting literacy development. He also suggests that the phonological system exists on two levels – one **implicit**, not available for conscious analysis, which underpins all oral communication, and a second metalinguistic level, which involves the **explicit** ability to manipulate linguistic entities. The implicit processes are part of natural development, but metalinguistic demands are imposed by the artificial process of acquiring literacy for which the brain was not originally designed (Wolf, 2008; Dehaene et al, 2003).

Seymour (2005a) supports the central processing hypothesis by stating that all conventionally developing readers need to develop the mastery to pass through these stages which build consecutively upon representations developed from oral language. Weaknesses within any phase will interfere with the mapping between orthography and linguistic systems and impede literacy development. He also found that monolingual children's acquisition of literacy in English takes longer than those reading in the more transparent European orthographies included in his study. Speed of progress and the development of the necessary cognitive structures will be affected by the phonology, morphology and orthography of the spoken language which will also interact with the way in which literacy is taught, for example through synthetic/analytic phonics or whole word, top down or bottom up literacy approaches (Reid, 2009).

Research supports the co-existence of both central processing and script-dependent processes and wide differences among alphabetic orthographies in terms of speed of acquisition of letter knowledge, decoding skills, orthographic literacy and the building of the morphographic framework (Perfetti et al, 2005; Caravolas, 2005; Duncan et al, 2006). This explanation allows for differential manifestations of effects across scripts' (Everatt et al, 2010) with evidence for both the central processing mechanism and also the existence of increased rates of reading acquisition in transparent scripts with some variation in the factors which predicted literacy across languages. Across languages, phonological deficits undermined literacy

development although the extent to which the role of phoneme awareness across languages is specific to the orthography (Wimmer et al, 1991) or universal remains unclear along with its role in skilled reading (Van Orden & Kloos, 2005). Phonological awareness levels, however, remained a good predictor of literacy levels, especially when learning English alongside a more transparent orthography.

How might learning to read in different types of orthography affect the brain?

There seems to be some consensus that different language systems have a subtle impact upon brain development with different writing systems generating distinctive networks and circuitry or differential use of areas of the brain involved in reading during the development of reading skills (Bolger et al, 2005). The complexity of a language will affect the speed and efficiency with which literacy is acquired and also the structure of the brain and the processes involved in reading.

The processing involved in a more transparent language shifts to the more direct and swifter visual route more quickly than English which demands both the simple alphabetic mapping system and a second logographic process with longer involvement of the areas linking phonemes and meanings therefore causing difficulties for learners at every stage. Thisdelays the development of reading in English by a scale of 2.5 years to 1 compared with shallower European orthographies (Seymour et al, 2003).

It is however, likely that bilingual learners use the same neural mechanisms for language 1 and language 2 (L1 and L2) but that linguistic and cultural influences, age of acquisition and the child's genes affect cerebral processing patterns (Abutalebi & Perani 2001). The picture is not clear. There is, however, general agreement of the importance of being aware of the nature of the learner's first language and the extent to which he/she is literate in this language.

How might dyslexia manifest in different languages?

As explained in Chapter 1, bilingualism need not be a barrier and can promote more effective literacy acquisition. Learning a regular orthography can encourage faster acquisition of phonological awareness and support the literacy in a less regular orthography (Everatt et al, 2010). Young bilingual learners readily transfer skills such as phonological awareness and decoding as well as word identification (Ziegler et al, 2005) and simultaneous bilinguals may be able to differentiate between the two different sound systems (Bialystok 1991).

There are potential similarities in reading development in L1 and subsequent languages, irrespective of differences between codes. The idea of cross-language transfer – “the extent to which phonological awareness in the first language facilitates learning to read in a second language” (Loizou and Stuart 2003) necessitates the consideration of L1 ability when understanding bilingual learners’ difficulties in literacy acquisition.

However, literacy acquisition is more challenging in opaque orthographies demanding complex connections between several processing systems. Frederickson and Frith (1998) found correlations between phonological awareness and reading accuracy across monolingual and bilingual 10 – 11 year olds. Being able to read across languages (Everatt et al, 2010) depends on processing words in terms of their phoneme grapheme relationship, hence phonological representation precedes literacy.

Across all languages, it is generally understood that children’s awareness of syllables and onset-rime is usually in place by the age of four (Goswami, 2002). Bilingual students at risk of dyslexia are likely to have considerable difficulty acquiring the complex orthography English. The ways in which dyslexia might manifest in the different systems reflect the processing skills involved in the developmental phase that has been most impeded. Several crucial differences have been identified: a phonological deficit, involving verbal memory: speed of processing deficit or visual processing deficits. Which will be most relevant for bilingual learners?

Phonology plays a role in developing codes for words and influences storage of visual codes, meaning that the two routes to reading, visual and phonological, become intertwined. Early reading sets up phonological units in the brain which children then map to the orthographic units they need for writing, creating a visual code. Ziegler and Goswami (2005) suggest that weaknesses in fine-grain phonological processing underpin dyslexia across languages but may not emerge in transparent languages until literacy acquisition and comprehension demand skill with complex orthographic units such as syllables and morphemes. Corrupted phonology will therefore affect any language reliant on an alphabetic script and manifestation of dyslexia would vary across languages reflecting the exactness with their orthography and phonology are matched.

Fluency or speed of processing may play a larger part than **phonological processing** in the development of skilled reading for dyslexic learners in transparent orthographies (Ziegler & Goswami, 2005; Denckla & Rudel, 1976). Synchronising many processes swiftly will overload those whose processing is slower (Perfetti et al, 2005). Hence speed of connection may be one of the best predictors of dyslexia across languages.

What might be the implications of differing orthographies for manifestations of dyslexia?

The range of first languages spoken by children in the project spanned transparent to opaque. Behavioural aspects of dyslexia may be less evident in transparent languages here, although underlying differences in memory, processing speed, phonological processing at fine grain level and automaticity will remain. Phonological processing., fluency and memory skills underpin dyslexia across languages but studies are contradictory, suggesting that the link between phonological knowledge and reading acquisition seems to vary across languages according to the orthography and morphology. Logographic systems make higher demands on visual processing and memory and lower demands on the phonological systems. In transparent languages, children may only manifest the fluency and comprehension difficulties linked with issues of speed but this does not mean that they do not experience difficulties with phonological processing. This lends credence to the suggestion that some learners will experience difficulties in only one of two languages acquired for reading (e.g. Smythe & Everatt, 2004). Hence the focus of the language will affect the difficulties identified (Wolf, 2008). For a transparent language, it will be fluency; for English, phonological difficulties, and for a non-alphabetic logographic script like Chinese, visuo-spatial memory and difficulty dealing with orthographic processes; although phonological deficits and auditory short term memory still have a part to play in acquiring literacy in a logographic script (Perfetti and Tan, 1998).

Dyslexia as a word level-literacy learning difficulty may be less evident in transparent languages due to the reduced demand on phonological manipulation skills and the strengthening of the feedback loops through consistent repetition (Van Orden & Kloos, 2005). However, the types of deficit highlighted in the Rose Review (2009) - difficulties in phonological processing, verbal memory and verbal processing speed - will affect even the readers of transparent orthographies in several ways, meaning that difficulties might emerge at different stages increasing the risk that the learner's needs will be overlooked.

To summarise, although there is still no firm consensus, research findings generally indicate that phonological processing deficits play a strong part in poor literacy acquisition across alphabetic languages. However, the level of transparency will determine the stage at which these fine grain difficulties begin to hamper reading and spelling skills and there is evidence that, in transparent languages, dyslexia may well be more likely to manifest in terms of speed and fluency difficulties which will, in turn, hamper comprehension skills.

How does moving from literacy acquisition in L1 to L2 affect developing readers?

The most commonly observed difficulties experienced by dyslexic learners across languages comprise phonological processing deficits, memory and fluency deficits. Difficulties in both phonology and orthography, experienced in first language, will impact upon second language learning (Ziegler & Goswami, 2005). Regardless of oral language proficiency, deficits in phonological, processing, Rapid naming (RAN) and verbal short term memory (digit span, word span and non-word span) all predict reading skills across all orthographies studied.

Geva and Wade-Wooley (1993) conclude that there is similar development in spelling and reading profiles in the first language (L1) and second language (L2) in spite of differing levels of proficiency in both. This development may be accompanied by the use of less flexible strategies by dyslexic learners.

Across orthographies, dyslexic children remain poorer at learning inconsistent spelling rules as reading improves (Alegria and Mousty, 1994). The spelling deficits will be milder in a transparent orthography but learners lag behind peers and show persistent subtle phonological problems. Difficulties in non-word accuracy are present but not as important in transparent orthographies as difficulties in fluency (particularly non-word) which is seen as a phonological recoding difficulty and linked with speed of processing. Davies et al (2007) suggest that reading development is delayed rather than deviant compared with age-matched controls. The salient characteristic is difficulty with speed which also impedes phoneme-grapheme association for spelling in transparent orthographies (Wimmer et al, 2000).

What needs to be in place in L1 to support L2?

A transparent L1 may well help to reduce the impact on phonological processing. L1 reading skills are related to L2, but children must have literacy training in L1 for this to happen and this may result in a powerful positive effect on spelling in L2 (Geva and Verhoeven, 2001). L2 development varies more than L1 particularly in the complex orthography of English .

Hutchinson et al (2004) state that a preference for speaking and thinking in L2 increases reading age in L2 and that for normally developing readers, L1 is more at risk than L2.

To summarise: the strengths and weaknesses evident in L1 will cross over to the development of L2 but literacy training in L1 is crucial to the level of impact. When learning the opaque English system, learners do need to develop their phonological

processing skills and to be able to generalise across to new or infrequent words. Although experience of a more transparent orthography may have helped to reinforce phonological skills, the demands of English may prove too complex.

Summary

What is the impact of these differences for defining, identifying and supporting dyslexia in bilingual learners?

Acquiring literacy rearranges the architecture of the brain with different orthographies giving rise to subtle differences. Rose's identification of the main characteristics of dyslexia as difficulties in phonological processing, verbal memory and verbal processing speed is largely reinforced by cross-linguistic studies. Possibly the phonological processing skills, so closely involved in the development of reading and spelling, may be enhanced both by acquiring some literacy in a transparent L1 and by the learning of a second language. In this case, those bilingual learners who still exhibit poor phonological skills may well be those at risk of dyslexia. The role of verbal processing speed is also evident and research indicates that poor fluency may be a stronger indicator in some languages than phonological processing difficulties.

The following factors are crucial, affecting the learner's proficiency in L2 according to the individual's learning and cultural history: the orthography, complexity and level of transparency of the learner's first language; the learner's oral proficiency in L1 and L2 and the extent to which the learner is literate in L1. These can all affect his or her cognitive skills profile when considering risk of dyslexia and must be taken into account when programmes of support are designed.

Chapter 3: Assessing bilingual learners for risk of dyslexia: How might bilingualism shape assessment procedures for dyslexia?

Introduction

The project explored the possibility of developing accessible screeners to identify bilingual learners at risk of dyslexia, both to select participants and to establish some means of identifying these children within schools. The reliability of the selected screening protocol was then tested by establishing the extent to which the outcomes of an assessment by a skilled SpLD/dyslexia specialist teacher or assessor might reflect the outcomes of the screeners.

It is the case that children from linguistic minorities in the UK are under-represented in the educational provision for pupils with dyslexia (Cline, 2000) with a high risk of false positive, or over-identification of ASN in bilingual children, or false negative, under-identification of those at risk of SpLD (Hall, 2001). Both errors culminate in the failure to provide appropriate services which has been termed institutional racism (Landon,2000).

Many factors contribute to this risk. Cummins suggested (1984) that bilingual learners were being assessed through ‘traditional’ assessment and pedagogical practices which did not consider language proficiency and bilingualism. Further factors include culturally inappropriate cognitive assessment processes, underestimating the role in developmental and literacy acquisition played by ‘word poverty’ (Wolf, 2008), SES, early nutrition and toxins, and the experience of instruction both within and beyond the school (Seymour et al, 2003).

This chapter will explore these issues in more detail. Chapter 2 explored the cognitive skills of learners at risk of dyslexia across different orthographies, the impact of differing language systems upon reading development and the effect on an individual’s skills and on the ways in which dyslexia might manifest. Regardless of oral language proficiency, deficits in phonological processing, Rapid Naming (RAN) or fluency and verbal auditory short term memory (digit span, word span and non-word span) emerge as predicting reading skills across all types of orthography and comprise the most commonly observed difficulties experienced by dyslexic learners across languages. This must have implications for the way in which dyslexic differences might be identified. However, a number of questions must be considered in relation to bilingualism.

What are the ingredients of a culture-fair assessment?

The Macpherson report (1990) defined institutional racism as:

> the collective failure of an organisation to provide an appropriate and professional service to people because of their colour, culture and ethnic origin. It can be seen or detected in processes, attitudes and behaviour which amount to discrimination through unwitting prejudice, ignorance, thoughtlessness and racist stereotyping...The only way to avoid 'institutional racism' is to develop a 'comprehensive contextual assessment framework'. Professionals should have an understanding of the complexity of linguistic, cultural and racist aspects and academic achievement; access to bilingual assessors will remove the communication barrier and facilitate communication between school, family and community. Macpherson (1999, 6.4 quoted in Peer & Reid 2000).

Chapter 1 highlighted the risk of applying deficiency models to bilingual learners which can be interpreted as institutional racism (Reed, 2000). Assessment for SpLd/dyslexia, however, has traditionally involved a focus upon testing the learner's cognitive skills and attainment with emphasis frequently upon the use of discrepancies within the profile to identify a *specific* learning difference (e.g. Thomson, 2009).

Three issues emerge here for the bilingual leaner.

Firstly, the cognitive and psycholinguistic approaches predominantly taken for assessing dyslexia risk not taking into account socio-cultural issues around cultural differences as well as linguistic difficulties. A culture-fair assessment must privilege the emotional and social significance of the culture of the learner and his or her community (Sternberg, 2000), and acknowledge that many cultures might value talents and responsibilities over the cognitive skills highlighted as the mainstay of the construct of 'intelligence' in Western society (Rogoff, 2005).

Despite the inclusion of 'intelligence' in the International Dyslexia Association (IDA) definition of dyslexia provided in Chapter 2, The Rose Review (2009) does not emphasise discrepancy and the role of intelligence within discrepancy definitions of SpLd/dyslexia has long been controversial (Siegel, 1989; Snowling and Stackhouse, 2008) and seems even less appropriate in the context of bilingual learners where language based intelligence tests are likely to underestimate performance undermining the use of any verbal/performance discrepancy as a criterion for dyslexia and risking the label of a 'low IQ' leading to unnecessary curricular restrictions being placed upon a learner (Everatt et al, 2000). Secondly there is

evidence for valuing within-child cognitive factors over the additive or subtractive role of context as an explanation for delayed learning. Mother tongue, or first language, teaching is regarded as essential to the language development of the bilingual child (Kidde, 2000, in Peer and Reid, 2000).

However, there is evidence of the imposition, within some schools, of the monolingual 'master model' where the additional or second language (L2)/culture displaces L1/culture. Smythe and Everatt (2000) suggest that 'subtractive bilingualism' and the school's disregard for the language and culture of the home restricts parents from attending meetings and being fully involved in their child's schooling. Standardised assessments carried out on these bilingual learners in English, with no consideration of their bilingualism, are likely to show depressed scores which may be attributed to lack of fluency in English with no further search for other literacy based difficulties, such as dyslexia.

School ethos will reflect the extent to which any comprehensive contextual assessment will be able to involve the family and the community. A comprehensive assessment should gather information about the whole child - background, classroom and environment - include dynamic and curriculum based assessment and appropriate cognitive tests, ideally in L1 (M'Gadzah et al, 1999; Seymour et al, 2003).

This project aimed to take into account the cultural ethos and levels of awareness within the schools through the pre-intervention questionnaires to head teachers, SENCos and TAs, alongside the voices of children and parents provided through the focus groups and interviews. Seymour and colleagues' suggestions that the following questions need to be covered (ideally in L1) were adopted for the project:

- Has the child missed school?
- How long has the child been attending a UK school and learning English?
- Has the child been in school in another country?
- How is education perceived at home?
- Are there any impairments? (e.g. hearing?)
- What is the child's general ability?
- What is the child's language capability in L1? Is he/she literate in L1?

The role of L1 in a full assessment for SpLD/dyslexia

Two issues emerged here; firstly the ability to communicate with parents or carers which may necessitate the employment of interpreters. Secondly, standardised assessments undertaken in English, risk any depressed scores being dismissed as indicating lack of fluency in English rather than any other literacy based issue (Deponio et al, 2000). However, realistically, UK schools contain a wide range of

languages, 43 are included in this project, and, although ideal, there is a strictly limited range of appropriate tests in L1.

Arguments in favour of using L1 follow the script dependent processing model which claims that dyslexia manifests differently in different languages (Smythe, Everatt & Salter, 2004) hence knowledge of the learner's L1 and the learner's developing literacy in L1 (Loizou & Stuart, 2003) is essential for understanding which cognitive deficits or differences might be indicative of dyslexia. An assessment in one language cannot be used as evidence of dyslexic difficulties in another and varied assessment measures should reflect specific linguistic features of the individual's L1 (Ziegler and Goswami, 2005). Variations in the ways of teaching English to children in other countries, for example rote learning rather than instruction in basic phonological principles of spelling, may impact on cognitive skills and explain lack of phonological knowledge.

Alternately the central processing theory claims that, since similar processing difficulties cross languages, underlying processing difficulties will be universal (Everatt, 2010) and phonological measures therefore useful in identifying bilingual children with dyslexia (Everatt et al, 2000).
The same three processing difficulties emerge consistently from the international studies reviewed. These comprised:

- phonological processing, (e.g. Geva and Wang, 2001; Everatt et al , 2004);
- phonological short term memory, (e.g. Smythe et al, 2008);
- speed of processing and rapid naming/RAN (e.g. Caravolas, 2005; Wolf & Denckla, 2005).

This reduces the imperative for using L1 in the assessment. It is therefore possible to assess a range of phonological skills in L2, using the same tasks as for native speakers of L1 (Guron and Lunberg,2003). Smythe states,

> In order to test the learning needs of an individual we only need to test in the language taught ... English tests can be used as criterion tests, since they will inform us where the areas of difficulty lie ... this is possible since we are measuring the skill and not the understanding of the words used in the test. A sympathetic awareness of these differences should be exercised when scoring. (2008, p.1)

Since the lack of tests in L1, and of suitably trained assessors, rendered their use impractical, common factors across languages and culture-free ways of exploring them were identified. The three skills of phonological processing, short term memory and speed of processing (RAN) were considered crucial for the full assessment process for the project. In addition, a knowledge of the characteristics of a learner's L1 and its implications for dyslexic markers in the language of learning would enable

the most reliable diagnostic assessment for dyslexia (see Table 4). A basic knowledge of the level of transparency of a language alongside its orthographic characteristics might indicate which markers in a profile might be prioritised.

Table 4: Assessment measures appropriate for transparent, opaque and non-alphabetic languages

Type of orthography	Assessment measure
Transparent	Phonological short term memory (repeat non-words) Rapid naming – name line drawings
Opaque	Standard phonological processing skills
Non-alphabetic	Rapid Naming (line drawings) Visual memory (recognising whether abstract shapes have been presented a few seconds previously.

The role of assessment

The project needed three levels of identification and assessment.

1. Firstly, a basic screening protocol to identify those who might be at risk of developing dyslexic differences;
2. Secondly – pre/post intervention tests to measure children's progress in a range of literacy skills;
3. Thirdly , a detailed assessment protocol to establish the reliability of the screener.

These are described within the study methodology.

The purpose of any assessment is to prove a hypothesis. It may be the only reliable means for discovering hidden qualities, strengths and weaknesses in the learner, by measuring individual differences in a number of areas and must provide a balance between testing and observation. An overall profile must be compiled using information from the learner, from teachers, other professionals, parents/carers, and most importantly the learner and be discussed by all. It should give the learner equal opportunity to demonstrate knowledge, identify barriers to achievement and also preferred learning styles that can be used when planning an effective teaching programme. Background information should include medical, and, where appropriate, developmental milestones.

The assessment should take place in undisturbed surroundings at a suitable time for the learner, with consideration given to breaks, mealtimes, emotional state, fatigue, health and anxiety. The language used in any report must be appropriate for all who might need to read it.

Assessments may also be used as a predictive tool, in order to see how the child would cope with particular aspects of the curriculum, and to highlight any areas in which they may have difficulty. If the test is being used to identify risk of SpLD/dyslexia using a discrepancy model, it must not be forgotten that dyslexia is described as a *specific* learning difference/difficulty and that the role of 'intelligence tests' is particularly controversial with bilingual learners where the tests are conducted in L2 and where immature development of L1 may affect the findings. In such cases, a more detailed analysis of performance in subtests, combined with further assessment of other factors such as phonological processing and working memory will help to inform a teaching programme that matches the profile of strengths and weaknesses.

An understanding of cultural and linguistic issues in relation to individual bilingual learners and using assessors who are able to empower the children (Baker 2006) are crucial. A Vygotskian perspective would recognise the cognitive role in learning alongside the socio-cultural processes needed if language is understood to be socially constructed. Practical aspects of the project, however, rendered the use of observation, either within or beyond the classroom, or dynamic assessment (Poehner, 2008) impractical. It was also difficult to consider conversational competence (Cummins, 2000). The screening tools needed to be easy and economical in terms of time and cost both for learner and administrator. The full assessment process was conducted individually at the children's schools by trained assessors and is described in Section C of the report.

Summary

Assessment with a bilingual learner must provide information about levels of competence and ways to initiate improvement; this is particularly relevant when a short period of intervention is provided before re-assessment. This study aimed to promote assessment approaches that are sensitive to diverse cultures and language systems, and can distinguish between difficulties of language acquisition in L1 and L2 and language disorder. There must be flexibility of administration of some assessments, whilst at the same time obtaining standardised results to inform the legitimacy of the assessment methods and tools used.

The areas of phonological processing, phonological short term memory and speed of processing remain markers for SpLd/dyslexia risk. However, information relating to organisational skills, understanding and use of language in social and academic situations, attitude to learning and curriculum based assessments should provide a holistic view of the learner's personality and learning style; this information is essential for intervention programmes (Walters et al, 2007).

What practical measures might be used for the preliminary screening?

SENCos and classroom teachers had been asked to select any children who were 'failing to thrive' in terms of literacy development for reasons that were not related to known physical, cognitive or emotional reasons. Hence, the project did adopt a discrepancy model to identify children to participate in the interventions but we were fully aware of the disadvantages; waiting for a discrepancy as proof of a deficit is waiting for proof of failure. Action needs to be taken as soon as there is an indication of difficulty (Elbeheri et al, 2006).

The following instruments were adopted to select those potentially at risk of dyslexia to include in the interventions. The Wesford Dyslexia Checklist (Ball, 2007, see Appendix 2) was adapted to add indicative items for children with EAL:

- Wesford Dyslexia checklist (Ball, 2007)
- Alloway Working Memory Rating Scale (Alloway et al, 2008)
- The Lucid Assessment System for Schools (LASS) 8-11
- The Verbal Measure from Lucid Ability 7-12 (Singleton et al, 2006)

1 .Checklists

The Wesford Dyslexia checklist asks teachers to endorse **regularly** occurring behaviours across a list of

a) attainment difficulties in reading spelling writing and maths;
b) underlying cognitive difficulties with phonological skills, working memory/sequencing, automaticity/ speed of processing, oral fluency, visual/motor skills, organisational skills, classroom behaviour;
c) comparative strengths;
d) discrepancies. A dyslexic profile must contain both strengths and weaknesses. It was adapted to contain extra items relevant to bilingual learners.

The Working Memory Rating Scale provides information about potential memory difficulties, motivation and the ability to shut out extraneous noise and distractions, whilst working in the classroom. Working Memory is now considered to play a significant role on learning outcomes (Gathercole & Alloway, 2008).

2. Computerised screening –

The Lucid Assessment System for Schools (LASS) and the Verbal Reasoning subtest from Lucid Ability, (Singleton et al, 1996) were selected. These take about 45 minutes to administer and were usually given over two sessions. There are 8

subtests in LASS, based on the phonological model deficit theory. Section B provides further details.

What was included in the full assessment?

> The secret of supporting the multi-lingual dyslexic individual is to identify strengths and weaknesses in the language of tuition and teach to the areas of weaknesses supported by those strengths. This does not discount the need for specialist support e.g. for auditory and processing difficulties. (Smythe, 2008 , p 1)

The National Association for Language Development in the Curriculum (NALDIC) states that an assessment scheme should:

> Clearly distinguish the EAL learner's starting point from that of a child whose mother tongue is English, and help to improve educational practice for pupils who have to learn the English language as well as the content of the curriculum...National Curriculum English (subject) scales are not by themselves sufficient for the charting of EAL development. There is a need for additional evidence based and fully validated EAL scales for primary and secondary phase of education which are complementary to the current National Curriculum English scales. (NALDIC, 2003).

The overriding considerations emerging from the literature review were the importance of understanding the structure and level of competence in the first language, and contextual issues of culture and ethnicity. Many difficulties in assessment emerge from culturally inappropriate – measures and standardised instruments provide an incomplete picture. The full assessment sought information about classroom and environmental factors and preferences. Although it had been decided not to use any assessment measures available in L1, assessors were advised to exercise awareness of these differences when scoring.

The following categories were included based on Everatt et al (2000), with additional items for comprehension, writing skills and phonological processing. Appendix 3 provides the protocol with details of the tests used.

- ***Basic skills****; sequences e.g. alphabet, number, phoneme-grapheme correspondence, days of week, months, also reversals of letters and numbers.*
- **Words & non-words:** reading (single word/non-word) and spelling (single word/non-word).
- **Phonological awareness and processing:** segmentation skills, *alliteration*

and rhyme tasks.

- **Auditory tasks:** digit span forwards backwards and Short Term Memory (STM) and working memory, *sound discrimination.*
- **Visual tasks:** *copying, visual recall of shapes, visual sequential memory*, visual spatial construction, matrices**.**
- **Rapid Naming***: pictures, numbers, letters.*
- ***Reasoning ability****: non-verbal reasoning task (covered in Lucid).*
- ***Writing skills.***
- ***Listening comprehension.***

(Items in italics were not included in the full assessment either to avoid overloading the children or because they loaded too heavily on knowledge of English or because they have been covered in earlier testing procedures)

Hutchinson and colleagues (2005) compared bilingual and dyslexic learners, indicating differences in approaches to reading. Dyslexia led to stronger context use/dependency alongside weaker decoding skills while the bilingual learners tended to exhibit lower context use/dependence and stronger decoding. Cline and Reason (1993) suggest that bilingual learners may well have reduced access to semantic compensatory strategies. Hutchinson also suggested a combination of a listening comprehension test, with a reading passage, cloze exercise and miscue analysis to check strategies.

Despite the contested role played by cognitive ability in identifying dyslexia, it is important, however, to be able to explore this. Hence the inclusion of the visuo-spatial and non-verbal reasoning tasks. Listening comprehension, as an integral component of the language process, can also be used in place of Intelligence Quotient (IQ) scores for exploring different kinds of reading disabilities and the implications for intervention (Hutchinson et al, 2005).

Chapter 4: Compiling a Programme

Cultural implications for the design of the programme

It is clear (e.g. Loizou & Stuart, 2003) that bilingualism can support literacy acquisition in a second language, particularly if the learning of a more regular orthography in L1 or L2 might lead to faster acquisition of phonological awareness skills to support the less regular English orthographic system (Everatt et al, 2010). Additive rather than subtractive approaches and materials which recognise and support the learners' culture are crucial. The project aimed to foster awareness amongst those involved through both an audit of existing awareness and cultural model within participating schools via questionnaires at the outset and through delivery of awareness /Dyslexia and Multilingualism (DAM) training.

What areas are likely to need support?

The literature review highlighted weaknesses in the following areas, confirmed by the collection of meta-analyses undertaken by the US National Panel on Language-Minority Children and Youth (NLP):

- Phonological processing, including verbal memory skills
- Comprehension
- Oral language and vocabulary development
- Morphemic awareness
- Speed of processing

The predictors of word recognition skills in English L2 are the same as found in monolingual learners of English and include the key components of phonological processing: phonemic awareness, rapid naming, phonological memory. Predictors of L2 reading comprehension are also similar to what has been found in L1: namely background knowledge, vocabulary, story structure and home literacy. Like L1 Readers L2 learners with dyslexia have difficulties mainly in phonological awareness and working memory (NLP; August and Shanahan ,2006; cited in Mahfoudhi & Haynes, 2009).

These sources recommended structured training in phonemic awareness, decoding, fluency, vocabulary, reading comprehension and writing with the added elements of, firstly, an awareness of the linguistic and typological differences between L1 and L2 to enable building upon the similar and transferable skills across L1 and L2 and secondly development or oral language skills in English. The project aimed to break new ground by combining the best current practice in support for bilingual learners

with the established structured multi-sensory support recommended for dyslexic learners (See Brooks, 2003: Brooks et al, 2008 and Singleton, 2009). Hence a range of sources were scrutinised for information as to existing needs and programmes.

Support Programmes for bi-lingual learners

The Ofsted report (2005) exploring the writing of advanced bilingual learners of English at Key Stage 2 suggested some key features of written language that these advanced bilingual learners (learners who had spent the majority of their school time in UK schools and whose oral English was indistinguishable from their peers with English as a first language) handled less confidently than their monolingual peers (Cameron & Besser, 2004). These include poorer sentence structure; limited vocabulary; grammar difficulties – e.g. tense, subject verb agreement, articles, prepositions; less extended writing ; difficulties with idiomatic English, reading for understanding, figurative language (p.11). It emphasised the need to be aware of the specific linguistic needs of bilingual learners and for the development of closer relationships with families and communities to build on pupils' cultural and linguistic experiences. However, the recommendations seemed to reflect standard good creative practice in the teaching of writing. There were few specific recommendations that seem to target the needs of the bilingual learner.

Phonological development

Systematic teaching of new 'phonemes' in L2 is essential (the inability to decode in year 1 predicts 88% of poor readers in year 4) and is particularly important for decoding English. Lundberg (1994) revealed a positive relationship between phonological awareness instruction and reading skills in early bilingual learners. Those learners who have been exposed to L2 prior to the age of three are likely to develop more economic processing of both languages in overlapping regions than those who have learnt later (Guron, 2005, in Peer and Reid, 2005).
Explicit teaching is the most successful (Mahfoudi & Haynes, 2009) with evidence that training in phoneme and letter knowledge for at risk learners can help them to catch up with normally developing readers (Caravolas, 2005). However, very severely phonologically impaired learners gain less from phonological intervention (Torgesen and Davies, 1996, cited in Wolf, 2008).

There is a risk that bilingual learners identified with dyslexia in a transparent language may be likely to have severe phonological deficits in which case phonological teaching may not be the optimal approach for them (Smythe & Everatt, 2004) as it will be essential to identify their cognitive strengths and make use of them.

Comprehension

The project aimed to develop comprehension skills in years 4, 5 and 6 for two reasons. Firstly, the shift in classroom teaching of reading (DCSF, 2006) from word based skills to general comprehension challenges comprehension skills. Secondly, it seems that lower cultural familiarity and skill with L2 may mean that some learners from transparent orthographies have more difficulty with the semantic/syntactic/contextual cues which enhance comprehension and are classically employed by dyslexia readers (Burgoyne, 2009; in Peer and Reid, 2005) than with decoding. Some display a comprehension age below accuracy age, poorer comprehension, poorer listening comprehension, lower grammar and word knowledge and poorer rhyming ability.They need explicit instruction in listening and reading comprehension strategies (Scarborough, 2001).

Kotula (2003) emphasises the multi-dimensional nature of comprehension embracing many skills that are challenging for a dyslexic learner with lower automaticity:

- working memory
- inference making
- comprehension monitoring
- word meaning
- constructing schema
- oral vocabulary.

The development of oral language and vocabulary through explicit instruction

Studies emphasise the role of rich vocabulary knowledge and semantic skills accompanied by awareness of grammar and pragmatics in developing literacy and comprehension for both monolingual and bilingual learners (e.g. Beckett et al, 2002). These skills figure consistently as factors in the prevention or development of dyslexia (Snowling & Stackhouse, 2008).

Snowling and Hulme (2005) suggest that any impairment in learning semantic forms in early reading development or a slower developing oral vocabulary impairs phonological representation. Any increase in oral vocabulary therefore directly enhances the phonological systems (Walley, 1993, in Snowling & Hulme, 2005) .

Snowling and Stackhouse (2008) have consistently emphasised the role of language deficits in exacerbating the risk of a learner with phonological processing deficits developing full blown dyslexia. Hence specifically targeted work to develop flexibility

of language use, to expand receptive and expressive vocabulary, semantic fields or inference as recommended for dyslexic students is appropriate.

Geva & Zadeh (2006) emphasise the importance of oral language skills and phonological processing for bilingual learners' text reading and comprehension success. They underline the need for bilingual intervention programmes to incorporate specific instruction to develop knowledge of the underlying life of words, including sounds within words, semantic families, syntax and the morpheme awareness that underpins awareness of semantic links and grammatical structures. Hall (2001) recommends oral collaborative work based specifically upon contextually relevant curriculum vocabulary and practice in the structures needed for questioning and reflecting. This is emphasised in the literature relevant to supporting learners with speech and language development deficits.

Morpheme work

The development of morphemic awareness is consistently cited in the literature (e.g Berninger, 1994; Seymour, 2005a & 2005b). Haven and colleagues (2004, in Smythe and Everatt, 2004) stress the role of morphemic awareness as a compensatory strategy for dyslexic readers. Each language incorporates its own morphemic system which must be mastered. The use of syllable work to support decoding, spelling and vocabulary development skills is common across programmes supporting dyslexic learners (e.g. Ott, 2007; Mortimore, 2008). Hence it is highly appropriate for bilingual learners at risk of dyslexia.

Summary: Providing support for reading deficits

The research into factors underpinning cross-linguistic literacy acquisition highlights the role of **phonological processing** (including verbal memory) and **comprehension** skills. Further analysis of the systems underpinning comprehension skills suggests the role played by **oral language**, the **development of vocabulary** and knowledge of the **morphemic** structure of L2. In addition, Wolf (2008) highlights the part played by **speed of processing deficits** in hampering the decoding and **memory** skills needed for comprehension. Is there evidence from intervention programmes and studies that these should form the basis for the intervention programme adopted in the current study?

The effectiveness of general intervention programmes for literacy

The Brooks Review (2003) provided an overview of the effectiveness of many Wave 3 and some Wave 2 intervention programmes in the UK for reading, spelling and

comprehension. Brooks's review confirms the suggestions that emerged from the literature review. Direct teaching of phonological skills is placed within a broader approach that recommends explicit vocabulary development and specific strategies to develop comprehension skills. Reciprocal reading and inference training are recommended. Brooks emphasises the need for explicit, structured, reinforced programmes.

From the limited evidence available it can tentatively be deduced that children's comprehension skills are benefited most by being directly targeted, and not indirectly through work on reading accuracy (Brooks, 2003). This is an under researched area in UK and numbers of children in the projects were low but inference training and reciprocal teaching were effective, as were paired reading, reading partnerships and Catch Up. Success with children with the most severe problems is elusive, and this reinforces the need for skilled, intensive, one-to-one intervention for these children.

The Impact of specialist dyslexia teaching

Singleton's (2009) review of published evidence on the impact of specialist dyslexia teaching concentrates on 'the core of specialist dyslexia teaching, which is structured multisensory phonics teaching' (p22). It is systematic, directly focussed on developing literacy skills and additional to that normally provided (at least 2nd tier or wave 2). The results are effective in groups of up to 4-5 children even when instruction is provided by non-teachers , providing they are explicitly trained.

The review establishes that effective intervention programmes for monolingual English speakers in US and UK, are likely to include:

- explicit training in phonological awareness - key to success, particularly in relation to sustained benefits;
- strong focus on phonological decoding and word-level work;
- supported and independent reading of progressively more difficult texts;
- practice of comprehension strategies while reading texts;
- instruction that is systematic, multisensory and intensive.

The focus of this review is, however, based on the assumption that phonologically based interventions work best for monolingual learners with dyslexia. There is no discussion of the importance of context or of those learners for whom phonological training may be less appropriate (Smythe & Everatt, 2004). Singleton's findings, do support the suggestions emerging from the current review of the cross-linguistic literature. However, reservations arise as to the extent to which the focus should automatically be upon phonological training for bilingual learners. Knowledge of the learner's linguistic context, literacy levels in L1 and the nature of its orthography should influence decisions about the nature of support activities.

Both reports support the suggestions that have emerged from the current review. Singleton emphasises the need for structure, which will be a strong aspect of the programme. He also confirms the effectiveness of delivery in small groups by trained TAs. This was the format adopted by the project. Again the role played by phonological processing is emphasised. However, this was placed within the context of working with comprehension strategies and development of vocabulary, as suggested for the project.

Singleton also recommends structured multisensory programmes as pedagogy for dyslexia (e.g. Hornsby et al, 2003) alongside evidence (Crombie & McColl , 2001), that a structured multi-sensory approach, incorporating deductive and metacognitive strategies and aiming to teach to automaticity, is also appropriate for teaching L2.

Reid (2009) cites Erlbaum and colleagues' (2000) meta-analysis of intervention research in support of the effectiveness of one-on-one tutoring programmes and summarises the key factors in a teaching programme for students with dyslexia.

• Balance between bottom-up phonics and top-down focus on meaning
• Develop listening skills
• Ample opportunities for listening work
• Utilise discussion to develop language and thinking skills
• Key focus on phonic skills
• Build sight vocabulary through whole word recognition
• Develop sentence and paragraph awareness
• Comprehension –building activities
• Highlight reading and spelling connections
• Develop skills in creative writing
• Opportunity to develop imagination and creativity
• Practice in the use of syntactic and semantic cues
• Emphasis on learning English language phonemes and graphemes
• Pre-reading skills such as visual and auditory perception
• Practice in auditory and visual discrimination
• Practice fine motor skills
• Develop knowledge of colour , number , orientation and directions
• Games to stimulate motivation and over learning
• Syllable segmentation and word attack skills
• Rhyme, rhyme judgement, rhyme production
• Alliteration and word activities
• Onset and rhyme activities to build up word banks (Reid, 2009, p. 162)

Schneider (et al,1997, in Reid 2009) focuses upon teaching MSL to dyslexic learners and suggests eight principles for structuring of a programme, familiar from pedagogy

for monolingual dyslexic learners (e.g. Ott, 2007). They link with Reid's factors; the programme must be:

Structured	Multi-sensory
Repetitive	Meta-cognitive with teacher modelling and think aloud activities
Analytic – synthetic	Explicit about the characteristic mechanisms in L2
Prescriptive	Diagnostic

Dyslexia and multilingualism

Few UK studies specifically address interventions for bilingual learners in multilingual contexts relating directly to dyslexia. Those that do exist are small scale (Fawcett & Lynch 2000) or more concerned with screening and assessment (Hutchinson et al 2004). Some US studies focus on Spanish speaking students in bilingual programmes (Vaughn et al 2006, Gerber et al 2004). For these reasons, in order to influence the project design, the review attempted to identify studies which:

- Identify effective reading programmes for pupils with English as an additional language (Cheung and Slavin 2006).
- Focus on improving literacy for poor readers set within linguistically diverse settings (Hurry et al 2005);
- Recognise additional variables that impact on progress in literacy (Duff et al 2008; Nunes and Bryant 2006);
- Acknowledge the role of family in biliteracy education (Brooks et al, 2008, Kenner 2005).

The following imperatives emerged. Programmes should:

- **Incorporate explicit teaching of vocabulary systematically linked to the literacy intervention** (Duff et al, 2008). The project participants' oral language competence is likely to be in advance of the limited vocabulary in reading books. This also offers potential for working bilingually. This study could provide a model and potential materials for intervention.
- **Include explicit teaching of morphology**. This could open up a second layer of systematic teaching of regular connections between spoken words and spelling at the level of morphemes. It offers a problem-solving metacognitive approach connected to linguistic knowledge for bilingual learners. Hurry and colleague's study (2005) offers a practical plan for the training of school staff.
- **Make links to programmes for reading specifically aimed at bilingual learners** (Cheung and Slavin 2009). Appropriate recognition and links to existing effective reading programmes in a bilingual context are essential.
- **Ensure recognition of family literacy eco systems in ways that counter stereotypes of bilingual children in the school system**. Kenner's (2005)

observations of the rich variety of literacy practices in the families within the study suggests that the stereotypical parent reading to /with the child is a deficient model for some bilingual families. The project should consider different experiences of literacy together with a wider understanding of support from the home.

Invisible variables and missing context: class, ethnicity, language/s, new literacies

One aspect of studies most commonly reviewed in relation to dyslexia is the invisibility of contextual variables that may influence children's progress in literacy. Studies which primarily focus on quantifying effects or progress tend to ignore more qualitative factors in children's lives that also influence progress in literacy. There is scant reference to the cultural issues discussed throughout this report. In relation to bilingual pupils these may be crucial to acknowledging the distinction between literacy difficulties arising from learners transferring to a new language and those whose difficulties may be both due to their bilingual status and to dyslexia. Whilst at one level these complicate the processes of identification and intervention, nevertheless there is widespread recognition of the tensions and dilemmas surrounding the identification and support of bilingual children with dyslexia. Some of the complicating factors especially relevant for this study are:

- recognising additional contextual factors relevant to lower attainment in literacy such as; parental educational experience – which may vary across ethnic minority populations, especially in children who are first generation schooled in UK and more recently arrived families; family economic and emotional stress arising from uncertainty about their status in UK (refugee children);
- misrecognition in schools of a child's underlying abilities resulting in inappropriate allocation to SEN groups /classes creating frustration and loss of desire to read;
- Generating statistical data on; patterns of pupil support for EAL and / or specialist support for reading difficulties (SEN) which is sensitive to variables such as; generational data (1^{st} /2^{nd} generation bilingual), home language/s, language proficiency, socio economic status, home literacies;
- the range of experiences children have of literacy in a variety of languages;
- the importance of relevance to children's desire to read.

These factors all reflect issues raised in the discussion of bilingualism in Chapter 1 of the literature review. Brooks and colleagues' (2008) international review of family literacies provides some key factors and debates that challenge assumptions and raises questions for the review. Does our view of literacy perpetuate a normative

middle class view of literacy? What is known of family literacy practices and how they 'fit' with school practices or might be drawn on in identifying EAL children with dyslexia? How can our knowledge of socio economic status, generation (1st /2nd generation bilingual), inform our understanding of reasons for an child with EAL's slow progress in literacy?

Hence the project aimed to provide a broader perspective on the area by adopting a mixed methodology design including the voices of children, parents and those working in the school context. This provided a richer picture within which to place the quantitative data which emerged from the intervention findings and arguably provides a perspective which has not emerged to any significant extent in the existing literature.

Design challenges

A number of constraints affected the design of the intervention programme. These included elements dictated by the nature of a research project:

- cost implications for resources;
- tension between the need to individualise programmes versus uniformity of practice within the research design;
- structuring the programme to enable uniform practice across the 75 lessons;
- ways of mapping activities closely to outcomes to enable 'measurement';
- developing easy to implement content to enable sufficient training for the TAs and avoid different levels of skill across the groups.

They also needed to complement existing bilingual practices and incorporate structured multi-sensory activities with a pair of students; to structure the 'cycle of assessment' recommended for SpLD teaching into the programme and to take into account cultural issues and individual learners' L1.

The chosen programme, training and presentation/monitoring of the materials, described in the methodology chapters, managed to meet the majority of these requirements, with the exception of the need to take the learners' L1 into account.

Conclusions

Relevant intervention studies reviewed (e.g. Hutchinson et al, 2004; Cheung and Slavin, 2006) demonstrated the clear need for effective oral language interventions to develop skills among bilingual learners. However, little evidence as to the efficacy of strategies (Gersten & Baker, 2000; Dockrell et al, 2010) emerged to inform the intervention programme, also indicating the need for further evaluated intervention studies.

The review suggested that programmes should incorporate a combination of strategies designed to improve phonological processing skills (including verbal memory), oral language development and explicit vocabulary teaching, explicit strategies to develop comprehension skills (such as reciprocal reading) work with morphemes and strategies to improve memory and processing speed. The programme should be structured, reinforced, cumulative and multi-sensory. It should take into account the learner's cultural background and experiences, structure of L1, learner's attitudes to literacy. TAs delivering the programme should be trained to enable awareness of additional contextual factors which will need to be taken into account when designing, delivering and evaluating the intervention. The school context in terms of cultural climate should be taken into account in the development of training.

C. Methods and findings across the project

Chapter 1: Intervention study

Staff training

Two days of mandatory local training for 76 SENCos, 106 participating TAs and 70 class teachers were delivered by specialist members of the team and experts from LUCID/LASS, Nessy and Rapid Reading (RR), and comprised research protocols and ethics (TAs/SENCOs); pedagogy for dyslexia and bilingual learners (TAs/SENCOs); training in identification screeners and pre-post testing (SENCOs); training in NESSY/RR/Paired Reading (PR) delivery and record keeping (TAs).

The training highlighted contextual factors affecting delivery and the importance of acknowledging and supporting the learner's cultural background and experiences (Cummins, 2000) the structure of the first language and the learner's attitudes to literacy, as well as the cultural climate of the school.

Participants

a. Context

Following project training, SENCos utilised LUCID Ability 7-11, LASS 8-11, The Alloway Working Memory Questionnaire (2008) and an adapted Dyslexia Screener Questionnaire (Ball, 2007) to identify 465 bilingual children from years 4-6 (aged 8 to 11) whose literacy was causing concern and whose 'failure to thrive' with literacy skills was not explained by global learning difficulties, hearing/visual impairment or emotional and contextual challenges and who might be at risk of dyslexia. All had attended English schools for a minimum of two years to ensure adequate Basic Interpersonal Communication Skills (BICS). These 55 schools represented Liverpool, Manchester/Salford, Swindon, Bristol, Bath & South West, and London, comprising a range of SES inner city and rural areas with high levels of bilingual learners. Over 43 first languages were represented (See Appendix 1 for language distribution).

b. Identification of participants – children at risk of dyslexia

One aim of the project was to trial accessible tools for identifying bilingual children at risk of dyslexia, suitable for classroom teachers supported by SENCos. This should, without lengthy one-to-one teacher/learner time, provide information on the child's behaviour in a range of contexts and on literacy skills such as reading and spelling alongside processing skills in the cognitive areas relevant to dyslexia and bilingual

learners highlighted in the literature review (phonological processing and decoding; working memory and auditory/visual memory; receptive oral language skills).

The computer screening tools of LASS 8-11 and Lucid Ability 7 – 11 were considered to meet these needs in a non-threatening way with less emphasis on language use and are currently in use in many UK schools. LASS provided the following measures:

- Non-verbal Reasoning;
- Verbal memory -: auditory sequential memory (digit span);
- Visual spatial memory : immediate recall of objects and their spatial positions;
- Phonological processing ability : segmentation and deletion of syllables and phonemes in real words;
- Phonic skills;
- Spelling: Single word spelling test;
- Word reading;
- Reading comprehension (silent).

The verbal ability measure from the LUCID Ability was added, although it was acknowledged that this test is not standardised on bilingual learners and may be an indication of lack of vocabulary knowledge rather than verbal ability.

The SENCos recorded all scores and provided a profile sheet for each child, including first language, languages spoken at home, number of years in UK school and previous additional support in EAL, Dyslexia and SEN.

The LUCID research team devised an algorithm for use in selection of the participants (See section 2c) but this was not available in time for the selection of the participants. The second stage of selection therefore involved three members of the project team selecting 240 learners at risk of SpLd/dyslexia on the basis of agreed criteria provided in Table 2 and a sample was moderated to ensure equal ratings. 220 finally participated at the onset. Ten exited from the study due to school management issues or family circumstances or were removed from the study in the absence of submitted scores from one or more of the three score phases of the project leaving a total of 210 participants on the database (23.2.2012).

Table 1 : Participation criteria

Indicative discrepancies on LASS/Lucid + discrepancies on Dyslexia checklist (DC)	**Strong yes**
Indicative on LASS/Lucid without discrepancies in DC but some difficulties boxes indicating discrepancies ticked	**Strong yes**
Unclear indicators on LASS/Lucid + discrepancies on DC	**Yes**
Unclear indicators on LASS/Lucid+ no discrepancies DC + working memory risk	**Possible/yes**
No discrepancies or indication of below average lit score on LASS/Lu + discrepancies on DC High risk Working memory + non-indicative profile All round depressed score LASS/LU + no DC indicators	**No (unless individual mitigating circumstances)**

SENCos had been instructed to select children without global learning difficulties or contextual contributing factors whose literacy was failing to develop, hence the project had by default adopted a discrepancy definition of SpLD/dyslexia and children's general cognitive ability is therefore implicated.

Since none of the identification screeners have been standardised with bilingual children, neither the non-verbal nor verbal ability tests may reflect ability accurately. Many children showed significant discrepancy between a high score on the Cave test (visual spatial memory) and low score on the non-verbal test, which may suggest that children misunderstood the rules of the non-verbal test. Similarly some children with lower scores in the Lucid verbal reasoning test have been included if they show strengths in other cognitive tests because bilingual learners may struggle with a verbal reasoning task based on knowledge of English vocabulary and because oral language impairment is implicated in the development of dyslexia (Snowling & & Stackhouse, 2008). Children with a high risk of working memory difficulties and with no indicative dyslexic profile were not included.

The role of highly transparent languages such as Turkish in predicting higher phonological processing was also considered in the selection.

Progress assessment procedures: Target Variables

Table 2: Literacy skill target variables assessed

:Key: Wide Range Achievement Test (WRAT) British Picture Vocabulary Scales (BPVS) York Assessment of Reading Comprehension (YARC),

Attainment	Skills tested	Test	Tester
Reading	1. Accuracy; rate; comprehension	YARC	SENCo
	2. Single word	WRAT4	SENCo
	3. Silent reading	WRAT4	SENCo
Spelling	Single word	WRAT4	SENCo
Phonological decoding	Non-word decoding	Turner (1994)	SENCo
Receptive language		BPVS	SENCo
Writing	**Free writing**:. Story of your day Word count: words per minute: length of time to complete in seconds % indecipherable Analysis based on National Curriculum SATS scales		TA in session standard determined by two raters

The SENCo assessed each child's ability in each target variable during the two weeks preceding interventions. The TA conducted the free writing task in the first week of the intervention. This procedure was repeated after 15 weeks at the end of the intervention with the exception of the 44 full assessment children whose testing, apart from the YARC, was included in the full assessment to prevent overloading the children. This testing procedure was repeated at the end of phase two in July 2011. SENCos were not blind to the intervention.

All assessment materials were age-appropriate – and selected as suitable for bilingual learners. The WRAT 4 was sampled on the main ethnic groups in the US and the overall sample percentages matched the population percentages.

What was compared?

The performance of the children in group A (Specialist Intervention) was compared with group B (Paired Reading) and group C (waiting control who received no SpLD specialist individual intervention beyond the primary school literacy curriculum). Group B received the same time and attention as the specialist group. Intervention impact was measured through comparing the three groups in Phase one on targeted skills reflecting development in literacy and spelling. Changes in performance within groups were measured across the time span of the two phases and effect sizes were calculated.

Group A (Int) undertook 15 weeks' specialist intervention followed by 15 weeks with no individual support;
Group B (PR) undertook 15 weeks' paired reading followed by 15 weeks' specialist intervention;
Group C (Control) undertook 15 weeks' with no individual support followed by 15 weeks' specialist intervention.

Phase 2 aimed:

- to establish the sustainability over time of gains achieved by the intervention group without further individual support;
- to compare the progress of children who had received only 15 weeks of individual support with those who had received 30 weeks;
- To examine the impact on the waiting control group of the delayed intervention;
- To compare the progress made in 30 weeks across the three conditions.

The Phase One Intervention

i. School settings:

To meet the gold standard of randomised controlled trials (RCT,) the intention was to divide participants randomly into groups across schools to undertake the three different learning conditions. However, to avoid the use of the study materials with children outside the individualised specialist teaching, the three conditions for phase one were undertaken in separate schools. Circumstances decreed that schools from the London area joined the project in September 2010, too late for their TAs to be trained in SpLD/Bi-lingual teaching methods and practical aspects of the intervention in July 2010 alongside the other areas. Hence the London participants became the waiting control group rather than this condition being spread across the different LAs.

ii. Intervention procedure:
Group A: specialist intervention: structure of lessons and materials

Based on research findings evidencing effective teaching for SpLD/dyslexia (e.g. Brooks, 2003) schools were provided with two Information and Communication Technology (ICT) based programmes Rapid reading (RR) and Nessy. Studies show evidence of the effectiveness of precisely targeted and ICT packages supported by facilitators (Brooks, 2003; Smythe, 2010) and of the impact on reading comprehension of vocabulary and repeated reading programmes (Hattie, 2009).

These programmes were cumulative with opportunities for overlearning and reinforcement. In addition they offered maximum opportunities for oral language development, explicit vocabulary teaching (with some pre-tutoring of key vocabulary), development of comprehension skills (oral and reading) and work with English morphemes.

Rapid Reading is a Computer based (Wave 3) reading programme comprising finely levelled sets of high-interest, low reading level, illustrated (fiction and non-fiction) books aimed to move 7-11 year old readers from reading ages of 5.6 to 8+ at double the normal rate of progress. Speech recognition software supports reading practice and worksheets consolidate word-level work. It meets the need for bilingual pupils to focus on comprehension, vocabulary and word-building skills in that programme features include pre-tutoring of new vocabulary, opportunities for discussions about vocabulary, context and comprehension of the text, analysis of the phonic features of words, spellings for common irregular words and dyslexia-friendly fonts and background colour in the reading books.

Nessy was developed specifically to support learners with SpLD/ dyslexia. It is a computer-based, structured phonics resource for reading and spelling including learning of letter patterns as well as spelling and reading rules. The material includes often humorous visual memory aids, games and activity worksheets. The intervention focused on the spelling aspects of this programme, with reinforcement through written worksheets.

Each offers an initial assessment enabling the learner to be entered at the appropriate individual level, following an initial assessment process integral to the programme. Detailed inbuilt mechanisms record the learner's performance, monitoring progress and adjusting the programme to individual needs.

Children entered the programmes at a stage below their current reading and spelling levels to build confidence and familiarity. Children with reading accuracy or reading comprehension scores equivalent to a reading age of less than 8 years used Rapid Reading, as well as Nessy. The few children who scored above 8 years in reading accuracy and comprehension levels, started off on the Rapid Reading and then either completed additional highest level books or utilised the Rapid reading approach with appropriate level paired reading texts for the last few weeks of the intervention, in addition to the Nessy spelling components.

It was possible to train TAs to use these resources relatively quickly and they offered the potential for reliability in terms of uniform delivery and content across the research study.

TAs were also trained to use provided multi-sensory teaching resources and activities utilizing visual, tactile, motor and auditory senses simultaneously alongside incorporating multi-sensory reinforcement throughout (e.g. when working on common irregular spellings, phonics letter patterns, phonological skills, working memory, processing speed or when building automaticity and learning reading and spelling rules). Training also included basic strategies to help to reduce possible visual processing difficulties (e.g. visual stress symptoms), letter reversals and mis-

sequencing of letters within words. There are also some useful activities within the teaching materials for these areas.

The schools provided additional resources and multi-sensory teaching equipment was provided including white boards, coloured pens and board wipe, plastic/wooden letters, salt/sand tray, coloured pencils/felt tips, pens, pencils, rubbers and coloured highlighter pens. The project provided notebooks and ring binders for the children's work and for the TAs' narrative records.

The project also provided laminated sheets with large 'tram lines' for spelling practice, with the central lines block coloured such that small letters would fill the coloured band, with tall letters going above it to hit a line, and long letters below it to another line. This can aid even letter sizing, particularly for those with visual-perceptual difficulties. These sheets were re-usable with dry-wipe pens.

Materials were scrutinised by the team for cultural appropriateness. The TAs were issued with a booklet that summarised strategies for working with children with SpLD and EAL.

Each lesson was delivered by one TA to two learners of similar ages where possible. Appendix 4 shows the time table of activities and the balance between computer based and TA focused activities for each child throughout the intervention. TAs were instructed to keep to the structure consistently and to indicate in audit books instances where the routines had not been followed.

The intervention aimed to achieve a 2:1 improvement ratio in reading and spelling levels (average eight months over the four month teaching period). Although expected effect size is currently under discussion, Hattie (2009) suggests that children are normally expected to make progress over a 40 week academic year of 0.4 which would equate to .015 over 15 weeks. The participants were thus expected to make gains with an effect size of 0.3 during the intervention.

Group B: paired reading: Intervention procedures: Structure of lessons; materials

Group B received the same amount of two to one individual time (30 minutes a day for 15 weeks) as group A, with a TA trained by the research team in the paired reading strategy, dyslexia and working with bilingual learners. The lessons were structured to mirror the specialist intervention with Pupil 1 carrying out paired reading with the TA while Pupil 2 reads silently to themselves for the first 15 minutes of the lesson. Then they will swap activities for the next 15 minutes, with Pupil 1 reading silently and Pupil 2 having paired reading. TAs were provided with a teaching timetable audit sheet and a detailed handbook and audit/commentary materials similar to those of the specialist intervention. Children were encouraged to talk about

the vocabulary, content and their reading and to self-evaluate. Every effort was made for the intervention to resemble the specialist intervention in every way except for the materials used.

A full and varied range of appropriate-level reading materials and schemes was selected from materials within the schools, from home or the public libraries in discussion with the SENCo and the children.

Group C: Waiting control Intervention procedure: non-intervention

Students received only their existing class and support provision as already arranged within the school. They received the specialist intervention programme during Phase 2. Pre and post testing of literacy skills was conducted.

v. Staff training, support and fidelity measures

Staff training has been described. SENCos and TAs received a tightly structured, detailed project handbook containing advice based on the training and daily progress audit sheets for Intervention A and PR. TAs kept records of activities and logged any departures from the arranged activities. They kept individual project files for their children containing information logged on the 2 computer programmes for each individual child and pertinent information. Project managers visited schools and kept Field diaries and systematic observation sheets.

vi. How were staff supported?

Further to the measures described under the ethical procedures, SENCos were trained to mentor TAs and the team responded to emerging questions from TA/SENCo questionnaires and focus groups. SENCos and TAs received a tightly structured, detailed project handbook containing advice based on the training and daily progress audit sheets for Intervention A and PR as intervention fidelity measures to ensure regular audit and uniformity across all participants.

The project staff supported through school visits and on-going communication with school staff throughout the programmes.

Intervention Findings: Phase One

216 children started phase one of the project. The scores from the pre and post testing of the items were entered in a PASW file and checked for outliers and errors. Descriptive statistics revealed a bias towards boys but even distribution by gender across the three project conditions. Although there were some uneven distributions across the school years, with 45 year 6 children compared with 81 year 4 and 89

year 5, Pearson Chi square analysis showed no significant difference in proportion of years 4, 5 or 6 across the three conditions (Sig = .248)

Intervention Findings Tables are presented in the technical appendix for the Intervention Phase One (Technical appendix 1).

Intervention Table 1 Distribution of sample across gender
Intervention Table 2 Distribution of sample across school year
Intervention scores had been established pre and post phase one of the project for the following items:

- WRAT single word reading; spelling and silent reading sentence comprehension
- YARC Reading accuracy, rate and comprehension
- BPVS
- Phonological non-word decoding (Turner, 1994)
- Free writing: total words, words per minute, words indecipherable, National Curriculum level

Comparison of the three groups at the outset

As indicated previously, contrary to intentions, allocation of project condition to local authority had not been random. The distribution across Local Authorities is shown in Intervention Table 3.

Pre-intervention scores for the control group, which contained only the London children, were consistently higher across the pre-assessment testing than for the intervention and paired reading groups. Intervention Table 4 in the technical appendices shows the pre-test means and standard deviations for the three groups across all the items. Details of statistical analyses are also shown in the technical appendix. The scores for the control group were the strongest and the paired reading the weakest of the three groups across all items with the controls starting out significantly better than the other two groups in receptive language, single word reading, WRAT silent sentence comprehension, YARC reading accuracy and rate.

Despite the different levels of achievement revealed by the three groups at the outset, examination of the percentages of children identified as on the SEN register or as having individual or small group support for EAL, SpLD/dyslexia or general literacy needs revealed no significant differences between the intervention and control groups for SEN register although both were less likely than the paired reading children to have been identified with SEN. The paired reading children had not, however, been offered more support than any other group.

Findings: Statistical procedures

Comparison of the scores for the three groups on each item across the two testing times used an analysis of variance (ANOVA) with 3 levels of the group factor (condition: intervention, paired reading and control) and 2 levels of the repeated measures factor (time: pre-intervention and post-intervention) to establish if time had an impact upon the scores and if there were significant differences between the three groups. Further analyses of variance (ANOVA) with 2 levels of the group factor and 2 levels of the repeated measures time factor compared improvements between each pair of groups: i.e. intervention against control, paired reading against control and intervention against paired reading. Finally the improvements in scores for each group were assessed using paired t-tests.
These same analyses were undertaken for each item. The tables and graphs are shown in the Technical Appendices 1 and 2.

Findings: Summary

The control group pre-intervention scores had been consistently higher than the specialist intervention or paired reading groups across all items, although not all differences are significant, but the control group consistently made less progress than the other two groups. The intervention and paired reading groups made significant gains across phase 1 (time) in all the items, with the exception of the free writing rate and legibility where none of the three groups shows significant improvement. The control group made progress in all areas of literacy. However, their failure to make significant progress in word count or National Curriculum writing levels over this 15 week period is of some concern as is the slow and non-significant development of the single word reading skills.

Table 14 shows significance of changes in item scores, pre and post intervention, across the three conditions. Bold italics indicate non-significant changes

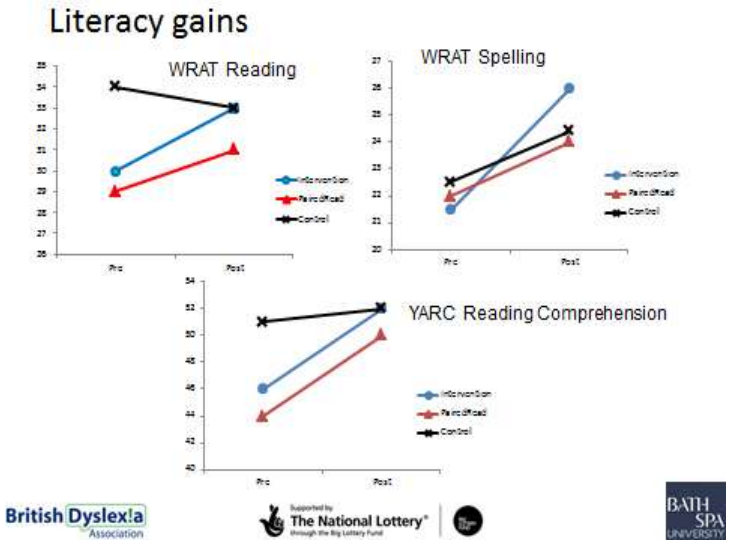
Table 14

	WRAT SWR	WRAT SWSp	WRAT Sent C	YARC R Acc	YARC RR	YARC Rcomp	BPVS	Phon Dec	FW No	FW Rate	FW % Illeg	FW NC
Int	.001	<.001	<.001	<.001	.001	<.001	<.001	<.001	.009	***.080***	***.102***	<.001
PR	<.001	.002	<.001	<.001	.014	<.001	<.001	<.001	.042	***.060***	***.101***	<.001
Contl	***.674***	.010	.002	.004	.004	.034	.003	.007	***.110***	***.091***	***.231***	***.58***

Key: WRAT SWR = single word reading (oral); SWS = single word spelling; Sent C = sentence comprehension (silent); Yarc R Acc = reading accuracy (oral); RR = reading rate oral; R comp = reading comprehension (oral); Phon dec = phonological decoding; FW no = free writing, number of words; FW rate = number of words per minute; FW % illeg = percentage or words unreadable; FW NC = National Curriculum Level of Free Writing

Both groups made significantly more progress than the controls in single word reading, YARC oral comprehension, phonological decoding and BPVS receptive language. The intervention group outperformed both groups in WRAT spelling, YARC reading rate, phonological decoding and total words written. However, the paired reading group equalled the intervention group on WRAT single word reading, and outperformed them in writing speed and the proportion of words illegible in the free writing task.

Figure 1 illustrates the significant differences between the groups in WRAT single word reading, WRAT spelling and YARC reading comprehension. The Intervention group is shown in blue, paired reading in red and control in black;



There is evidence here that different interventions have separate impacts upon individual skills. The intervention has had a specific impact on spelling and phonological decoding compared with the paired reading. However, the paired reading also produced significant gains in all aspects of literacy skills, including phonological decoding and vocabulary with a perhaps unexpected tradeoff for writing skills (WRAT Spelling and National Curriculum levels) which were not targeted.

Figure 2 illustrates the significant differences between the groups in non-word reading and receptive vocabulary (BPVS). The Intervention group is shown in blue, paired reading in red and control in black;

Figure 2

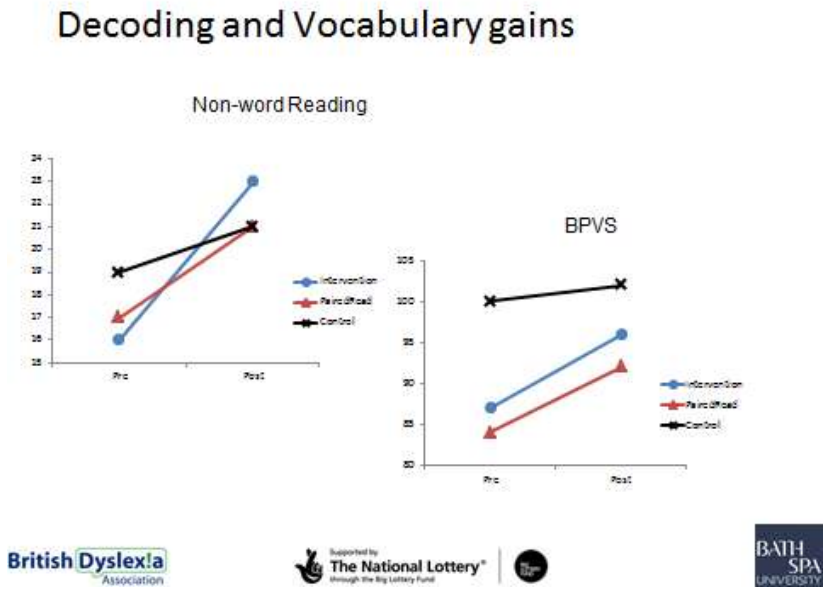


Table 40 in the technical appendices shows the items where the intervention and paired reading groups significantly outperformed the controls as indicated by the ANOVA analyses.

To explore further and compare the impact of the different conditions on each group, effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort as an estimate of population variability.

For example, for the WRAT single word reading (N=190, SD=10.09):
Effect size (improvements) for the intervention group: 2.60 / 10.09 = 0.26
Effect size (improvements) for the paired reading group: 3.20 / 10.09 = 0.32
Effect size (improvements) for the control group: -0.70 / 10.09 = -0.07

Overall, the effect sizes for the intervention group and paired reading group were moderate and about the same, but positive in contrast to the negative improvements shown by the controls. An effect size of .40 is expected for a normally developing learner across one year of schooling (Hattie, 2009). Phase One represents 15 weeks of intervention. These effect sizes across the full range of items are summarised in table 15:

Table 15:

Item	Int	PR	Control	Impact
WRAT single word	.26	.32	-0.07	Int/PR; effect size (ES) moderate; control negative
WRAT spelling	.84	.45	.38	Int: ES is twice that of the control
WRAT Sentence comprehension	.61	.72	.39	Int and PR groups: ES is twice that of the control
YARC reading accuracy	.62	.55	.53	ES good and roughly equal
Reading rate	.28	.51	.24	Int and cont: ES good: PR twice the other groups
Reading comprehension	.58	.62	.19	Int and PR: ES good and three times control
BPVS	.46	.49	.19	Int and PR: ES good and twice control
Non-word decoding	.77	.45	.23	Int : ES very good; PR good and twice control
Free writing total words	.33	.33	.26	ES moderate
Free writing words per minute	.20	.28	.17	ES moderate to small
Free writing legibility	.09	.40	.23	PR: ES good, twice, control and three times intervention
Free writing NC level	.44	.45	.46	ES good for all 3 groups

However, since the control group means were significantly higher than the intervention or paired reading groups across all items except WRAT single word spelling, non-word test and National Curriculum writing level , effect sizes were also calculated using the mean difference for each separate group and are presented in table 16:

Table 16: Effect sizes when separate group mean differences are utilised

Item	Int	PR	Cont
WRAT single word	.43	.46	.00
WRAT spelling	.93	.47	.37
WRAT Sentence comprehension	.69	.74	.45
YARC reading accuracy	.65	.52	.56
Reading rate	.31	.46	.31
Reading comprehension	.77	.74	.77
BPVS	.43	.74	.62
Non-word decoding	.80	.44	.21
Free writing total words	.32	.38	.27
Free writing words per minute	.26	.36	.25
Free writing legibility	.17	.18	.22
Free writing NC level	.45	.39	.33

Summary and conclusions:

Both intervention groups outperformed the controls across all areas. In areas such as spelling , phonological decoding and reading accuracy, the children who had worked with NESSY and Rapid Reading performed better than the paired reading children. NESSY does target spelling and explicit phoneme, grapheme and morpheme activities so this might be expected. However, as might be predicted by the activities covered in the paired reading, the paired reading group made higher gains in skills associated with reading fluency, silent reading sentence comprehension and oral receptive language alongside comparative gains in single word reading. More surprising was their outperforming of the intervention group in writing speed and volume and their comparative gains in NC levels as the paired reading activities involved no writing tasks.

The value of the paired reading with the added emphasis on oral vocabulary, comprehension strategies and positive feedback, has produced significant gains in all aspects of literacy skills with a perhaps unexpected trade-off for writing skills. The intervention has had a specific impact on spelling and phonological decoding compared with the paired reading. The control group has continued to make some progress in all areas of literacy. However, the failure to make significant progress in word count or NC levels over this 15 week period is of some concern as is the slow development of the single word reading skills.

The original intention to allocate schools to project condition randomly had to be abandoned. The resulting uneven performance at the start of the project may complicate analysis of differences emerging between the groups during phase one.

Phase Two Aims and Analyses

Phase Two Aims

- To establish the sustainability over time of gains achieved by the intervention group without further individual support;
- To compare the progress of children who had received only 15 weeks of individual support with those who had received 30 weeks;
- To examine the impact on the waiting control group of the delayed intervention;
- To compare the progress made in 30 weeks across the three conditions.

Analyses comparing groups on improvements in literacy/language measures in phase 2

Analyses were undertaken to compare the children's scores at the three testing times in the project (tIme 1: pre intervention: time 2: post-intervention; time 3: follow-up point). These are presented for each of the groups. Group A (intervention group) undertook the intervention in phase one and was then left without individual attention; group B (paired reading) undertook paired reading in phase one and the intervention in phase 2, hence receiving individual support for 30 weeks and group C (control) formed the waiting control group for phase one and then undertook the intervention in phase 2. Tables are presented in the Technical Appendix for Phase 2 (Technical appendix 2) . Analyses are not reported for the writing measures as schools only submitted data for 124 of the 210 participants and the timing in the summer term affected the reliability of the scores.

Intervention group

Comparisons of scores at time 2 (post-intervention point) and time 3 (follow-up point) were undertaken to assess maintenance of progress following withdrawal of the intervention.

Paired t-test analyses were performed to assess differences between time 2 and time 3 for each measure. Tables are presented in the technical appendices.
These analyses indicated continued significant gains with WRAT single-word reading and sentence comprehension, YARC reading accuracy, rate and comprehension, and non-word reading. However, there was a non-significant gain in vocabulary and no gains (poorer performance) in both WRAT spelling and free-writing words per minute. See Tables 1 and 2 in the Phase 2 technical appendices. (These results can also be seen in the graphs of individual measures in Figures one and two.)

Paired reading group

The paired reading group had entered the project with the lowest pre-intervention scores of the sample. Comparisons of scores with time 2 (post-intervention point) allowed an assessment of improvements following the paired reading programme. Comparisons between time 2 and time 3 (follow-up point), as with the control group, allow an assessment of improvements following implementation of the intervention.
Paired t-test analyses were performed to assess differences between time 2 and time 3 for each measure. Tables are provided in the technical appendices.
These analyses indicated significant gains from the intervention in WRAT single-word reading and spelling, YARC reading accuracy, vocabulary, non-word reading and free-writing words per minute. However, there were non-significant gains in WRAT sentence comprehension and YARC reading rate and comprehension. See

Tables 5 and 6 in the Phase 2 technical appendices. (These results can also be seen in the graphs of individual measures in Figures one and two in the technical appendices.)

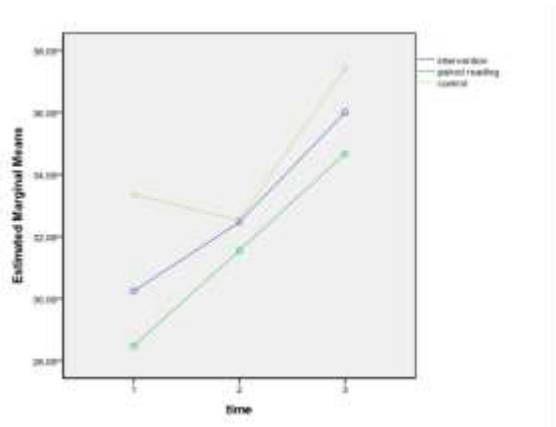
Control group

Comparisons of scores at time 2 (post-intervention point) and time 3 (follow-up point) allow assessment of improvements following implementation of the intervention. Paired t-test analyses were performed to assess differences between time 2 and time 3 for each measure. Tables are provided in the Technical appendices.
These analyses indicated significant gains with WRAT single-word reading and spelling, YARC reading rate and comprehension, vocabulary and non-word reading. However, the gains in WRAT comprehension were marginal in terms of significance, and there were non-significant gains in YARC reading accuracy and free-writing words per minute. See Tables 3 and 4 in the Phase 2 technical appendices. (These results can also be seen in the graphs of individual measures in Figures one and two in the technical appendices.)

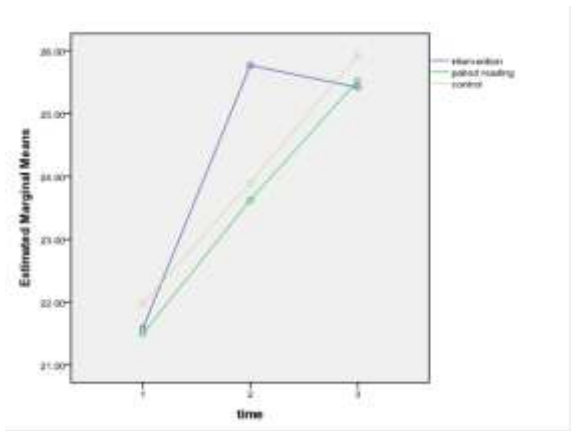
Figures one and two show the results of three groups across the three time points are presented in the series of graphs illustrating the changes for each item. The intervention group line from time 2 to time 3 indicates the level of maintenance of improvement following intervention withdrawal. The lines from time 2 to time 3 for the paired reading and control groups indicate improvements with the intervention.

Figure One:
Changes across the three testing points: Blue/ intervention A; green/ paired reading B; Brown/ control C

WRAT Individual word reading

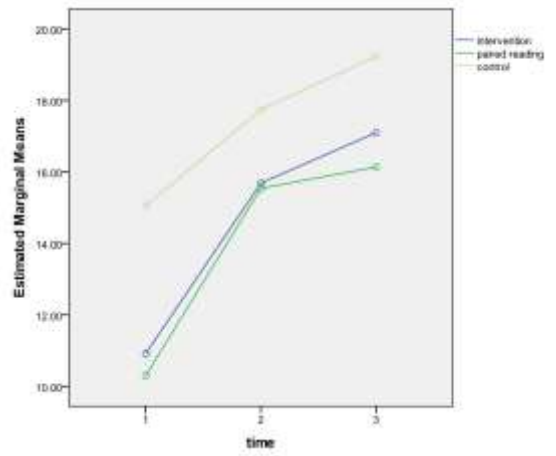


WRAT individual word spelling

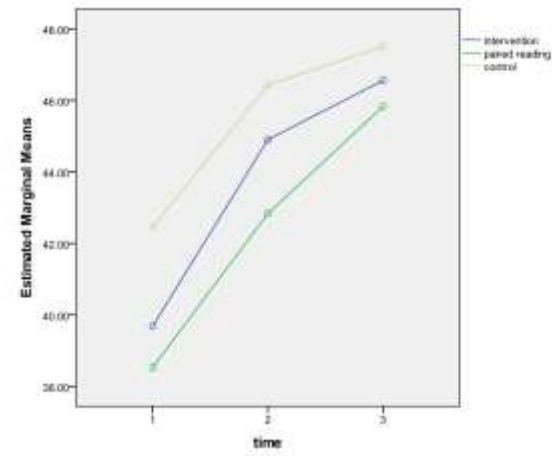


RA

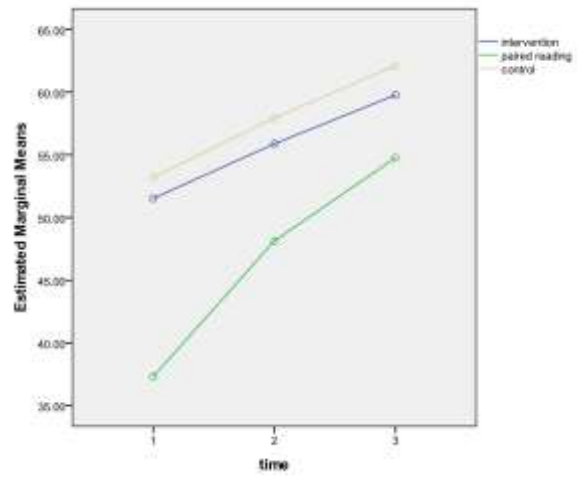
WRAT Sentence comprehension



YARC Reading accuracy



YARC Reading rate



YARC reading comprehension

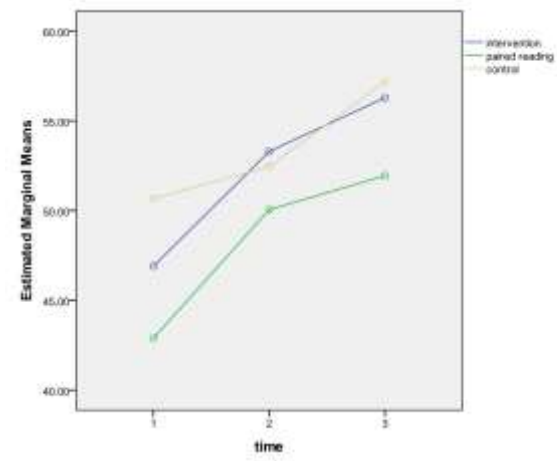


Figure two: Changes across time: BPVS and Non-word reading

Effect sizes were calculated using the standard deviations from the whole cohort in the calculations, as in Table 15 of the phase one findings. Table 1 shows effect sizes for the three groups over the two phases of interventions.

Item Phase 1 Effect size Phase 2 Effect size	Group A Intervention – control	Group B Paired reading – control	Group C Control – intervention
WRAT Word reading 1	0.26	0.32	-0.07
2	0.34	0.31	0.49
WRAT Word Spelling 1	0.84	0.45	0.38
2	-0.06	0.37	0.37
WRAT Comprehens. 1	0.61	0.72	0.39
2	0.20	0.11	0.22
Yarc Read Accuracy 1	0.62	0.55	0.53
2	0.20	0.38	0.18
Yarc Reading Rate 1	0.28	0.51	0.24
2	0.21	0.27	0.22
Yarc Reading Comp 1	0.58	0.62	0.19
2	0.23	0.17	0.44
BPVS 1	0.46	0.49	0.19
2	0.11	0.30	0.37
Non-word Reading 1	0.77	0.45	0.23
2	0.21	0.38	0.52

Table 1: Effect sizes for the literacy items across the two phases of the project

Summary and conclusions

Intervention group A:

Without individual support, the children's gains continue for all the reading measures and, to a lesser extent for the vocabulary, averaging a further effect size of 0.21 for all these measures. However, the spelling gains are less robust. The marked effect size gain for WRAT spelling of .86 fell back to -0.06 although this still reflects a strong gain since the start of the project. This reduction would reflect practitioner research in SpLD/dyslexia which suggests that spelling skills need more consistent targeted practice than reading skills to achieve mastery (e.g. Ott, 2007) and would argue for sustained small group reinforcement support targeted on this area beyond any initial 15 week programme. Likewise, although improvement in receptive vocabulary is sustained, the lower effect size would argue for a continuing focus upon vocabulary development for these learners.

Paired reading to intervention group B:

The gains made through the phase one paired reading process were sustained during the intervention although effect sizes for the reading comprehension, both silent and oral reduced to 0.11 and 0.17 respectively. Alongside increased reading fluency, important for comprehension, phase one had also seen gains in spelling and writing measures, which were unexpected as the paired reading did not involve these activities. The follow up data on writing was considered unreliable but the spelling gains were sustained through phase 2. This group, who started with the lowest pre-intervention scores, do not make significantly stronger gains than the 15 week intervention group. However, it is not possible to predict their performance had they been left without support during phase 2.

Control group to intervention group C:

This group started the intervention significantly stronger than the other two groups in receptive language, single word reading, WRAT silent sentence comprehension, YARC reading accuracy and rate of reading. Phase one had shown their single word reading skills falling to develop. Once they complete the intervention, they show significant gains, with marked improvements in effect size, in WRAT single-word reading (-0.07 to 0.49), YARC oral reading comprehension (0.19 to 0.44), non-word reading (0.23 to 0.52) and receptive vocabulary BPVS (0.19 to 0.37). The significant gains in improvements shown in the WRAT spelling, WRAT silent sentence comprehension, YARC reading accuracy and YARC reading rate either equal or remain lower in effect size than during phase one.

A proportion of these control children started the project with reading ages equal to the level of the books in the Rapid Reading programme so may have been less challenged by the material, which would argue for careful individualised choice of reading material to promote further development in silent reading comprehension, oral accuracy and rate. However the significant gains in single word reading, non-word reading and BPVS scores once the control group pick up the intervention is striking as these were the areas where the pre-intervention scores did not differ significantly across the three groups and it suggests the impact of one to two support over a short term upon these areas of weakness which have been suggested as particularly relevant to children with EAL who might be at risk of dyslexia (See chapter 3). Despite the control group starting out at a higher level of skill than the other two, there is still real room for improvement once the intervention is started and their performance argues for the need to target these children with short focused two to one intervention rather than leaving them to cope unsupported in the mainstream classroom.

Summary

An overall perspective would be that this fifteen week, half hour daily intervention, focused upon skills traditionally associated with deficits in literacy acquisition for children at risk of dyslexia and children with EAL, shows evidence of working with these children. It has particular impact at the level of word reading/decoding/fluency and vocabulary skills, which are likely to support text comprehension. The structured *two children to one adult* design also impacts upon vocabulary and phonological skills and the unexpected effect of the paired reading upon writing related skills is striking and would support more widespread application of this easily implemented strategy. Neither intervention seems to be as successfully sustained for writing and spelling, which, although increasing initially, seems to suffer when the intervention is removed. This does, however, reflect research in dyslexia and writing skills indicating the difficulty of developing accurate spelling and written skills compared with reading skills.

Chapter 2 . Verification of screening instruments

Methods

The project also aimed to explore the effectiveness of a simple, quick, accessible tool which could be used by classroom teachers, with support from SENCos, to identify bilingual children who might be at risk of dyslexia. It was therefore important to establish whether the children identified through this process would also be identified as at risk of SpLD/dyslexia through a full specialist assessment procedure.

Staff training

As described earlier, The SENCos attended training in assessment and in the materials provided for use in the screening process. SENCos recorded scores and provided details about each child on provided proformas.

Identifying Children at risk of dyslexia

For the purpose of the project, LUCID Research undertook an analysis of LUCID Ability 7-11 and LASS 8-11 data from 359 children (mean age 9,yr 5 m, SD 10 m.) out of the original 462. Table 1 presents the outcomes. (Thomas, 2010)
Table 1:

Measure	Mean score	Standard deviation
Verbal intelligence	89.32	8.27
Non-verbal intelligence	89.62	9.78
General intelligence	89.23	7.31
Visual memory	97.03	14.11
Verbal memory	89.98	13.44
Phonological processing	86.07	14.59
Phonic skills	95.33	10.01
Word reading	83.15	14.51
Reading comprehension	80.77	10.56
Spelling	82.80	11.72

The score distributions were close to normal for verbal, non-verbal and general ability, visual and memory and phonic skills, while the distributions for literacy attainment and phonological processing clustered towards the lower tails of the distributions. This placed the sample on the lower borderline of normal average range (standard score 90) in all the measures with the exception of visual memory

and phonic skills where the mean was close to the population average. This could link with hypothesis that the learning difference is more specific than global and that bilingual children cannot be assumed to present with lower phonological processing skills than their peers.

In order to determine which of the children were most likely to have dyslexia, the data were analysed using the Lucid Dyslexia Index (LDI) a modified version of Turner's Dyslexia Index- a calculation which utilises the average of differences between ability scores (verbal and non -verbal reasoning) and diagnostic scores (memory and phonological processing) , together with the average of differences between actual attainment scores and the attainment scores expected on the basis of the individual's general ability.

It is common professional practice to consider the verbal and nonverbal IQ measures separately, particularly in children with EAL, where limitations in spoken English can depress verbal IQ scores. The scores were therefore modified in 61 cases to avoid false negatives arising from averaging out the verbal and non-verbal IQ scores in cases where verbal IQ was more than 10 SS points lower than nonverbal IQ. In 47 of these cases the modification resulted in a significantly increased LDI score, while in the remainder of these cases the LDI score was not significantly altered.

21 cases would have been classified by the Turner Index as having 'mild dyslexia' but without significant discrepancies between IQ and key diagnostic cognitive measures such as phonological processing and/or verbal memory. Arguably, this under-attainment may not be due to dyslexia. These 21 cases in category 3 that do not meet these criteria have therefore been put into a subcategory (3a), described as 'Literacy under-attainment without diagnostic signs', in order to distinguish them from those with mild dyslexia (subcategory 3b).

Allocation of each learner's category was based purely upon the LDIs analysis of LASS 8-11 and Lucid Ability 7-11 data. Table 2 indicates the distribution of the children across the 7 categories of severity of dyslexia.

Table 2. LDI categories: frequencies in the sample.

Category	LDI	Category label	Frequency	Percent
1	< 0	No dyslexia signs	96	26.7
2	0.0 – 0.4	Few dyslexia signs	109	30.4
3a	0.5 – 0.9	Literacy under-attainment without diagnostic signs	21	5.9
3b	0.5 – 0.9	Mild dyslexia	71	19.8
4	1.0 – 1.4	Moderate dyslexia	49	13.6
5	1.5 – 1.9	Severe dyslexia	10	2.8
6	2.0 +	Very severe dyslexia	3	0.8

The following caveats apply: LASS 8-11 and Lucid Ability 7-11 were originally designed to compile a profile of a child's strengths and limitations to inform programme design and support and were not originally researched as screening tools. The probable incidence of false positives and false negatives is unknown and, despite attempts in this case to reduce incidence, some will inevitably arise particularly in the absence of contextual factor and the possibility that some children this study did not fully understand the requirements of the tests. Unfortunately these findings were not available to inform the second stage in of selecting the 240 learners for the project but were used to explore the reliability of the screening process.

Selection of children for full assessment

The broad location of project children throughout the UK made random selection of children uneconomic. Six experienced AMBDA qualified assessors were recruited to cover the main areas of the project (London, Swindon, Manchester, Salford, Bristol and Bath) to include a range of inner city and rural schools across the full range of SES and a broad range of L1. The LUCID algorithm was used to select 44 children from these areas for full assessment for dyslexia using the following criteria. All those scoring 5 to 6 on the LUCID dyslexia risk index (10) were included, alongside a range of learners who scored 4 (21), 3 (4), 2 (3) and 1 (2) on the index. Four children were included who had no Lucid index score.

Full Assessment: materials, protocols and procedures

The literature reviewed suggested the following skills should be covered by the full assessment protocol:

Verbal and Non-verbal Reasoning ability
Receptive language
Word & non- word reading (phonic decoding)
Listening and reading comprehension and miscue analysis:
Phonological awareness and processing:
Auditory tasks: digit span, forwards, backwards,
Memory: short term, working memory, and sound discrimination
Visual tasks: copying, visual recall of shapes, visual sequential memory
Rapid Naming:
Writing skills: Timed/untimed free writing
Spelling skills

The full assessment protocol therefore included the following test items:

Test	Specific Skill	General Skill Area
WRIT	Matrices	Nonverbal (visual)
	Diamonds	
TAPS 3	Segmenting	Phonological processing
	Blending	
	Numbers forward	Short term working memory
	Numbers reversed	
WRAT 4 (green)	Single word	Reading
	Single word	Spelling
	Silent reading	Comprehension
TAPS 3 CTOPP	Word memory	Auditory memory
	Non -word repetition	
BPVS	Receptive language	Language
Turner	Non-word decoding	Phonological processing
TAPS	Auditory comp	
CTOPP	Rapid letters Rapid colour Rapid object	Rapid naming (time in seconds)

These were undertaken alongside full exploration of the child's family, educational and social context. As discussed in chapter 4, since assessment materials were not available across the full range of L1 spoken by participants, assessment was conducted in English. All assessors had some prior experience of assessing bi-lingual learners. They attended an afternoon of training in issues relevant to bi-lingual learners delivered by the project team and were provided with a proforma for their reports detailing the age-appropriate instruments to be used. Training covered standard questions to elicit background information, reduced use of 'jargon', focus upon boosting the learner's confidence and sense of achievement and suggestions for practical/economical recommendations.

Ethical procedures described earlier were followed, sensitive cultural issues around the nature of identification of learning differences were considered and parents offered the opportunity to discuss the outcomes, although none took this up. Assessments were carried out at suitable venues and acceptable times for the children and their schools, following assessment practice protocol established by the BDA.

To avoid overloading the children, the timing of the full assessments allowed the assessor to conduct the BPVS and WRAT post-intervention testing for Phase 1 of the intervention project, usually undertaken by the SENCo, and to scrutinise the free writing samples provided for the intervention project. All assessment reports

were checked by the project team for accuracy and accessibility and translations were offered for parents.
The full assessment protocol was piloted on two further students and informed the final protocols and training for assessors.

What were the predictions?

The prediction was that those children identified by the dyslexia checklist, working memory questionnaire and LUCID Cops algorithm as being at risk of mild to severe dyslexia would present with risk of dyslexia subsequent to the full assessment.

Findings: Verification of Screening instruments

i. Screening the whole group

Outcomes of analysis of the sample of 359 out of 462 children, identified by SENCos as 'failing to thrive' with literacy skills have been described earlier.
As indicated, The Lucid Dyslexia Index (LDI) had revealed the following distribution of learners across the 6 categories of risk.

Table 3. LDI categories: frequencies in the sample.

Category	LDI	Category label	Frequency	Percent
1	< 0	No dyslexia signs	96	26.7
2	0.0 – 0.4	Few dyslexia signs	109	30.4
3a	0.5 – 0.9	Literacy under-attainment without diagnostic signs	21	5.9
3b	0.5 – 0.9	Mild dyslexia	71	19.8
4	1.0 – 1.4	Moderate dyslexia	49	13.6
5	1.5 – 1.9	Severe dyslexia	10	2.8
6	2.0 +	Very severe dyslexia	3	0.8

37% of this sample were categorised as showing signs of mild dyslexia through to very severe dyslexia with the caveat that the probable incidence of false positives and false negatives is unknown and, despite attempts to reduce incidence, some would inevitably arise.

These findings had not informed the second stage of selecting the 240 learners for the project but were used to explore the reliability of the screening process. Of the 211 learners who completed the project, 174 had full Lucid scores.

The full sample of participants was scrutinised for LDI SpLD risk Category, Alloway Working Memory scores and Risk of SpLD/Dyslexia as indicated by the Dyslexia

checklist (Ball, 2010). The accuracy of this data was checked and descriptive statistics generated for LDI SpLD risk, Alloway Working Memory Risk and SpLD/Dyslexia Checklist risk.

Table 4 shows the distribution of LDI SpLD risk across the full sample of participating children. Category 3 to 6 indicates those children at mild to very severe risk of SpLD/dyslexia. 51% were indicated as being at risk of dyslexia.

Table 4: LDI SpLD risk

LASS spld risk

LDI Category	Frequency	Percent of sample
1	25	11.8
2	41	19.4
3	59	28.0
4	37	17.5
5	9	4.3
6	3	1.4
missing	36	17.1
Total	211	100.0

54% of the children in the sample had shown some or high indicators of working memory risk from the Alloway questionnaire (See Table 5: Technical Tables for Assessment Study) but when the Lucid codes are compared with working memory scores across the whole sample, there was little obvious relationship between LDI Risk codes and working memory score from the Alloway Working Memory Questionnaire. Those children showing working memory deficits were not necessarily those at risk of SpLD/dyslexia.

Tables are included in technical appendix 3: Technical Tables for Assessment Study. Data from the Wesford Risk of Dyslexia checklist indicated that 60% of the full sample scored clear indicators of SpLD/dyslexia, 28% showed unclear indicators of SpLD/dyslexia and 12% showed no indicators (See Table 6). There seems, however, to be little relationship between the LDI Risk codes and the SpLD/Dyslexia checklist. The small number of 'no sign' values (22 /210) makes conclusions difficult but if there were more **no** values and the current trend was followed, there might be more evidence of a relationship between the Checklist Dyslexia risk/no risk and LDI risk codes.

ii. The Full assessment children

Scrutiny of the full assessment reports for the 44 children assessed, enabled children to be categorised as 'at risk'; 'possible risk' or 'no risk' of dyslexia on a PASW file. Table 5 shows the distribution. 52% were at possible risk of dyslexia while 48% were not.

Table 5 **Full Assessment outcome: Distribution of dyslexia risk**

Category		Frequency	Percent	Cumulative Percent
	Risk of dyslexia	10	4.7	22.7
	Possible risk of dyslexia	13	6.2	29.5
	No risk of dyslexia	21	10.0	47.7
	Total	44	20.9	100.0

Fewer girls were likely to emerge as at risk of dyslexia (9 to 12) than boys (14 to 9) but this was not significant. Table 8 in technical appendix 3 shows the distribution. The full assessment outcomes seemed to be reasonably distributed across years 4 and 5 (See Table 9 in the technical appendix). The smaller number in year 6 makes conclusions here difficult. The same is true for years in English school; i.e., missing data and small sample make conclusions difficult, but there may be slight bias for 'no risk' amongst those with fewer years in English school (see Table 10).

Relationships between the full assessment codes and previous support for SpLD/ dyslexia, EAL or SEN values seem to argue for (i) SpLD/Dyslexia support to be related to 'at risk', though small numbers again are a problem, (ii) no obvious association with EAL support, and (iii) some association between being on the SEN support and risk (Technical Appendix 3 Tables 11- 13).

When the at risk scores on the Lucid Dyslexia Index LDI (See Technical Appendix 3 Table 14) were compared with the Full Assessment outcomes, there was no clear relationship.
Table 6 shows the mean and standard deviation of the LUCID scores for each LDI level from the sample while Table 7 shows the average scores on the LDI levels for the children in the risk, possible risk and non risk of dyslexia groups from the full assessments. These are not as would be expected if the LDI risk correlated with the Full Assessment outcomes.

Table 6: Lucid scores for each LDI risk level

LDI codes	Mean	Std. Deviation	Minimum
1	.0525	.14575	.00
2	.2756	.13329	.02
3	.7127	.14682	.50
4	1.1727	.16350	.68
5	1.6440	.14485	1.51
6	2.1033	.10116	2.04

Table 7 Full Assessment outcome by Dyslexia score – LUCID

Assessment outcome	Mean	Std. Deviation	Minimum
Risk of dyslexia	1.2586	.53589	.27
Possible risk of dyslexia	1.0864	.48939	.00
No risk of dyslexia	1.1155	.56754	.00
Total	1.1300	.52685	.00

The absence of a clear relationship between the 'full assessment' and LASS/LUCID LDI values means that we may want to question one or the other or to suggest that both may have problems when dealing with bilingual children.

The numbers in the *at risk* and *possible risk* of dyslexia Full Assessment categories are small and vary across the literacy/language measures and LASS scores. Hence the two groups of *at risk* and *possible risk* were combined to create a Full Assessment '*risk*' group of 23 children to compare with the 21 Non-risk children. Independent samples t-tests were used to compare the two groups across the LASS and pre-intervention literacy measures.It should be pointed out that raw scores have been used in all analyses since these instruments are not standardised on this population. This, necessitates caution in the interpretation of the comparisons, as the children came from years 4, 5 and 6. (See Table 9 in the Technical Appendices. A chi-square anlaysis did indicate no significant difference in the distribution of year group across the risk and no risk groups. However, the small numbers from each year group (particularly year 6) reduces the reliability of the analysis.

Technical Appendix 3 Table 15 compares the scores of the *at risk* and *no risk* groups across the LASS measures.Two children did not have LASS scores. Across the LASS items, the children *at risk* of dyslexia mainly perform marginally better on the cognitive processing items (cave, mobile and segments) although worse on the non-word reading and verbal reasoning. The *non-risk* children perform

better on the literacy tasks: sight word reading, reading comprehension and spelling alongside the verbal reasoning. However, none of the differences reach significance.

The scores of the *at risk* and *no risk* full assessment children on the pre-intervention literacy tests were then compared across the project groups. Some literacy scores were incomplete. The reliability of these pre-intervention literacy tests undertaken by the SENCOs is discussed later. At the time of the full assessment, only 8 of the 23 *at risk* children had completed the phase one intervention. This might have lifted their scores but the small number makes further analyses unprofitable.

Table 8 shows the distribution of the children across the project phase one groups.

		DvND		
		risk of dyslexia	no risk of dyslexia	Total
project condition phase 1	intervention	8	15	23
	paired reading	5	1	6
	control	10	5	15
Total		23	21	44

Technical Appendix 3 Table 16 compares scores for those *at risk* and *not at risk* of dyslexia across the Pre-intervention literacy measures. With the exception of the BPVS, the *at risk* group's literacy scores were lower than the *no-risk* children.

Independent sample t-tests indicated the differences were significant for non-word reading [t(-2.26), p= .03], total words written in free writing task [t(-3.341), p=.002]. YARC reading rate almost reached significance (t(-1.91,p= .066].

BPVS scores are comparatively low for this whole sample with M = 89.92 (which might be expected with a low English experience group). However, the scores for the 'no risk' group (M = 82: SD = 19.42) are particularly low.

Children had been identified as at risk of dyslexia through an assessment protocol, which included further literacy tests and tests of cognitive processing. These were undertaken at least 15 weeks after the pre-intervention tests (the time varied for individual children, as did the child's project intervention condition).

Technical Appendix 3 Table 17 presents mean and SD for the Full Assessment item scores across the two groups. With the exception of auditory comprehension and WRIT matrices, the *no risk* children scored consistently higher than the children

designated as *at risk*. Independent samples t tests were conducted to compare the scores between the groups.

The professionals conducting the full assessments had undertaken the testing for the WRAT4, BPVS and non-word scores to reduce the pressure on the children. Scores for the BPVS were compared indicating that the higher scores for the at risk children on receptive language (BPVS) almost reached significance (p=0.59).

WRAT single word reading, WRAT single word spelling, phonological processing segmenting and blending and non-word decoding were significant. Details are provided in the technical appendices.

It may be that this combination of higher scores in receptive language and in some cognitive processing items combined with the lower literacy and phonological processing and decoding skills were main factors in the allocation of risk following the full assessment procedures.

Technical Appendix 3 table 18 shows mean and standard deviation scores for the WRIT diamonds and matrices. The at risk group performed marginally better than the non-risk group in the matrices items and worse in the diamonds but neither difference reached significance.

Summary of findings

These results suggest that the sample of children cannot be classified as a group of children purely with dyslexia: the LDI risk averages supported by the full assessment results both seem to argue for this conclusion. This may indicate that either the screening/sampling method is inappropriate to select a group of bilingual children with pure dyslexia or that the full assessment is biased in some way.

Combined data from the LASS measures, the pre-intervention literacy measures and the full assessment items suggest that those in the 'risk' category of the full assessment differ mainly from the *no risk* children in presenting with lower scores in the basic literacy measures, phonological processing and non-word decoding alongside higher scores in receptive language, auditory comprehension and some cognitive processing (cave, mobile and segments in the LASS screening; WRIT matrices, although not diamonds, in the full assessment).

This seeming discrepancy may have been a main factor in the allocation of *at risk* status which would argue for consistency of identification criteria across the assessors. (It should be noted that only 8/23 of the *at risk* children had completed the intervention programme whereas 15/21 of those *not at risk* had done so. This might have raised the literacy levels of the *non-risk* children and reduced earlier

differences between their literacy scores and cognitive processing.) However, although, clearly, poor basic literacy levels (such as poor non-word reading) seem to be another key factor contributing to an *at risk* identification, it seems that children with poorer English vocabulary may be less likely to be classified as being at risk for dyslexia, raising the issue of false negative identifications.

Chapter 3. Human Experience

To compile a rich picture of the experiences of those involved in the project, questionnaires were completed by head teachers or SENCOs prior to their involvement in the project to set the context and inform the planning of the project. A questionnaire, leading to focus groups involving a proportion of the respondents, was completed by all TAs and SENCos at the pre-intervention training. Post project questionnaires were distributed to all SENCos, TAs and the children's Class teachers at the end of the project. Six schools were selected as case study schools and interviews and focus groups undertaken with a sample of children and parents as well as interviews with TAs.

All these data sources have been combined to provide a rich picture of the project. The numerical data from all TA, Class teachers and SENCo questionnaires were entered into Excel and PASW files. The comments were transcribed into word documents and analysed for emergent themes. The full assessment reports were scrutinised for themes. Focus group data was transcribed and themes relevant to assessment and identification issues extracted.

The School Experience

SENCos and TAs

Anticipating the project

To establish their contexts and needs, questionnaires had been sent to all schools invited to participate and returned by 23 out of the 55 schools who undertook the training and submitted children to participate in the project. They provided information about the number of bilingual children in the whole school, ranging from 26 to 472, comprising 2,060 children across years 3 to 6. The number of languages spoken within the school ranged from 4 to 23. Schools also reported the children's levels of acquisition of English across these years using Hester's Stages of Learning (1990).

The percentage of year 3-6 children on SEN stages, as defined by the Code of Practice, ranged from none to 60% . Seven schools reported under 10%; 12 reported 11-30% and three reported between 40 and 60%, providing some support for the suggestion that identification of Additional Support Needs (ASN) is inconsistent with risk of false positives/negatives. The incidence of reporting of risk of dyslexia across the 2,060 children was 147. These children were, however, concentrated across 6 schools who reported an average of 22% of their children as being at risk. 14

schools indicated they had fewer than one child at risk. Bearing in mind that 4-10% of children might be expected to be at risk of SPld/dyslexia, this also indicates potential for false positives and negatives .

The head teacher or SENCo was also asked to indicate levels of expertise amongst their TAs and staff and to nominate areas of need for SpLD and bilingual training and this information was used to help shape the design of the training and intervention. It was intended to revisit the schools with a follow up questionnaire but this was eventually not possible.

Pre intervention Focus Groups with TAs

At the first pre intervention training sessions for TAs in the South West region, Swindon and Liverpool, focus groups were held. These were based upon extending the conversation around a questionnaire that all those who had attended completed, these explored the TAs' existing knowledge and practice supporting learners with SpLD/dyslexia and EAL. The questionnaire had revealed that levels of confidence and experience amongst the TAs had varied considerably across the groups with some TAs being both innovative and confident in working with their bilingual children while other reported low levels of experience. It was noteworthy that they welcomed the opportunity offered by these training days to share their expertise and questions with TAs from other schools.

A total of 28 TAs then took part in three focus groups comprising a mixture of male and female (although the majority were women); of monolinguals and bilinguals and included some qualified teachers who were working as TAs. The following themes emerged:

Theme 1: What do you know about dyslexia /multilingualism and how did you learn it?

A few TAs indicated that they had no knowledge or experience but the substantial majority had some prior knowledge of dyslexia from a range of different sources:

- Personal experience – dyslexic, own children or family members identified as having dyslexia;
- Courses attended: general training for support work, specific programmes such as, Toe by Toe, Wexford, precision teaching, reading recovery;
- From working in Dyslexia friendly schools.

TAs discussed their knowledge and experience of multilingualism. Only 3 of the 28 TAs selected by schools were bi/multilingual, speaking European languages rather than full range of languages spoken in the schools. It would seem that schools might

have been prioritizing skills relating to dyslexia rather than those with experience of learning to become effective in an additional language. One TA offered insights into the experiences of arriving in an English school and becoming a proficient user of English.

The TAs indicated knowledge and experience in the following areas:

- Personal experience of having a language other than English as a first language;
- What they had 'picked up' through working in multilingual schools;
- Through using reading recovery as a support for literacy with 'new arrivals' stating the value of the language and visual based approach and sentence based work that is integral to reading recovery.

In one of the areas there were marked contrasts between schools in their policies about the use of home languages in schools. In some schools children were encouraged to use home languages to support their learning and bilingual resources were in common use. In other schools the policy was to speak English in class and only use home languages in the playground. However in this area all schools talked about the use of interpreters. All the TAs discussed the range of languages spoken in their schools.

Theme 2: What are the signs that make you stop and think that there's more of an issue here for this child's language and literacy development than learning English as an additional language?

The TAs suggested a range of indicators that helped in the recognition of children 'at risk':

- When children made better progress in curriculum areas such as numeracy and science in comparison to literacy;
- Gaps in progress in learning English and / or literacy between children who arrived in UK at same time (especially within same language groups);
- Children who do not seem to make progress with literacy even with additional multi- sensory approaches;
- Gap between communication and writing - children who can tell you something but just cannot get it down on paper;
- Children who find it difficult to retain information from day to day.

Some TAs discussed more general issues that may hinder children's progress that also made identification problematic:

- Families spending long periods absent from school visiting relatives;
- Contrasts between education systems such as arriving from a formal classroom with differing expectations from English classrooms.

TAs also raised more general points related to their work with bilingual children:

- Feeling unsure about how to help a child;
- Children work well in groups where pace of language is slower;
- Children becoming reliant on support and not working independently;
- Sometimes hard to discuss concerns with parents due to language barriers;
- Parents sometimes viewed need for extra support as a criticism.

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Theme 3: How do you feel about being part of this research project? How much of a priority is it for you and your school?

Overall TAs were looking forward to participating and suggested that the intervention programme would improve their skills and help them support a group of children currently 'left on the shelf' more effectively. TAs also stated that there is currently little research in this area, few people trained and a lack of support ideas and materials.

There were fewer comments on how much of a priority the project was for the schools, with only 1 school stating that it was a major priority.

Post intervention TA questionnaire: Their perceptions of the project

62 out of 76 TAs involved in the project, completed the post intervention questionnaire. 28% had less than 5 years' experience in their role compared with 33% 5-10 years and 39% 10-21 years. One was a qualified teacher and fourteen were employed as Higher Level Teaching Assistants (HLTAs). 60% had received prior training in in dyslexia and 53% training in working with bilingual learners. The number of uncompleted questionnaires prevented comparison across local authorities.

Knowledge of languages

The questionnaire also sought information about the TAs' knowledge of their pupils' first languages. 91% knew which languages were spoken by their pupils. 21% had at a little knowledge of these languages but only four had used the languages during the intervention. 47% did not know whether their pupils were literate in their first language.

Their experience of the intervention:

At the end of their schools' intervention programme, questionnaires were distributed to all 55 SENCos and 76 TAs. The questions for both groups covered their previous training and experience in supporting bilingual learners, or children with ASN, their knowledge of their learner's L1 alongside feelings about the intervention programme

and their participation in the research project. The SENCo questionnaire also explored the screening and testing processes. This was completed by twenty-four out of the 55 SENCos and two TAs who had been responsible for the full implementation of the programme at their schools, a response rate of 47%. The TA questionnaire was completed by sixty-two out of 76 TAs and one SENCo who had run the intervention with two children, a response rate of 82%.

The screening process

65% of SENCos were satisfied with the training provided on the Lucid screeners. None reported major difficulties in administering the tools. 81% of the SENCos agreed that the results from the screeners were useful and informative with one SENCo commenting that the results 'served to confirm where the children were struggling'.

The testing process

24% of the SENCos reported that the training on both administration and scoring of the various tests was inadequate. 35% of the SENCos commented on the time-consuming nature of the testing and marking/scoring.

Despite this, the majority reported no difficulties administering the WRAT4, BPVS or the Non-Words test although 12% reported difficulties administering the YARC. However, over 80% found the results informative and would consider using all three tests with other pupils despite the unfamiliar vocabulary and the 'unhelpful Americanisms' on the WRAT4. Typical comments included:

> testing data has been a useful indicator to support class teacher tracking and to help uncover exactly which areas the child was finding difficult.

Another stated,

> I have gained a more in depth knowledge of my year 6 pupils and have been able to pass this on to the secondary SENCo.

Post intervention SENCo questionnaire : their perception of the project

77% of the SENCos felt that their TAs' skills and confidence had increased as a result of their involvement with the project. Although 58% of the SENCos suggested that TAs were able to run the intervention without further support, some felt that they had been forced to rely on the TAs to deliver the intervention with little or no support and there was a sense among a few SENCos that this may have compromised the effectiveness of the intervention. Reasons for the lack of SENCo involvement in the intervention included, for some, a teaching load of four-five days a week; devotion of

time to the project necessitating catching up with other work, the absence of training on Nessy/Rapid Reading rendering them unable to provide support to the TAs. SENCos also commented on logistical difficulties with fitting the intervention into the school day and the issue of unavoidable interruptions, especially during the second half of the summer term.

At the start of the intervention TAs had struggled with technical problems, unreliable laptops and setting up and using the IT but, in many cases, familiarity with the software resolved their difficulties. However, 24% of TAs reported ongoing problems including difficulties printing, lost data and laptops which crashed when the Rapid software was installed.

Shared perceptions: the benefits

Over 88% of the SENCos reported that the children had enjoyed participating in the intervention. Over 60% of SENCos thought that their children's reading speed, listening comprehension and writing had improved. Perhaps surprisingly, less than half of the SENCos thought that their children's productive vocabulary had improved although this assumption may be less reliable.

92% of the TAs felt it had helped reading (8% neutral). 77% felt it had helped spelling (16% neutral). 80% felt it was effective overall (7% neutral) and 90% would recommend the intervention activities to others (5% neutral). All the TAs stated that the children had enjoyed using Nessy and found it easy to use. However, comments revealed some criticisms of worksheets becoming ' a bit *samey,* pictures being unfamiliar to her children, spelling games leading children to answers rather than encouraging them to work them out.

> *Nessy was effective for rehearsing spelling skills but that more input (was) needed to explain spelling rules/patterns initially and to facilitate transfer to classroom activity/context.*

Just over 60% of TAs felt that their children had enjoyed using Rapid Reading, with 20% neutral. However, when the TAs' additional comments are taken into account, it emerges that most of the children enjoyed the books themselves and aspects such as their content, layout, familiar characters, repeated phrases and the quizzes.

However, roughly 10% of the children had reported frustration with the software. The microphone check was often unsuccessful so a lot of time was wasted. The system did not always pick up the voices of children who spoke softly or would cut them off partway through their reading. Some children felt frustrated when they had to keep repeating words which they had already read. Another TA observed that the software sometimes appeared to struggle with accents.

Shared perceptions: the drawbacks

60% of TAs and 57% of SENCOs reported that 30 minutes was insufficient for them to set up the intervention, run and monitor it and complete all the paperwork. They also felt that managing the two programs together was problematic because there was too little time to use the resources effectively. There was a sense that each of the programmes could have been used alone for 30 minutes and that, because so much was covered, the children may not retain what they had been learning. This left insufficient time to play Nessy card games or listen to their Rapid Reading recordings.

A third of the TAs felt that working with two children was less effective. Children tended to interrupt each other and both children needed input and supervision with some aspects such as the spelling prompt feature in Nessy.

The project's impact on SENCos and TAs

Focus groups had been conducted with SENCos and TAs on the training days to explore their knowledge of dyslexia and of working with bilingual children. The end of project questionnaires had indicated that 60% of both TAs and SENCos reported increased knowledge of dyslexia with 50% reporting an increase in understanding of bilingual issues. Over 50% of both reported higher levels of confidence in their roles as SENCo or TA. 89% of SENCos reported higher knowledge of screening/testing tools with 75% suggesting that their TAs' skills and confidence had increased during the project.

Data was also gathered at the end of the project through interviews with five TA's. These additional interviews were a chance to interview TAs who had taught the children and been present at the focus groups with children and parents.

These interviews were analysed using the same key themes as in the children's focus groups, reported later in this chapter.

Theme 1: Pleasure /enjoyment in general.

- Have you enjoyed your special work with the TA?
- Children's views of the materials used. The people who wrote the Rapid Reading books and the Nessy computer spelling have asked us to find out what you liked /or didn't like about the books and computer programme
- Progress and Learning: Do you think you've got better at reading because of the work you've been doing with the project? What about spelling?
- Languages and Bilingualism: How many languages do we speak in this group? Which do you speak at home, in class, playground, with friends?

Which languages do you read and write? Would you like to speak more in your home languages in school and learn to read in those languages?

Theme 1 Pleasure and Enjoyment

TAs talked enthusiastically about working with the children, how much they had learnt through the programme and being present at the focus groups with parents and children.

Theme 2: The materials used

Management of the sessions was one major area of comment. In particular TAs felt they needed more time to become familiar with programmes as once the routine was established the sessions worked well.

Rapid Reading

TAs indicated that RR was an easy to use carefully graded scheme. The books were enjoyable to read with the children and it was possible to be flexible about which section, fiction or fact, was read first.
Positives of using the computerised Reading Assistant were it:

- followed on from reading with adult;
- increased child's confidence at reading aloud;
- helped some children with pronunciation of unfamiliar vocabulary.

The difficulties with using Reading Assistant were:

- recognition of children's accents;
- following text on screen e.g. needing to use a pencil to track text across the screen;
- children didn't find it easy to work independently.

Nessy Again TAs indicated that the children had gained from using Nessy and highlighted the following as significant:

- the games were an incentive and motivator for practice;
- some children liked multisensory activities such as rainbow writing and sand activities more than computer games.

TAs indicated that the training and materials would be useful to the school in the future. They looked forward to continuing to use the materials as they felt that children had grown in confidence and made progress. TAs felt that their personal preferences such as, enjoyment of reading with books had influenced how children responded to different aspects of the intervention programme. However, there were

some reservations as to how effectively the NESSY games reflected spelling mastery.

Progress and Learning

TAs talked about children's struggles with reading comprehension. One said she had spent additional time on activities around the texts, asking comprehension questions, retelling of stories and information, inference and deduction. Vocabulary enrichment was viewed as important especially linked to pre reading activities of RR. The interesting, challenging content of information sections were motivating for the children. Quite a few of the children came into RR at the highest level (NC Level 2B or RA 8.00) but whilst they could decode these texts the challenging content enriched their comprehension.

The TAs said that the biggest gain for many children was their growth in confidence and reinvigorated interest in reading. Two TAs talked about children who had scarcely or never spoke in English in school starting to join in.
The TAs interviewed did not talk in detail about specific aspects of children's progress in reading, confining their comments predominately to increases in confidence and enjoyment. The daily records and narrative records for the schools were often brief and contained few details about specific areas of for example phonics or vocabulary that individual children struggled with. The indications were that TAs' qualifications and prior experience were related to understanding what was required and how to analyse children's progress. Training and follow up support for TAs seems to be crucial.

A SENCo and TA in one school had concerns about the mismatch between progress in learning and progress in literacy, even when a child had been in school for some time. They were concerned about whether other signs were indicative of potential SpLD such as evidence of poor literacy skills in L1; forgetfulness, disorganisation and frustration at progress.

Classroom Teachers

Recorded observations

Class teachers' experience of the impact of the specialist Phase 1 intervention upon their children was sought through two questionnaires delivered to the schools pre and post the Nessy/Rapid Reading interventions (see the Human Experience section). Teachers had been asked to use a Likert scale to comment on the children's literacy skills, vocabulary, behaviour, motivation, concentration and contribution in class. Data were entered into a PASW file and a paired sample t-test analysis was undertaken to compare responses at the two stages in the study.

Complete questionnaires for only 39 of the 104 children in phase one were returned, making reliable conclusions impossible as the experience of those who did not respond may have been negative. However, the analysed data for all the items, with the exception of enjoyment of writing ($t(38)=.89$, $p=.38$) indicated significant improvements over the project time with p between <.001 and .04. Few teachers provided comments comparing the children before and after the intervention but comments from the end endorsed themes of 'steady progress' and 'significant improvement' , 'greater confidence' alongside specific developments in fluency and spelling.

> Her writing shows greater confidence she is able to write longer, sustained pieces of text using more adventurous vocabulary. She has a wider spelling vocabulary of high frequency words and attempts at less familiar words show some phonic awareness

Summary

Only 50% of the participating SENCos completed the questionnaire which undermines the reliability of their responses. However, overall they felt that their children enjoyed taking part in the Nessy /Rapid reading intervention and made significant progress in reading and spelling . Although the SENCos found the project very time-consuming, they found the screening and testing process to be useful and informative and reported increased confidence in their skills in supporting children with dyslexia and with EAL. They noticed a development in their TAs' skills and confidence. All the schools had been provided with the resources and testing materials. The majority of SENCos intended to use Nessy and Rapid Reading in the next academic year. The low response rate from classroom teachers must undermine the potential to generalise the positive tone of thecomments to others in the study.

The 80% of TAs who responded were generally enthusiastic about the intervention materials and the majority of them felt that their pupils' reading and spelling skills had improved. The TAs also felt that they had developed their own knowledge and had fun taking part in the intervention. Class teachers recorded significant progress amongst their intervention children although the absence of questionnaires exploring the impact of the paired reading or control situation prevents comparisons. Recommendations and Lessons to be learnt included:

- encouraging the development of communities of practice and networks among TAs in neighbouring schools;
- exploring ways to ensure that the expertise of TAs is shared and celebrated to develop confidence and status;

- allocating time for TAs to record learning and progress in more detail, especially in encouraging children to reflect on and understanding their strengths and weaknesses as readers and spellers;
- ensure that training includes both EAL and dyslexia specific information focussing on increasing the awareness of understanding children's capabilities within their first language;
- reducing the number of activities included in a session or increasing the time available to avoid overload;
- careful selection of children, if working in a pair is to be successful.

Impact on Parents and children

Focus groups

Focus groups for parents and children were held in a sample of six schools at the end of the year. For ***four*** phase 1 Intervention A schools this was 4 months after the completion of the intervention. In the case of Phase 1 intervention B schools (2) it was 2 months. The focus groups with parents and children offer a different view on the intervention programmes; one which suggests, in a limited way, influences beyond the school and professionals involved. The focus groups with children were led by one of the researchers, held in school with the children's TA present. A total of 36 children participated 22 girls and 14 boys. The focus groups for parents were organised by the schools and held with the TA present. Where required interpreters worked within the focus groups. A total of 18 parents participated, 11 mothers and 7 fathers .

The four themes for discussion were the same as those used in the work with the TAs:

- Pleasure /enjoyment in general
- Children's views of the materials used
- Progress and Learning
- Languages and Bilingualism:

The focus groups for parents were organised by the schools and held with the TA present. The themes for the focus groups with parents were:

- Their children's reading and spelling
- Whether they had observed any differences in their children's reading over the timescale of intervention:
- Willingness to read /write
- Enjoyment of reading
- Knowledge of words /sounds
- Knowledge and understanding of dyslexia

- View of the importance of literacy in home / language of religion
- Any observations / views on whether child was struggling in home language

Children

Theme 1; General pleasure and enjoyment. Have you enjoyed your special work with (TA)?

Almost all of the children said that the experiences of being part of the intervention programme had been positive. Some said that had enjoyed coming out of class or liked reading with the TA. However one child indicated that he disliked missing his art lesson. All the children indicated that they had liked Rapid Reading and Nessy.

Theme 2: Children's views of the materials used.

The people who wrote the Rapid Reading books and the Nessy computer spelling have asked us to find out what you liked /or didn't like about the books and computer programme

Considering it was at least 2 months and sometimes up to 4 months since the completion of the intervention for 5 of the 6 schools children could recall considerable detail about the materials used in the project. Overall both sets of materials used were a success from the children's point of view. They spoke enthusiastically about Rapid Reading and Nessy. Children were clear about their interests and preferences.

Nessy: Children spoke predominately about particular games that they had enjoyed, concentrating on the competitive element together with being proud of the number of games completed. Children mentioned the gaining of rewards as incentives for moving through a game and certificates for completing work. Only two children linked their comments directly to these being spelling games. For example one boy commented that, 'Nessy's like games and it drags you into it, it drags children into like doing the spellings.'

Rapid Reading: The children talked at length about their interests and personal preferences for specific books from Rapid Reading. Even after time away from the books they could recall in detail sections, characters and information learnt from their favourite books. Many indicated that they appreciated the combination of humour in the stories, real photographs and topics in the non-fiction. Some children stated that they particularly liked the quiz and jokes at the end of each book.

Theme 3: Progress and Learning

Children indicated that overall they felt that their reading and spelling had improved. On the whole they rated their progress in terms of moving through levels or moving from scheme based reading in class to being a 'free reader'. Some children picked out specific words that they had learned to spell or suggested that it had helped with in class spelling tests. One girl linked her progress with Nessy helping her to memorise the words. 'I keep on getting my spellings right every week.'
Other indicators of progress that children talked about were:

- I am reading more at home and buying books
- I can read faster
- I used to sound words out but I can just say them perfectly

Children discussed how the Reading Assistant had helped them 'learn new words and some words I didn't know how to say'. A common theme was how voice recognition software had helped them learn to pronounce new and difficult words. The negative comments about the materials were predominately about the frustrations of computer failures with both Nessy and Reading Assistant. However some children found it frustrating that the Reading Assistant failed to recognise their accents or could not deal with quiet voices.

Theme 4: Languages and Bilingualism

The final part of the focus group sessions invited children to talk about languages and being bilingual. The first question simply asked '*How many languages do we speak in this group?'* This provoked a fascinating discussion between the children, especially in the schools where a wide range of languages were spoken. Many children talked about the range of languages that they spoke. For example, Somali children listed, Somali, Dutch or Italian and Arabic as languages they spoke, read or wrote. They were comfortable, knowledgeable and interested in language and languages. For example children would discuss differences in spelling in different languages and different scripts. Children discussed the different modes of language use such as speaking, reading and writing and seemed to be aware of how good they were in each. The impression is that many of these children are knowledgeable global citizens with family connections that spread across the world.

In some schools children indicated that they felt they were 'not allowed' to speak languages other than English unless there was a new non-English speaking child in the school that they could help. This is surprising given what is known about the extent to which languages support each other and the extent of the knowledge and interest children displayed in each other's languages.

Parents

Schools varied in the number of parents who came to the focus groups. Over the six schools a total of 11 mothers, 7 fathers and 1 older sister attended. In one school the focus groups were divided into a fathers' group and mothers' group. The focus groups had been organised around 4 themes.

Theme 1: Their children's reading and spelling

Many parents indicated that they felt their child had struggled prior to the start of the project. Parents indicated that they had noticed:

- Differences in comparison with other children in the family
- Difficulties in more than one language
- Writing well in Arabic but not reading well
- Slowness in reading speed
- Not being able to read what friends could

Not all parents pinpointed specific reasons for their child's struggles however one reason was the difficulties of English language, especially spelling stating 'even for English kids it's not easy to spell straight away'.

Theme 2: Whether they had observed any differences in their children's reading over the timescale of intervention:

Parents agreed that the intervention programme had helped their child and were happy with the extra support. Although parents were not often very specific, the main improvement noticed was children's increased confidence in reading. This was noticed in the child being more willing to read or write at home, choosing to read and reading more books, reading more quickly and with enthusiasm. Mothers' comments included:

- my daughter is now reading under the bed covers at night with a torch (mother)
- my daughter is going to the library more often
- now she reads to me and I listen
- I can see the change in her attitude towards books, the computer, she's now more focussed on her reading and enjoying what she's reading

In one school parents stressed how their children's spelling had improved and how they now made fewer spelling mistakes.

Theme 3: Knowledge and understanding of dyslexia and of children's progress

Although parents had general questions about the school and intervention project they didn't ask specifically about dyslexia. However, comments made by parents raised issues over communication questioning how much they really knew about how their child was progressing or the level they were achieving in school:

> I see he's writing good and reading not bad. But I don't know if that's enough for his age or not?

There were also indications of confusion over information given to parents by schools. On the one hand the school had said the child was reading well but then they were included in the programme. In one school parents were asking (4 months after the end of the programme) when they would know the results of the full assessments.

Theme 4: View of the importance of literacy in home, of language and of religion

This was an important focus for discussion in many of the schools especially those which were linguistically diverse. What became apparent was:

- Some children speak, read, write more languages at home than schools had indicated;
- Parents appreciated the value of learning more than one language early in life 'because they never forget';
- Families with strong community connections and contacts in locality or outside UK, this was either in country of origin or family living elsewhere in the world, tended to stress the importance of maintaining home languages;
- Families were sometimes making strategic decisions about which language/s would be most beneficial to concentrate on. For example in multilingual families choosing to concentrate on European languages (Portuguese and English) rather than an oral African language.

Although keen for their children to speak, read and write the language of family some parents found that children preferred to speak English. This seemed to be particularly the case for children born in UK.
Parents appreciated the importance of children learning English quickly in order to feel socially included.

One parent discussed the dilemma of wanting your children to be proficient in English in order to succeed in the future but wishing them also to grow up with the advantages of being bilingual for both career flexibility but also identity. At the same time growing up proficient in both languages is hard when they spend most of their

waking hours in school speaking only English and to succeed they have to be better at English than English people.

In some linguistically diverse schools parents were coming in to speak to children about language, religion and culture. There was talk of a general recognition of diversity but this was not necessarily embedded within day-to-day working with the school. Although some TAs had spoken about some of the resources they were using in school, such as dual language texts and Polish talking dictionaries, in the 6 case study schools, only one of the TAs working with children spoke languages used by the children selected.

Summary

The discussions with children, parents and TAs raised many issues, over and above a shared sense that all had benefited their involvement in the project, both in terms of enjoyment of the process and the materials and that, despite challenges in managing activities and using the software, there was an impetus to repeat similar interventions in the future. The importance of revisiting learning and of consistent practice in learning to read is highlighted along with the opportunity to talk and develop language and confidence for reading outside the classroom. There were questions about communication, between parents and schools, between the different 'silos' of literacy support and bilingual learning and a sense that different parties view L1 and L2 in different ways, especially children and parents. Varying indicators of the extent to which L1 is kept active within schools and contributes to the creation of an additive environment were evident. The responses also raise many questions about the role and status of TAs and about their levels of knowledge and depth of training.

Recommendations and Lessons to be learnt

- All parties interviewed stressed the importance of challenging and enjoyable materials and highlighted the value of good relationships between TAs and children.
- Children's interests and preferences are an important factor in increasing desire to read and making progress.
- When encouraged, children talk and appreciate their progress and can pinpoint what has been learned – increased reflection /meta cognition can support understanding.
- Training for TAs should include detail about what information is needed for records.
- Children's knowledge about languages should be a factor in assessment procedures.

- It would be helpful to have parents more central to and involved in specialist programmes.
- The advantages of being multilingual need to be more concretely recognised.

Case studies

As the intervention programme was drawing to a close it become apparent the rich sources of data that had been accumulated and analysed had potential for investigation beyond the initial brief of the project. One way forward was to compile case studies of each the six schools included in the focus groups which would bring together data from the school files, statistical analyses, the focus groups and project manager field notes. The primary purpose of case studies is to view a specific case in its complexity and entirety whilst keeping context in view (Punch 2009). Whilst the statistical data overall offers a detailed and quantifiable account of the impact of the intervention upon the children, case studies can produce valuable concrete context-dependent knowledge to learn from (Flyvbjerg 2006, Ruddin 2006). Flyvbjerg argues that 'the force of example is underestimated' (p228). The intention is to explore existing data in order to shed light on some of the complexities of individual children's responses to the intervention and raise further questions /hypotheses both about children at risk and the richness and complexity of linguistic diversity that has become so evident in the analysis of the parent and children's focus groups. Flyvbjerg argues that the selection and classification of cases can function as reference points and a focus for developing schools of thought more generally. In this instance a more detailed examination of some schools, children's profiles and staff experiences may illuminate and inform our understandings more fully. At this stage there are some factors which have come to the fore:

- The crucial importance of understanding educational histories within a more global context: for example the Somali child arriving in England at age 6 from Italy will not have attended school whereas her older sister age 8 is literate in and speaks Italian.
- Whether a more detailed view of individual children and schools can help us understand the progress some children have made.
- In addition the case studies may provide practical examples which can contribute to the professional development of teachers, TAs, trainee teachers and researchers.
- Analysis of these case studies is ongoing and findings will be presented elsewhere.

Other sources of data: The BDA project team

The project adopted a mixed methodology design to combine empirical rigour with the real life world of the school and those within it. The aim had been to comply with the gold standard for a randomised controlled trial but the project's real-world environment challenged every stage. Hence the insights obtained by the research team and, in particular, the project managers from their consistent work with the teachers, TAs and SENCos enabled the reliability of the quantitative data to be enhanced.. Analysis of this data has produced insight into the running of a project of this type and would inform recommendations for future projects across schools.

Setting up the project

The project aimed to involve 60-80 schools in Bristol/Bath and Liverpool and 53 schools were initially contacted but, since take-up was slow (Some schools did not respond and others subsequently withdrew, citing lack of staffing or financial capacity, suitable children or other priorities) the project extended later to include Swindon and Manchester, London and the South-West broadening the geographical area covered.

This wider area undoubtedly posed challenges arising. The original plan had envisaged two centres, each supported by either the project manager or project co-ordinator, and allowing for schools to be visited on a regular basis. Increasing the number and distances reduced the potential for visiting schools and those which were furthest away from the original centres, were not visited more than once during the intervention reducing the capacity to build relationships between the BDA project team and the schools.

This delayed entry meant that the July screening continued into September, delaying the selection of the children for the project and also preventing the use of an algorithm development from this data by Lucid research to aid the selection of children for the project. The late entry of one LA meant that their children had to form the waiting control group to avoid delay in the start of Phase one, preventing the random selection of schools for this project condition.

There was also considerable variation between schools in the amount of time spent preparing for the start of the intervention in Phase One and the extent to which intervention delivery matched Handbook instructions over the first couple of weeks. Schools involved in phase 2, on the other hand, had longer to prepare and were also able to benefit from the acquired experiences of phase 1 schools and TAs. Where possible, prior to the beginning of the second phase of the intervention, meetings were arranged to enable phase 1 TAs to share their knowledge with phase 2 TAs.

Delivering the intervention programme

The project manager and co-coordinator were in constant contact with the schools and gathered further data from them as to their on-going experiences. One of the most frequent complaints from TAs during the intervention was the viability of covering all required activities within 30 minutes particularly where they were required to return to their classes immediately. Some, where schools were flexible and seemed to prioritise the project, were allocated extra time at the beginning and end of each session to allow time to monitor the children's recordings on the Rapid Reading assistant, worksheets and records. This was not uniform.

A few schools reported that incorporating the intervention had potentially provoked stressful situations in school around timetable upheavals or children missing break time. Others reported issues over room allocation. Sometimes the intervention became 'peripatetic', moving into whichever room was available at the time or project children were expected to do the intervention in a shared space such as an IT room, a library, or even in a corridor or a central space outside several classrooms. In these cases, children were constantly distracted by disturbances and noise levels or by children who had been sent out of class and told to work on their own.

Many TAs, however, established a very positive environment for the paired reading intervention. Children were made to feel special. Special boxes of books were brought in; sessions were conducted in the local library, or in the school library sitting on a beanbag with shoes off, and having the treat of selecting books from the whole library.

There were also issues over hardware usage. Examples emerged of computers crashing, freezing , losing children's records during reconfiguration or even being stolen, with delays in replacement. Many schools experienced on-going problems with printing and this was a particular problem with Nessy where certificates cannot be printed out at a later date. Many of these primary schools did not have full-time IT technicians available to help with software problems, resulting in frustration for TAs and pupils alike..In addition, some TAs needed to develop confidence in their ICT skills to overcome resistance to using computer based products. Where a space was designated for the intervention, it was not always possible to leave the materials or computers in situ. Consequently session time was reduced when the room had to be set up each time. Sometimes the computer could not be placed next to where the TA was working with the other pupil, so she was often pulled away from one child to attend to the needs of the other. These practical difficulties challenged the effectiveness of the interventions.

Attendance

One frequent issue was the reluctance of some class teachers to allow children to miss classes in core curriculum subjects meaning that, in some schools, sessions were conducted to coincide with the morning assembly. There were many problems with attendance on the part of pupils and TAs alike. Children missed sessions for a range of reasons including SATS revision, extended, unauthorised holidays or teachers forgetting to send them. Solutions to concerns about specific children's attendance were elusive indicating that this project activity may not always have had priority within the school. TAs did not complete the provided attendance records rigorously so data was incomplete and could not be included in the analysis.

The broad range of roles and responsibilities undertaken by TAs within schools beyond the classroom affected the consistent delivery of the intervention programme. An exemplar log showed absences of 8 to 10 days through training and inset and the most common reason for TAs missing sessions was to provide cover or to meet existing obligations, such as providing 1:1 support.

In addition to attendance problems, some TAs were absent for a number of reasons including ill-health or change of responsibilities. Consequently, the replacement TA had not attended the pre-intervention training sessions and, therefore, needed extra support from the BDA project team.

TAs' skill and confidence

The quality of input varied according to the differing levels of expertise across the TAs who varied from being inexperienced and lacking in confidence, to former teachers, trained dyslexia specialists, or fully qualified Higher Level Teaching Assistants (HLTAs), skilled at exploiting reading texts or devising activities to reinforce learning. Some were bilingual and able to check understanding in the child's first language.

In a small number of cases, the SENCo seemed to have minimal involvement and running of the project was left entirely with the TA. In most cases, however, TAs were accustomed to following instructions from their class teacher and were challenged by the fact that the design of the intervention programme had called on them to make independent decisions. Despite detailed project handbooks, reluctance to ask for support or clarification at the start of the intervention led to some errors in the organisation or delivery of the programme in its first week or until the BDA project team clarified misunderstandings. Meetings with TAs were essential to iron out problems and provide a forum for sharing experiences, ideas and good

practice. Frequently the experience of overcoming initial anxieties and contributing to regular meetings resulted in participating TAs having a real sense of personal achievement by the end of the programme.

Children's attitude

The majority of children responded very enthusiastically to the programme, enjoying the sense of being 'special' and having access to materials exclusively for them. At one school, a TA described how the children 'absolutely love' the intervention and were very proud of their files. In another school, children were so reluctant to stop the intervention that they petitioned the head-teacher to ask if their classes could continue. Occasionally, however, children were less positive, notably when paired with a younger child of the opposite sex, if they were the only child in their year group having the intervention or if taken out of classes they enjoyed.

Whole school commitment

Ideally, a research programme such as this would benefit from the commitment and involvement of the whole school. Apart from a couple of smaller schools, this ideal was seldom achieved. Reasons for this must include the demands on all staff members within the school, but also the lack of time available to foster relationships between the staff and the project team.

The attitude of the SENCo was pivotal in determining the likely success of the intervention and the degree to which the project was embraced by the whole school. In schools where pressures prevented the SENCo' s full involvement she was less able to check that the intervention was running smoothly. However, where the SENCo was fully engaged and enthusiastic, there was much more likely to be enthusiasm around the project and its results. A few SENCos undertook the actual intervention, which, although not part of the project design, proved very successful and strengthened their support for their TAs as they had in-depth knowledge of materials and practical administration. They also had the confidence to make adjustments and add reinforcement and overlearning when the children were struggling. As members of the senior management team, their commitment also raised the status of the project.

Some SENCos also made productive use of all the data gathered as a result of the screening and testing process. Examples included application of the LASS screening results to provide feedback to class teachers, enabling modification of the Individual Education Plans, or organization of staff meeting about the intervention. When class teachers became aware of the new materials being used, they were keen to make future use of them rendering it likely that the intervention programme and its materials will continue to be of use.

The Challenge of the pre-post and follow up intervention testing: Implications for the research design

The BDA project team's diaries of their experiences revealed reservations as to extent to which the quantitative data from the pre, post and follow-up intervention testing might be fully reliable. This has implications for recommendations for future research which are summarised in Section F.

The pressure of the SENCos' heavy workload reduced the time available to them for testing the children. Consequently, some testing seems to have been rushed, with inaccuracies in the scoring, or undertaken either by another teacher or the TA, who had not been trained in the test structure, administration and scoring procedures. Examples reported from at least 7 schools included errors in scoring or administrative processes, plus not following the research team's request for two independent markers for the free writing. The follow up free writing scores were too incomplete to be included in the analyses.

The BDA project team's work checking the score sheets ensured that the majority of these errors were corrected prior to data entry. However, this could only happen where the whole of the test record booklet (YARC, BPVS, WRAT 4) was returned to the team. This was not always the case. There were also examples of the TAs (who had not been trained by the team) carrying out testing and several SENCos, who have heavy teaching schedules and management responsibilities, expressed dissatisfaction with the amount of testing required for the project suggesting that they would not have taken part had they known this in advance.

The WRAT sets less complex tasks with low potential for ambiguity in response and, once the tester is familiar, had few errors in administration. It did provide the data needed for a project of this nature and the scoring errors were mostly corrected by the BDA project team. The YARC, however, proved a less appropriate test for a research project because it is less easy to administer and score 'correctly' than anticipated when it was selected.

There are many variables and ambiguities in instructions relating to selection of starter passage for child's testing, scoring of repeated errors, ambiguities in scoring for comprehension answers and for the use and scoring of additional questions. As a diagnostic exercise, it has good potential for exploring the child's understanding and reading strategies and those SENCos who have thought deeply about the testing and what it means for their children, have developed their professional skills and gained insights from administering this test. However as a source of fully reliable quantitative data for a research project, this would not be recommended for future use, unless administered by a research team to highly specific criteria, which could in its turn, undermine the test's reliability. This comment from the BDA project team encapsulates many of the emerging themes

> I went into as many schools as possible to help with testing and/or do the scoring. This had the huge advantage of being able to pick up errors there and then and getting the SENCOs/ TAs to get the children back and carry on (if discontinued too soon especially on the YARC) although I recognise that this re-starting is not ideal either. It also means I have become more aware of issues such as not asking additional questions on the YARC (as recommended in the manual) when a partial answer is given, inaccurate timing of passage readings etc. Some of the children have been really reluctant to come out of class again and a small number have made very little effort especially on the free writing. There are quite a few cases of the comprehension questions being marked as correct when they are incomplete.

The nature of the bidding system for this project prevented undertaking a pilot for the pre-testing which would be likely to have highlighted these issues of training, support and test selection.

This raises issues around the reliability of numerical data collected in larger scale quantitative research within the world of the school. This would justify the team's decision to adopt a mixed methodology approach and enrich the quantitative data with data from the human experience of all those involved. It would also argue for the following considerations in future research:

Recommendations for future research projects within the world of the school:

- Adoption of a mixed methodology design.
- Establishment of a robust support network if a project has to be geographically broadly distributed.
- Testing procedures should be piloted in advance.
- Priority in selecting tests for benchmarking needs to be precision and ease of scoring rather than the quality of information rendered for the purposes of supporting the children. This raises ethical issues.
- All numerical testing to establish benchmarks should be undertaken by the research team. If this is not possible, more detailed training is required and the insistence that all instrument records and completed test sheets be returned for checking, not just summary scores. This will naturally increase the cost of such projects.
- Support of the type offered by the BDA project team is essential.

Summary

An overview of the diaries would suggest two issues: firstly that schools varied considerably in the way in which the intervention was hosted in terms of levels of involvement, skills and commitment of personnel, provision of facilities and the level of priority given to the project. These are all variables which cannot be controlled for or properly reflected in the statistical analyses. Secondly, there are many examples of issues which must have challenged the impact of the intervention, for example, accommodation, hardware deficits, TA commitments and expertise, TA and children's attendance. Hence it is striking that, despite these challenges, the interventions have both raised the children's performance significantly. The issues around the TAs' role, status and around practical issues of managing individual support, reflect other research on the impact of TAs and are discussed briefly in the recommendations..

D. DISCUSSION

1. SUMMARY

The project's aim of establishing an accessible screener to identify risk of dyslexia in bilingual children who have been in English schools for at least two years was not fulfilled. Children assessed as being at risk using the LDI specifically developed for the project (Thomas, 2010) or the Wesford Dyslexia Checklist and Alloway Working memory Questionnaire were not more likely to be identified as at risk by a full assessment, conducted in English by an experienced AMBDA specialist dyslexia teacher assessor, than those categorised as not at risk by the LDI or Checklist. Hence it is not possible to assert that all these year 4-6 children in the sample were at risk of dyslexia nor to recommend a protocol for identifying risk of dyslexia in bilingual learners . The participants were, however, all children identified in their schools as 'failing to thrive' in literacy skills without obvious cause and undertaking the 15 week interventions enabled these bilingual children to make both significant progress in their literacy skills and in their confidence, attitudes to reading and oral expression. This assumption is confirmed by the statistical analyses and reported by children, parents, TAs, SENCOs and class teachers in focus groups and interviews.

The findings back previous research (Brooks, 2003) suggesting that short-term, daily, focused interventions, delivered by trained TAs, work and should be prioritised for at risk bilingual learners within the school system. The project would therefore argue for the efficacy, for this bilingual group, of the deployment of trained TAs using either a daily short paired reading session using challenging curriculum/relevant resources and incorporating vocabulary enrichment or a multisensory, structured, phonological word pattern and spelling programme. As suggested by the Blatchford report (2009), TAs delivering the programmes must be trained and supported within specific structures to make the most of the opportunity.

Improvements in reading comprehension and fluency occurred across both types of programme but only the NESSY/RR intervention affected the specific skills of spelling and non-word decoding targeted by the activities. The recorded improvements were sustained across the items measuring reading comprehension and receptive language but less reliably across the spelling and writing , which would reflect the differing levels of difficulty in developing and sustaining spelling compared with reading for dyslexic learners (e.g. Mortimore, 2008). Since Response To Intervention (RTI) is a specific marker for dyslexia identification (Rose, 2009), it could be argued that those children whose spelling and writing fell back at the end of the intervention may be the ones most likely to have been at risk of dyslexia and should be the focus for additional assessment and support.

2. Identification and full assessment findings: impact and indicative recommendations

Responses from schools invited to join the project revealed huge variations in the numbers of bilingual children thought to be at risk of dyslexia indicating inconsistent understanding of the nature of dyslexia. The challenge of identifying risk of dyslexia in bilingual children with the primary school context remains. Further research should explore the extent to which the full assessment children might be identified as having SpLd/dyslexia at the end of KS3 when their CALP should be in place. The project findings confirm the need for extreme caution in assuming a need for categorisation and for awareness of the contested role and sensitivities of false negative/positive labelling alongside the tensions around any links made between SEN and bilingualism.

It remains challenging to identify assessment processes for SpLD/dyslexia, or indeed literacy measures, that are heterogeneously meaningful, standardised and appropriate across languages and the risk of giving over prominence to the role of L2 (English) proficiency within the identification process for dyslexia remains high. Any assessment for SpLd/dyslexia must include knowledge of the whole child and his or her context and story. Two benefits from the screener/full assessment activities did emerge: firstly the range of assessments undertaken during the project provided the SENCos with useful information as to some children's cognitive profiles which could be used to develop individualised support based upon an understanding of strengths and weaknesses and to indicate potential areas of weakness to monitor. Secondly, SENCos now have access to, and have developed some much needed expertise in, a range of literacy assessment instruments for the future benefit of all their pupils.

3. Recommendations for identification of SpLD/dyslexia in bilingual children:

- Caution must be exercised over assuming risk of dyslexia and over decisions to assess for SpLD/dyslexia for children with English as an additional language at primary school level.
- The child's full story is indispensable and parents must be involved and, where necessary, interpreters employed to help gather the story, including issues around early acquisition of L1.
- Assessment instruments must be meaningful for all involved. Where possible, L1 should be used with L2, particularly for speed of processing issues.
- It would be preferable to see any in depth assessment as helping to indicate a bilingual child's profile of strengths and weaknesses rather than as providing an identification of SpLD/dyslexia at primary level.

- Inadequate response to intervention RTI is becoming a major criterion for risk of dyslexia – bilingualism should not be taken as an explanation for a child failing to make progress. Clear monitoring and investigation of the skills of children in this situation might help to identify those whose difficulties might indicate risk.

4. Impact of and recommendations from the intervention findings

The quantitative data, confirmed by the human experience, highlighted the positive effect of both the paired reading and the specialist intervention upon children's reading, comprehension and vocabulary. The voices of all those involved in the project, particularly parents and the children themselves, highlighted the growth in the children's confidence , motivation and interest in reading and sense of themselves as readers and this was reflected at home. Books, both inside and outside school, hitherto regarded as in accessible, are now a resource to be explored. Both types of intervention were valued by the children for the opportunity to read, talk and be listened to in an atmosphere of 'unconditional regard' (Wolf, 2008). The small group time was essential and the conversational peer and TA support, particularly around the language of the non-fiction Rapid Reading books, encouraged the development of academic language, reflection upon the nature of reading and language and the movement from BICS to CALP, with evidence of children recalling content with pleasure several months later.

The impact of undertaking the intervention upon the confidence and expertise of the TAs was marked, as was their enthusiasm to share this expertise and take it forward beyond the lifetime of the project. Their raised understanding of the children's own stories and background enriched relationships with children and their awareness of the issues facing bilingual children. It also emphasised for the TAs the credit that should be given to the child as a potential reader and explorer of informative texts. Unlike the impact upon reading and vocabulary skills, which emerged from both the specialist intervention and the paired reading intervention, and was maintained beyond the intervention periods, the impact upon spelling and writing, although marked while the NESSY and RR interventions were ongoing, tended to plateau without further reinforcement indicating the need to maintain individualised support for these learners at this stage in their schooling.

The literature search had highlighted the demand for schools to develop an additive context and to take into consideration each child's story and history. The high numbers of languages and communities included in UK primary schools had made it impossible to take these varied needs fully into account while designing the intervention programme, beyond examining the materials for relevance to children's

lives and interests including a minimum of stereotypical images and inappropriate cultural /religious content. More use of learners' L1 is recommended, particularly in relation to the clear sense that emerged from the focus groups of the children's awareness of different modes of language and enthusiasm to discuss these issues. Undertaking the intervention heightened the TAs' awareness both of the languages spoken by their children, the children's previous educational and personal histories and of the TAs' and schools' frequent lack of centralised knowledge prior to working closely with these children. The project has highlighted issues for all those involved in the contested relationship between the two worlds of bilingualism and special educational needs and there is still much to explore and develop in terms of the knowledge levels of all adults involved in the different learning contexts and collaboration between these worlds.

Recommendations for intervention programmes:

- Start intervention as soon as possible. However, findings suggested that years 4 to 6 seemed optimum for this particular type.
- Intervention should be a chance to profile a child's progress in more detail to generate understanding of the areas that might be holding a child back if he or she does not respond to intervention.
- Use small groups e.g. 2-1 for optimum participation;
- Recognise the value of the relationship built with a significant adult – intervention should be an opportunity to use and develop learning conversations relevant to CALPS.
- Intervention must be focused and delivered by trained TAs.
- Acknowledge the real impact of enriched paired reading;
- Build up vocabulary in both languages to overcome poor word knowledge (L1 impact on L2);
- Get resources right for the individual children;
- Type of intervention must include meaningful vocabulary, comprehension strategies, active engagement and dialogue, conversation and deep Knowledge about Language (KAL) ;
- be aware of the need for further individualised monitoring of spelling to maintain progress;
- Include L1.

Recommendations for Training TAs

Benefits from the project were most marked in contexts where a member of the senior management team was highly committed both to the project and to making the most effective use of their TA team.

- To enable TAs to be deployed in a highly effective manner, they need appropriate and focused training in both the nature of the intervention and in record keeping. This should go beyond 'mechanical ' box ticking and develop an understanding of the role of records in tracking a child's literacy and approaches to learning.
- Experience of this type of focused intervention enhances the expertise and confidence of TAs and could comprise one element of experiential training.
- Time taken to prepare and record sessions should be included in TA remuneration.
- Training in ICT use for TAs and communication between IT technicians and learning support staff.
- Discussion and resolution of many issues and sensitivities around the role and status of TAs within schools should enable expertise arising from this type of project to enhance the support offered to bilingual learners within schools.
- The role of communities of practice for TAs should be explored. TAs with varying ranges of skills/ knowledge of languages from different schools in the neighbourhoods expressed real enthusiasm to develop these when brought together at the training. Facilitating this would enhance training and sharing of expertise.
- Recruit TAs with knowledge of the languages of the local communities.

Recommendations for the Whole School context

The project has raised questions of communication; how to gather the information about the child's story - what systems to set up – how to include parents and carers – how to ensure that all involved with the child are aware of this. It has highlighted the following:

- issues of separate silos of expertise ;
- need to install an individual with responsibility for supporting bilingual learners in each school who is not the SENCo;
- need for specific training courses for teaching/monitoring and assessing EAL;
- management and mentoring for TAs;
- schools must pick up and run with what they have been given in terms of resources, experience and developing expertise and apply all this;
- the value of focusing upon a child for a short and intensive period of time.

5. The impact of the study

This study has been ground breaking in its evaluation of the impact of an intervention designed to reflect good practice across the two worlds of dyslexia support and literacy development in bilingual children. It has also been ground breaking in its

attempt to bring together these two worlds and to offer appropriate training to TAs, SENCos and class teachers.

It has been larger scale than other studies within this field in the UK and has brought together a full range of schools with populations of bilingual learners ranging from less than 10% to over 60% in rural and urban areas and from all SES levels. It has attempted to be rigorous in its examination of the potential for screening instruments to identify children at risk of dyslexia and in its selection and interrogation of the impact of the intervention programmes adopted.

This project has taken place within the real world of the school rather than the laboratory. Hence, it adopted from the outset a mixed methodology design, arguably unusual within the field of SpLd/dyslexia. It did aim to meet the gold standard for randomised controlled trials but real life intervened, forcing the abandonment of the random allocation of children to project condition. Other limitations and issues around the reliability of the bench mark testing emerged as reported from the BDA project team's field diaries in section D.

The mixed methodology approach has therefore been doubly justified, not simply for the ways in which the qualitative data strengthens the overall findings but also in the light of the enriched data it has gathered and would be recommended as a way forward for school based research and collaborations between schools and researchers. It offers a unique snapshot of the multilingual world of children within UK primary schools today which has been able to inform a broad range of recommendations and pose further questions, not simply to do with measuring the literacy progress or dyslexia status of the participants, but also for developing the ways in which the community of schools, professionals, parents and children can collaborate to ensure that all these children receive the support that they need.

Final words

This project has aimed to interrogate and apply practice in identifying and supporting bilingual primary school learners who were currently identified as failing to thrive in their literacy development. Overall, although advocating caution in attempting to ascribe dyslexic differences to these children at this stage in their schooling, the findings emphasise the value of short term, focused small group work based upon combining tested principles from the dyslexia and bilingual worlds. Above all they argue that time given to TAs or suitably supported others for small group work on paired reading or other appropriately focused activities will help to enable this group of children to make up for delays in their literacy acquisition and sense of themselves as valued and confident learners.

Appendix 1

Distribution of Languages across the Local Authorities involved in the Project

	Local authority									
	BANES	BRISTOL	SWINDON	WILTS	LIVERPOOL	SALFORD	MANCHESTER	LONDON SOUTHWARK	SOMERSET	Total
arabic	1	0	1	0	4	7	7	2	0	22
Turkish	0	1	1	1	0	0	1	5	0	9
Czech	0	2	0	0	4	3	1	0	0	10
Polish	2	1	4	0	4	0	1	3	4	19
mandarin	0	0	0	0	1	0	0	0	0	1
cantonese	0	0	0	0	4	0	0	1	0	5
Slovak	0	0	0	0	1	0	0	0	0	1
Bengali	0	1	3	0	2	0	5	1	0	12
Dutch	0	0	1	0	1	0	0	0	0	2
Punjabi	0	3	1	0	1	0	5	1	0	11
Somali	0	10	0	0	5	0	9	5	0	29
Urdu	0	1	0	0	0	0	18	2	0	21
Swahili	0	0	0	0	0	0	1	0	0	1
Lithuanian	0	0	0	0	0	0	1	0	0	1
Chinese	0	1	1	0	0	0	1	1	0	4
Pashto (Afgani)	0	0	0	0	0	0	1	0	0	1
Nigerian	0	0	0	0	0	0	1	0	0	1
Albanian	0	1	0	0	0	0	0	1	0	2
Malayalan	0	2	0	0	0	0	0	0	0	2
Gujerati	0	1	0	0	0	0	0	0	0	1
Portugese	1	0	7	0	0	0	0	3	0	11
Konkani	0	0	9	0	0	0	0	0	0	9
Nepalil	0	0	2	1	0	0	0	0	0	3

Afrikaans	0	0	0	0	0	0	0	1	0	1
Ga	0	0	0	2	0	0	0	0	0	2
Twi	0	0	0	0	0	0	0	2	0	2
Yoruba	0	0	0	0	0	0	0	4	0	4
Mandinka	0	0	0	0	0	0	0	1	0	1
Spanish	0	0	0	0	0	0	0	3	0	3
Krio	0	0	0	0	0	0	0	2	0	2
English	0	0	0	0	0	0	0	1	0	1
French	0	0	0	0	0	1	0	2	0	3
Vietnamese	0	0	0	0	0	0	0	1	0	1
Kurdish	0	0	0	0	0	0	0	1	0	1
Guyanan	0	0	0	0	0	0	0	1	0	1
Russian	0	0	0	0	0	0	0	1	0	1
Lingala	0	0	0	0	0	0	0	1	0	1
Igbo	0	0	0	0	0	0	0	1	0	1
Serbo-Croat	0	0	0	0	0	0	0	1	0	1
missing	0	1	1	0	1	0	2	1	0	6
Total	4	25	31	4	28	11	54	49	4	210

Appendix 2

DYSLEXIC PROFILE – A CHECKLIST

based on work by Sandy Ball AMBDA

Tick only PERSISTENT behaviours. A pattern of ticks across ALL FOUR main sections may suggest a dyslexic profile.

No

Name_____

Yr_____ Date:_____

1 ATTAINMENTS

Possible Reading Difficulties

Difficulties learning sound/symbol links	
Difficulties recognizing high frequency/familiar words in text	
Confusion between similar looking letters and words (e.g. *was, saw*)	
Difficulty using phonics to decode words in text	
Hesitant, slow, 'word-by-word' reading	
Slow 'sounding out' each word	
Omissions, insertions, transpositions (letters, words, lines)	
Not reading for meaning or using context as a strategy	*
Poor attention to detail/finer points/prediction in comprehension	
Difficulties summarizing what has happened	
Reluctance to read aloud, or for pleasure	

Possible Spelling/Writing Difficulties

Poor sound/symbol association: non-phonetic spelling or omission of letters	
Difficulty learning common word-specific spelling variations	
Confusion of visually similar letters/words (e.g. b/d; saw/was)	

Reversals of letters or letter strings	
Difficulties with letter formation and/or cursive script	
Difficulties with spatial layout/presentation of work	
Difficulty sequencing ideas and structuring written work	
Content and ideas do not reflect ability	
Uses simple vocabulary that does not reflect ability	
Difficulty expressing ideas in writing, despite comparatively good oral expression	
Difficulty keeping up with demands of course work, despite making effort	

Possible Numeracy Difficulties

Difficulty linking number name with written symbol	
Misreads or fails to remember meanings of signs and symbols	
Difficulty with mathematical language (e.g. terms for concepts)	
Persistent reversals of numerals and numbers	
Confuses similar numbers	
Difficulty remembering number facts (e.g. number bonds, tables)	
Directional confusions in written operations	
Difficulty with counting back/subtraction	
Difficulty understanding place value	
Intuitive rather than 'logical' approach to problems	
Difficulty remembering step-by-step processes	
Difficulty starting tasks/remembering instructions	
Anxiety about maths/tendency to 'panic' when asked questions	

2 UNDERLYING DIFFICULTIES

Dyslexic learners would be expected to have difficulties in some, though not necessarily all, of these areas.

Phonological Skills

Difficulty discriminating and generating rhyming words in speech	
Difficulty blending separately spoken phonemes for spelling	
Difficulty segmenting spoken words into phonemes for spelling (breaking words into sounds)	
Tendency to mis-sequence phonemes ('spoonerisms', mispronunciations)	

Working Memory/Sequencing

Problems remembering days of week, months, address in Language 1	*
Difficulty with sequencing, e.g. counting; days of week; remembering sequenced data	
Difficulty in following instructions	
Relying on others for what to do	
Difficulty sustaining concentration on task	
Difficulty in maintaining train of thought	
Difficulty planning work and organising ideas	
Difficulty organizing/ordering tasks or elements within a task	
Difficulty retaining concepts from one lesson to the next	

Automaticity/Speed of Processing

Difficulty learning skills to automatic level – forgets quickly	
Slow, laboured reading	
Slow, laboured writing	
Slow or delayed responses in talk	
Slow to process instructions	
Skills not transferred into independent reading and writing	
Problems dual-tasking (e.g. in note-taking)	
Skills deteriorate under pressure	

Oral Fluency

Persisting problems producing some sounds in speech	
Sound sequencing difficulties (e.g. 'hostipal'; 'par cark')	

Word-finding difficulties	
Reluctance to contribute orally, despite apparent understanding	
Delayed or non-responses to questions or in discussions	
Circumlocution ('talking around' a forgotten word)	

Visual/Motor Skills

Difficulty dressing/undressing – buttons, laces etc.	
Late hand preference	
Left-right confusion (fine or gross motor activities, games etc.)	
Clumsiness (e.g. poor use of fine tools; can't follow dance sequences)	
Difficulties with balance (e.g. in gymnastics; riding bike etc.)	
Tracking difficulties – omitting words or lines when reading	
Difficulty copying (shapes, letters, numbers, words)	
Problems copying from the board	

Organisational Skills

Persistently losing belongings	
Problems remembering to bring equipment needed e.g. letters, dinner money	
Problems assembling equipment needed	
Uncertainty about what day it is, times, timetables, routines etc	
Difficulties organising ideas (e.g. relating events in sequence)	
Poor sense of direction	

Classroom Behaviour

Variable concentration span (poor in literacy-based tasks)	
Avoidance strategies (e.g. sharpening pencil, going to toilet, bad behaviour)	
Reluctant to write	
High levels of effort often for little result	
Over- or persistent tiredness	
Frustration / disruptive behaviour / disaffection	

3 COMPARATIVE STRENGTHS

Lateral thinking – creative 'mental links' (e.g. between subjects, ideas)	
Able to have several ideas at once (e.g. 'mind map')	
Imaginative ways of working (e.g. unusual ideas, different presentation style)	
Constructional/technical abilities	
Holistic thinking ('all parts at once'; good at 3D representation)	
Visualisation skills	
Musical ability	
Design skills	
Artistic expression	
Verbal expression	

4 DISCREPANCIES

Literacy or numeracy attainments / general ability	
Literacy / oral language skills	
Written work / practical activities	
Written recording / understanding of topic	
Reading comprehension / listening comprehension	
Performance in different subjects/lessons	
Literacy/creative or practical abilities	
Organisation/creativity	

Appendix 3

FULL ASSESSMENT RECORD SHEET

FULL ASSESSMENT RECORD SHEET						
Name of Assessor: Lynda Hansen						
Date of test:		School:				
Child's name:		Child's code no:				
Date of birth:		Chronological age: years months				
Child's first language(s):						
Test	**Specific Skill**	**General Skill Area**	**Raw score**	**Standard score**	**% ile**	**C.I.**
WRIT	Matrices	Nonverbal (visual)	/ 53			na
	Diamonds		/ 56			na
TAPS 3	Segmenting	Phonological processing	/ 35			na
	Blending		/ 35			na
	Numbers forward	Short term working memory	/ 32			na
	Numbers reversed		/ 32			na
WRAT 4 (green)	Single word	Reading	/ 70			
	Single word	Spelling	/ 57			
	Silent reading	Comprehension	/50			

TAPS 3 CTOPP	Word memory	Auditory memory	/ 30			na
	Non -word repetition		/ 18			na
BPVS	Receptive language	Language	/ 168			
Turner	Non-word decoding	Phonological proc	/ 39	na	na	
TAPS	Auditory comp		/ 32			na
CTOPP	Rapid digits	Rapid naming (time in seconds)				na
	Rapid letters					na
	Rapid colour					na
	Rapid object					na

Appendix 4

Intervention Timetable: Week 1

Week 1	Pupil A	Pupil B
Mon	Introduction to Rapid Reading books for both pupils. TA explains how the scheme works and shows the children the books from their Stage. Each child chooses a first book and takes turns to read with the TA while the other child watches. Both children can be involved in the discussion of the text topics.	
Tues	Introduction to the Rapid Reading Assistant. TA sets up both children on the software voice recognition. Children take turns to practise the *Read to Me* and *Read and Record* features.	
Wed	Consolidation and further practice of Rapid. Re-reads first text with TA.	Consolidation and further practice of Rapid. Works on computer with *Read to Me/ Read and Record.*
	Work on computer with *Read to Me/ Read and Record.*	Re-reads text with TA.
Thurs	Free writing task for both children – please see instructions on pages 3-4 of this handbook.	
Fri	Introduction to Nessy. TA shows the children how the programme works and its main features. Children's names and passwords are set up and each child has a chance to practise.	

Intervention Timetable: Week 2

Week 2	Pupil A	Pupil B
Mon	Nessy Spelling Challenge/Tricky Words test. One child does Challenge while the other completes the first set of the Nessy tricky words test; then reverse.	
Tues	Consolidation of Nessy. Use computer programme to work on the problem areas identified by the Challenge.	Consolidation of Nessy. Use worksheet to work on the problem areas identified by the Challenge.
	Worksheet with TA.	Practise using computer programme.
Wed	Further consolidation of Rapid: Second text in chosen book: *Read to Me*	Further consolidation of Rapid: Second text in chosen book: Read with TA
	Second text in chosen book: Read with TA.	Second text in chosen book: *Read to Me*.
Thurs	Depending on pupils' progress: EITHER continue to practise texts from first book, OR do expansion activities using texts from first book. OR, if these materials have already been fully exploited and the children are becoming bored with them, allow them to choose a new book.	
Fri	Further consolidation of Nessy. Use worksheet to work on the problem areas identified by the Tricky Words test.	Further consolidation of Nessy Use computer programme to work on the problem areas identified by the Tricky Words test.
	Practise using computer programme.	Worksheet with TA.

Intervention Timetable: Week 3 onwards

	Pupil A	Pupil B
Mon	Rapid Reading: New book introduced; first text read 1:1 with TA.	Nessy: computer practice of spelling rules.
	Rapid Reading Assistant (RRA): pupil works on text with RRA software programme.	Rapid Reading: New book introduced; first text read 1:1 with TA
Tues	Nessy: worksheet/multi-sensory practice of spelling rules.	Rapid Reading Assistant (RRA): pupil works on text with RRA software programme.
	Nessy: computer practice of spelling rules.	Optional: work on Rapid Reading worksheets.
Wed	Nessy: computer practice of tricky words and multi-sensory reinforcvement using Rainbow Writing (see page 17).	Rapid Reading: New book introduced; first text read 1:1 with TA.
	Rapid Reading: New book introduced; first text read 1:1 with TA.	Rapid Reading Assistant: pupil works on text with RRA software programme.
Thurs	Rapid Reading Assistant: pupil works on text with RRA software programme.	Nessy: worksheet/multi-sensory practice of spelling rules.
	Optional: work on Rapid Reading worksheets.	Nessy: computer practice of tricky words and multi-sensory reinforcvement using Rainbow Writing (see page 17).
Fri	**Catch-up session**: Each Friday, continue games on Nessy and multi-sensory spelling activities as for spelling rules/patterns and for tricky words. Complete the narrative record with each child; do Rapid Benchmark Assessment as necessary. This time can also be used to do expansion activities (see page 12).	

Appendix 5

Technical Appendices: Intervention findings

Intervention Table 1: Distribution of sample across gender

project condition phase 1 * gender

Count

		gender		
		girl	boy	Total
project condition phase 1	Specialist intervention	46	59	105
	paired reading	20	26	46
	control	27	35	62
	missing	3	0	3
Total		96	120	216

Intervention Table 2: Distribution of sample across school years

project condition phase 1 * Year at school Crosstabulation

Count

		Year at school			
		4	5	6	Total
project condition phase 1	Specialist intervention	45	35	24	104
	paired reading	14	23	9	46
	control	20	30	12	62
	missing	2	1	0	3
Total		81	89	45	215

Intervention Table 3: Distribution of sample across LA

Local authority

project condition phase 1			Frequency	Percent	Valid Percent	Cumulative Percent
intervention	Valid	BANES	4	3.8	3.8	3.8
		BRISTOL	13	12.5	12.5	16.3
		SWINDON	29	27.9	27.9	44.2
		LIVERPOOL	28	26.9	26.9	71.2
		SALFORD	11	10.6	10.6	81.7
		MANCHESTER	19	18.3	18.3	100.0
		Total	104	100.0	100.0	
paired reading	Valid	SWINDON	2	4.4	4.4	4.4
		WILTS	4	8.9	8.9	13.3
		MANCHESTER	35	77.8	77.8	91.1
		Somerset	4	8.9	8.9	100.0
		Total	45	100.0	100.0	
control	Valid	BRISTOL	9	15.0	15.0	15.0
		SOUTHWAR/LONDON	51	85.0	85.0	100.0
		Total	60	100.0	100.0	
missing	Valid	BRISTOL	3	100.0	100.0	100.0

The scores for the control group were the strongest and the paired reading the weakest of the three groups throughout. A series of ANOVA and post hoc comparisons using the Tukey HSD test revealed significant differences between the control and the other two groups were significant across the BPVS receptive language, the WRAT single word reading [F (2,189)= 6.4; p = .002], WRAT Sentence comprehension [F (2,179)= 11.2; p = <.001]., YARC reading accuracy [F (2,174)= 5.6; p = .005] and YARC reading rate [F (2,147)= 9.6; p = <.001]. The differences between the groups did not reach significance in either the WRAT single word spelling, the non-word tests of phonological decoding or the National Curriculum levels of the pre writing sample.

Intervention Table 4 **Analyses comparing groups on improvements in literacy/language measures in phase 1**

Table of pre-intervention means and standard deviations (SD).

project condition phase 1		Pre WRAT single word reading raw	Pre WRAT single word spelling raw	Pre WRAT sentence comp raw	Pre YARC reading accuracy raw	Pre YARC reading rate raw	Pre YARC reading comp raw	Pre BPVS raw	Pre non-word raw score	Pre freewriting words per min
intervention	Mean	30.0638	21.6774	10.7978	39.9885	50.1250	46.5682	87.4066	15.7500	7.5160
	N	94	93	89	87	72	88	91	88	92
	SD	9.35996	5.33276	6.86092	7.61195	17.99760	11.62419	21.37027	8.19903	4.93007
paired reading	Mean	28.5366	21.5366	10.4474	39.5854	38.0882	44.6341	83.8049	17.4390	6.7537
	N	41	41	38	41	34	41	41	41	41
	SD	6.96095	4.34797	6.82878	8.57606	21.97846	11.74469	12.59408	8.86580	3.11585
control	Mean	34.6727	22.8727	15.6604	43.8723	55.1667	51.3617	99.1538	18.8936	7.3277
	N	55	55	53	47	42	47	52	47	47
	SD	12.23240	5.15340	6.22632	7.59467	14.49124	8.50173	16.54392	9.09427	2.61565
Total	Mean	31.0684	21.9947	12.1556	40.9371	48.7905	47.3977	89.9239	16.9830	7.2932
	N	190	189	180	175	148	176	184	176	180
	SD	10.08905	5.08805	7.01540	8.00011	19.03783	11.13814	19.26901	8.65562	4.04681

WRAT Single Word Reading

Table 5 : ANOVA comparisons for WRAT Single word reading pre and post intervention

The important effect is the interaction between group and time, which indicates whether improvements over time differ significantly between the three groups.

Project condition phase 1 * time: Pre and Post mean scores for WRAT single word reading

Measure:MEASURE_1

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
intervention	1	30.193	1.069	28.084	32.303
	2	32.795	.791	31.233	34.358
paired reading	1	28.537	1.566	25.446	31.627
	2	31.732	1.159	29.443	34.020
control	1	34.340	1.462	31.454	37.227
	2	33.638	1.083	31.501	35.776

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	227.613	1	227.613	7.252	.008
time * projcond1	Linear	215.050	2	107.525	3.426	.035
Error(time)	Linear	5429.674	173	31.385		

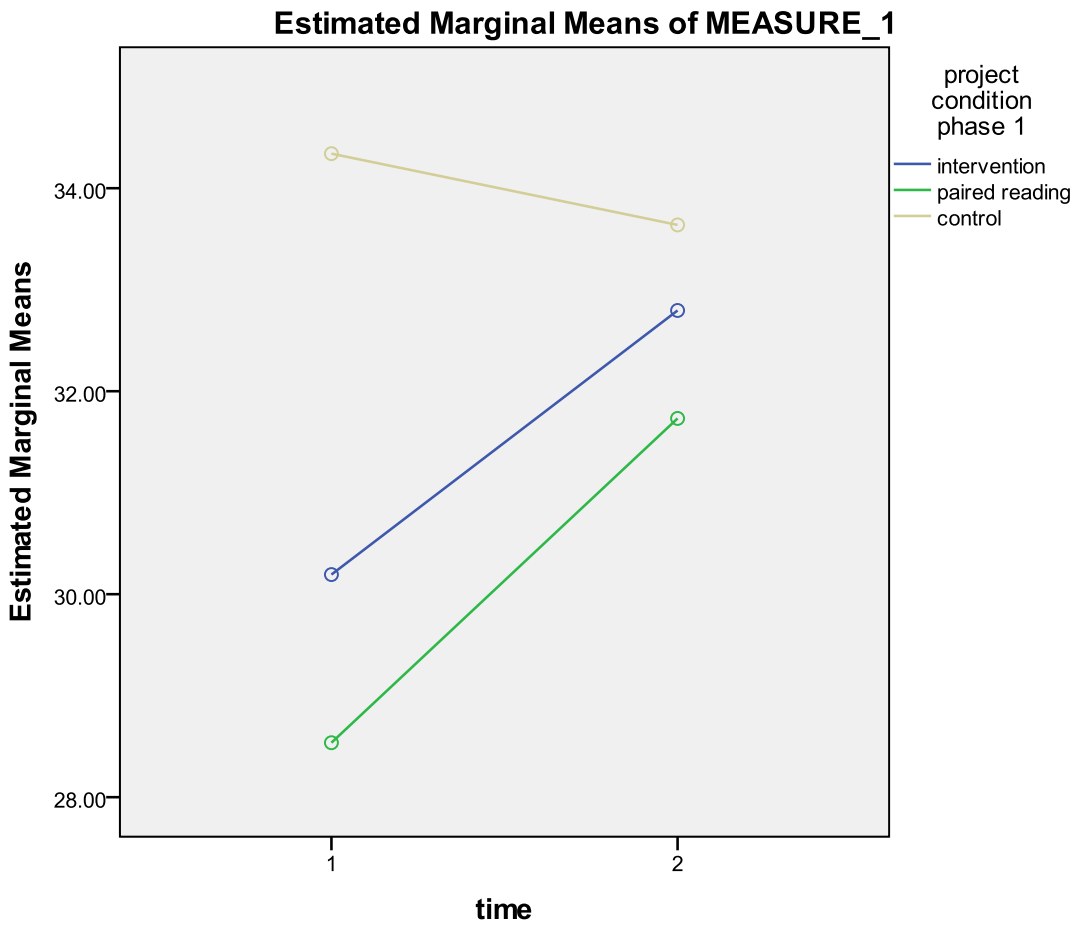
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	320627.473	1	320627.473	2580.412	.000
projcond1	693.898	2	346.949	2.792	.064
Error	21496.008	173	124.254		

The interaction effect is significant ($F_{(2,173)}$=3.43, p=.035) and is presented in Figure 1.



The interaction effect, as shown in the graph, indicates that there are improvements in the intervention and paired reading groups, but not in the control: i.e., improvements differ for the intervention and paired reading groups compared to the control group. (These improvements can be seen in the graph and the table of pre and post mean scores.)

The following analyses compare improvements between each pair of groups: i.e., intervention against control, paired reading against control and intervention against paired reading. These use analyses of variance (ANOVA) with 2 levels of the group factor and 2 levels of the repeated measures time factor.

Again, the interaction is the important effect and the analyses indicate that there are significant interactions when intervention and control are compared ($F(1,133)=4.48$, $p=.036$), and when paired reading and control are compared ($F(1,86)=4.15$, $p=.045$), but not when intervention and paired reading are compared ($F(1,127)<1$). This is consistent with the graph: i.e., significant improvements for the intervention and paired reading groups are shown in contrast to the controls, though the improvements for the intervention and paired reading groups are about equivalent.

Tables 6a - c : Comparisons of improvements over time within the three groups

1. Intervention V Control a

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	55.308	1	55.308	1.481	.226
time * projcond1	Linear	167.264	1	167.264	4.478	.036
Error(time)	Linear	4967.455	133	37.349		

2. Paired reading V Control b

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	68.047	1	68.047	1.700	.196
time * projcond1	Linear	166.297	1	166.297	4.154	.045
Error(time)	Linear	3443.134	86	40.036		

3. Intervention V Paired reading c

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	470.016	1	470.016	24.376	.000
time * projcond1	Linear	4.915	1	4.915	.255	.615
Error(time)	Linear	2448.759	127	19.282		

Table 6: a – c Paired t-tests comparing improvements between the three groups

1. Intervention a

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre WRAT single word reading raw - WRATsingle word reading post	-2.60227	6.75778	.72038	-4.03411	-1.17044	-3.612	87	.001

2. Paired reading b

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre WRAT single word reading raw - WRATsingle word reading post	-3.19512	4.80739	.75079	-4.71252	-1.67772	-4.256	40	.000

3. Control c

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre WRAT single word reading raw - WRATsingle word reading post	.70213	11.38442	1.66059	-2.64046	4.04472	.423	46	.674

Finally, the improvements in scores for each group were assessed using paired t-tests shown in tables 3 a – c. These indicated significant improvements for the intervention group ($t_{(87)}$=3.61, p=.001) and for the paired reading group ($t_{(40)}$=4.26, p<.001), but not for the control group ($t_{(46)}$=0.42, p=.674).

WRAT word spelling

Intervention Table 7

ANOVA comparisons for WRAT Single word spelling, pre and post intervention.

project condition phase 1 * time

Measure:MEASURE_1

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
intervention	1	21.701	.545	20.626	22.776
	2	25.966	.512	24.954	26.977
paired reading	1	21.537	.793	19.970	23.103
	2	23.805	.746	22.332	25.278
control	1	22.578	.757	21.083	24.073
	2	24.489	.712	23.083	25.895

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	613.503	1	613.503	73.900	.000
time * projcond1	Linear	104.416	2	52.208	6.289	.002
Error(time)	Linear	1411.306	170	8.302		

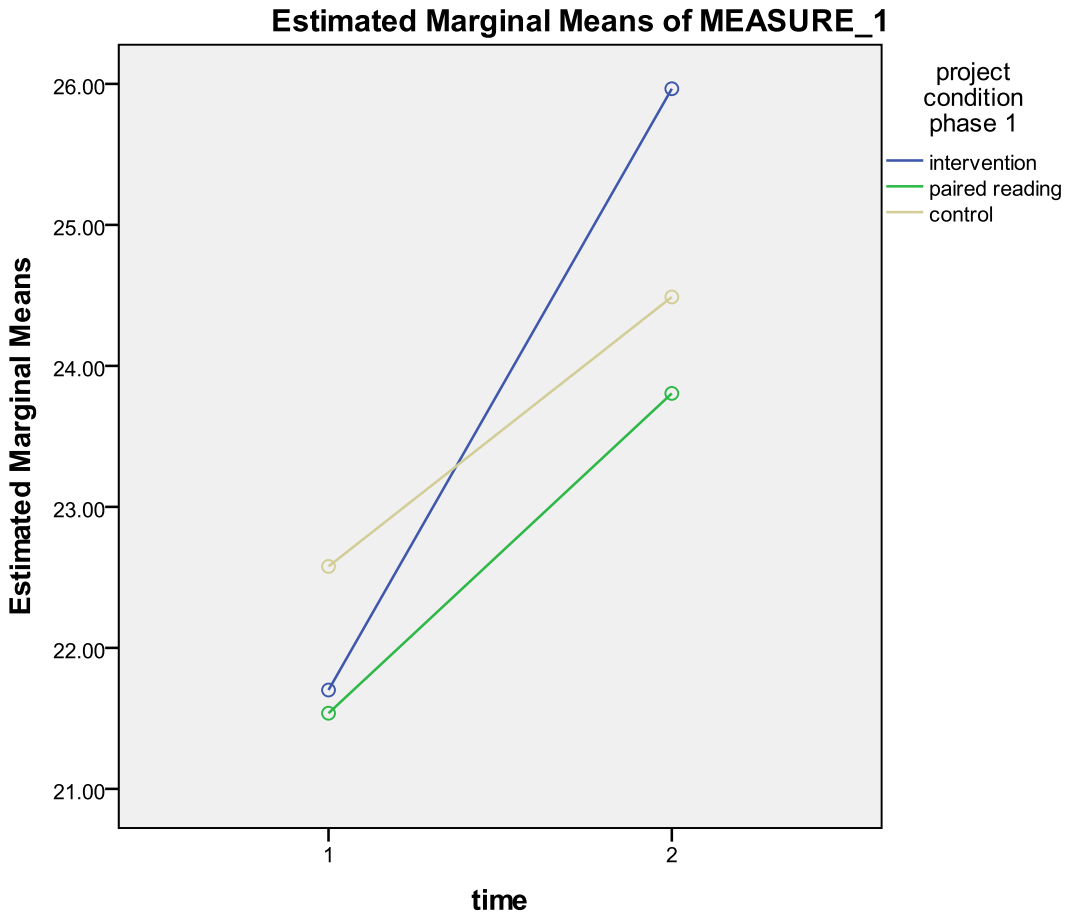
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	168835.455	1	168835.455	4184.776	.000
projcond1	75.682	2	37.841	.938	.393
Error	6858.676	170	40.345		

The interaction effect is significant ($F_{(2,170)}$=6.29, p=.002) and is presented in the graph.



The interaction effect, as shown in the graph, suggests that there are larger improvements in the intervention group compared to both the paired reading and control groups. (These improvements can be seen in the graph and the table of pre and post mean scores.)

The analyses indicate that there are significant interactions when intervention and control are compared ($F_{(1,130)}$=10.48, p=.002), and when intervention and paired reading are compared ($F_{(1,126)}$=7.73, p=.006), but not when paired reading and control are compared ($F_{(1,84)}$<1). This is consistent with the graph: i.e., significantly larger improvements for the intervention group compared to the other two groups.

Tables 8a - f : Comparisons of improvements over time within the three groups

1. Intervention V Control a.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	565.548	1	565.548	72.201	.000
time * condP1	Linear	82.123	1	82.123	10.484	.002
Error(time)	Linear	1018.282	130	7.833		

2. Paired reading V Control b.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	187.369	1	187.369	17.510	.000
time * projcond1	Linear	1.369	1	1.369	.128	.722
Error(time)	Linear	898.847	84	10.701		

3. Intervention V Paired reading c.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	594.625	1	594.625	82.743	.000
time * projcond1	Linear	55.516	1	55.516	7.725	.006
Error(time)	Linear	905.484	126	7.186		

Table 9: a – c Paired t-tests comparing improvements between the three groups

1. Intervention a

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre WRAT single word spelling raw - WRATsingle word spelling post	-4.26437	3.45220	.37011	-5.00013	-3.52860	-11.522	86	.000

2. Paired reading b.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre WRAT single word spelling raw - WRATsingle word spelling post	-2.26829	4.43297	.69231	-3.66751	-.86907	-3.276	40	.002

3. Control c.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre WRAT single word spelling raw - WRATsingle word spelling post	-1.91111	4.79499	.71479	-3.35169	-.47054	-2.674	44	.010

Finally, the improvements in scores for each group were assessed using paired t-tests. These indicated significant improvements for the intervention group ($t_{(86)}$=11.52, p<.001), for the paired reading group ($t_{(40)}$=3.28, p=.002), and for the control group ($t_{(44)}$=2.67, p=.010).

Effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort (N=189, SD=5.09) as an estimate of population variability.

Effect size (improvements) for the intervention group: 4.26 / 5.09 = 0.84
Effect size (improvements) for the paired reading group: 2.27 / 5.09 = 0.45
Effect size (improvements) for the control group: 1.91 / 5.09 = 0.38

Overall, the effects sizes for all three groups are moderate to very good. The intervention group shows the largest effect size.

WRAT comprehension

Intervention Table 10

ANOVA comparisons for WRAT sentence comprehension , pre and post intervention

project condition phase 1 * time

Measure:MEASURE_1

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
intervention	1	11.072	.724	9.643	12.502
	2	15.373	.749	13.895	16.852
paired reading	1	10.447	1.070	8.335	12.560
	2	15.526	1.107	13.341	17.712
control	1	15.302	1.006	13.316	17.288
	2	18.023	1.040	15.969	20.078

Table 11a: Comparisons of improvements over time within the three groups

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	1188.224	1	1188.224	70.038	.000
time * projcond1	Linear	60.689	2	30.344	1.789	.170
Error(time)	Linear	2731.442	161	16.965		

Table 11b: Comparisons of improvements over time between the three groups

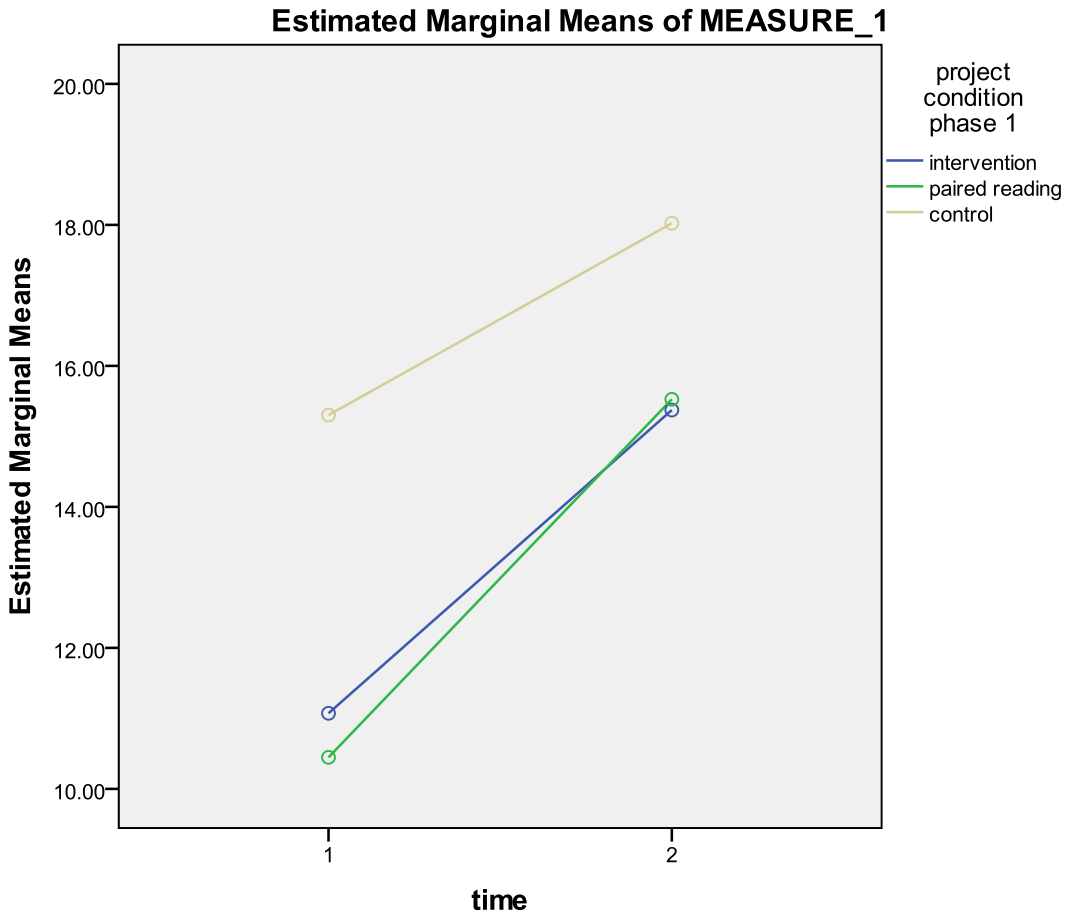
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	59657.885	1	59657.885	816.574	.000
projcond1	786.426	2	393.213	5.382	.005
Error	11762.461	161	73.059		

The interaction effect is non-significant ($F_{(2,161)}$=1.79, p=.170) and is presented in the graph.



The interaction effect, as shown in the graph, suggests that improvements are roughly equivalent for all three groups. (These improvements can be seen in the graph and the table of pre and post mean scores.) Given the non-significant interaction, comparisons across pairs of groups were not performed.

Tables 12: a – c Paired t-tests comparing improvements between the three groups

1. Intervention a

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre WRAT sentence comp raw - WRAT sentence comp raw post	-4.30120	5.35276	.58754	-5.47001	-3.13240	-7.321	82	.000

2. Paired reading b

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre WRAT sentence comp raw - WRAT sentence comp raw post	-5.07895	7.20878	1.16942	-7.44842	-2.70948	-4.343	37	.000

3. Control c.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre WRAT sentence comp raw - WRAT sentence comp raw post	-2.72093	5.32436	.81196	-4.35953	-1.08233	-3.351	42	.002

Improvements in scores for each group were assessed using paired t-tests. These indicated significant improvements for the intervention group ($t_{(82)}$=7.32, p<.001), for the paired reading group ($t_{(37)}$=4.34, p<.001), and for the control group ($t_{(42)}$=3.35, p=.002).

Effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort (N=180, SD=7.02) as an estimate of population variability.

Effect size (improvements) for the intervention group: 4.30 / 7.02 = 0.61
Effect size (improvements) for the paired reading group: 5.08 / 7.02 = 0.72
Effect size (improvements) for the control group: 2.72 / 7.02 = 0.39

Overall, the effects sizes for all three groups are moderate to very good. The intervention and paired reading groups, though, show very good effect sizes that are about twice that of the control group.

YARC reading accuracy

Intervention Table 13

ANOVA comparisons for YARC reading accuracy , pre and post intervention

project condition phase 1 * time

Measure:MEASURE_1

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
intervention	1	40.059	.844	38.392	41.725
	2	45.035	.977	43.105	46.965
paired reading	1	38.789	1.262	36.297	41.282
	2	43.184	1.462	40.298	46.071
control	1	43.556	1.160	41.265	45.846
	2	47.800	1.343	45.148	50.452

Table 14: Comparisons of improvements over time within the three groups

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	1537.128	1	1537.128	75.200	.000
time * projcond1	Linear	9.468	2	4.734	.232	.794
Error(time)	Linear	3372.671	165	20.440		

Table 15: Comparisons of improvements over time between the three groups

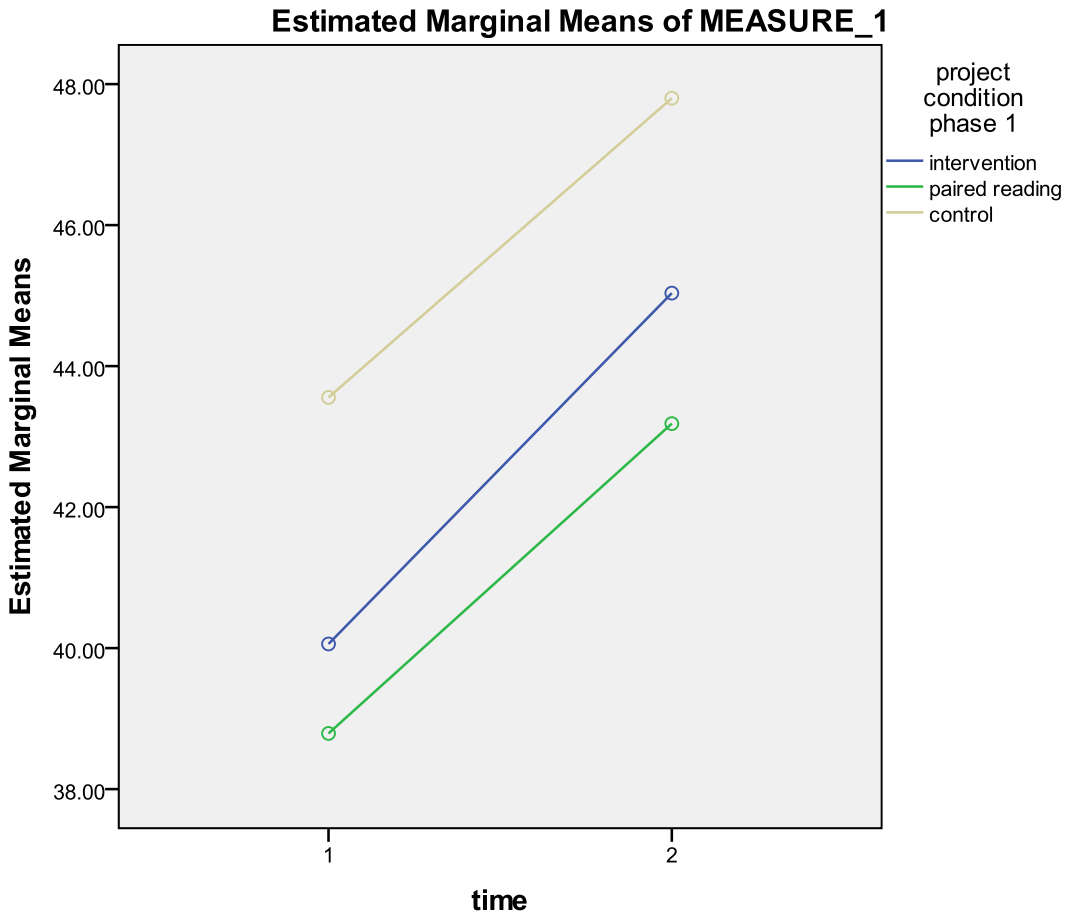
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	553728.209	1	553728.209	4564.317	.000
projcond1	987.874	2	493.937	4.071	.019
Error	20017.266	165	121.317		

The interaction effect is non-significant ($F_{(2,165)}$<1) and is presented in the graph.



The interaction effect, as shown in the graph, suggests that improvements are roughly equivalent for all three groups – i.e., three roughly parallel lines. (These improvements can be seen in the graph and the table of pre and post mean scores.)

Given the non-significant interaction, comparisons across pairs of groups will not be performed.

Tables 16: a – c Paired t-tests comparing improvements between the three groups

1. Intervention a

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre YARC reading accuracy raw - YARC reading accuracy Post	-4.97647	5.10830	.55407	-6.07830	-3.87464	-8.982	84	.000

2. Paired reading b

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre YARC reading accuracy raw - YARC reading accuracy Post	-4.39474	4.56508	.74055	-5.89524	-2.89423	-5.934	37	.000

3. Control c

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre YARC reading accuracy raw - YARC reading accuracy Post	-4.24444	9.27155	1.38212	-7.02993	-1.45896	-3.071	44	.004

Improvements in scores for each group were assessed using paired t-tests. These indicated significant improvements for the intervention group ($t_{(84)}$=8.98, p<.001), for the paired reading group ($t_{(37)}$=5.93, p<.001), and for the control group ($t_{(44)}$=3.07, p=.004).

Effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort (N=175, SD=8.00) as an estimate of population variability.

Effect size (improvements) for the intervention group: 4.98 / 8.00 = 0.62
Effect size (improvements) for the paired reading group: 4.39 / 8.00 = 0.55
Effect size (improvements) for the control group: 4.24 / 8.00 = 0.53

Overall, the effects sizes for all three groups are good and roughly equal.

YARC reading Rate

Table 17

ANOVA comparisons for YARC reading rate , pre and post intervention

project condition phase 1 * time

Measure:MEASURE_1

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
intervention	1	50.557	2.103	46.399	54.715
	2	55.914	1.807	52.341	59.487
paired reading	1	38.500	3.110	32.350	44.650
	2	48.250	2.673	42.965	53.535
control	1	55.050	2.782	49.550	60.550
	2	59.600	2.391	54.873	64.327

Table 18: Comparisons of improvements over time within the three groups

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	2739.061	1	2739.061	26.352	.000
time * projcond1	Linear	280.497	2	140.248	1.349	.263
Error(time)	Linear	14447.986	139	103.942		

Table 19: Comparisons of improvements over time between the three groups

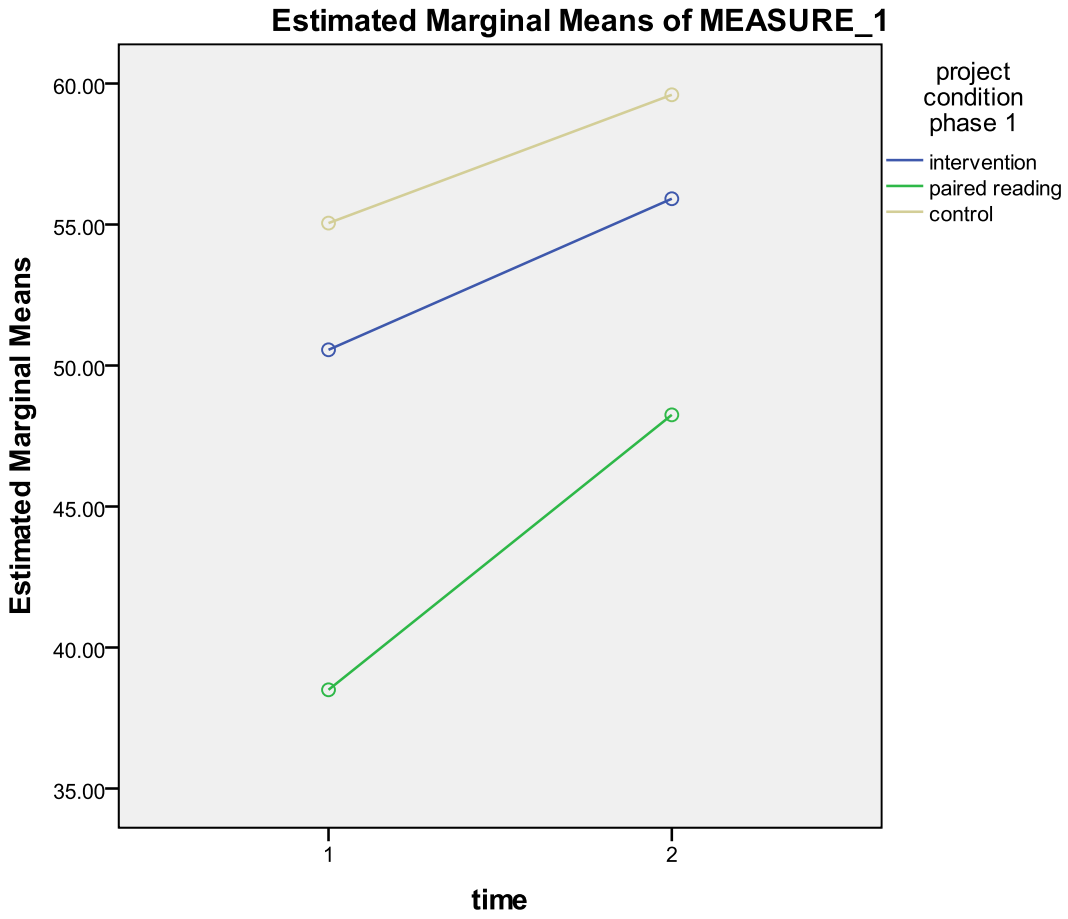
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	671892.370	1	671892.370	1547.260	.000
projcond1	7235.450	2	3617.725	8.331	.000
Error	60360.271	139	434.247		

The interaction effect is non-significant ($F_{(2,139)}$=1.35, p=.263) and is presented in the graph.



The interaction effect, as shown in the graph, suggests that improvements are roughly equivalent for all three groups – i.e., three roughly parallel lines. (These improvements can be seen in the graph and the table of pre and post mean scores.)

Given the non-significant interaction, comparisons across pairs of groups will not be performed.

Tables 20: a – c Paired t-tests comparing improvements between the three groups

1. Intervention a

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre YARC reading rate raw - YARC reading rate Post	-5.35714	12.98275	1.55174	-8.45277	-2.26152	-3.452	69	.001

2. Paired reading b

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre YARC reading rate raw - YARC reading rate Post	-9.75000	21.09885	3.72978	-17.35695	-2.14305	-2.614	31	.014

3. Control c

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre YARC reading rate raw - YARC reading rate Post	-4.55000	9.42705	1.49055	-7.56492	-1.53508	-3.053	39	.004

Improvements in scores for each group were assessed using paired t-tests. These indicated significant improvements for the intervention group ($t_{(69)}$=3.45, p=.001), for the paired reading group ($t_{(31)}$=2.61, p=.014), and for the control group ($t_{(39)}$=3.05, p=.004).

Effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort (N=148, SD=19.04) as an estimate of population variability.

Effect size (improvements) for the intervention group: 5.36 / 19.04 = 0.28
Effect size (improvements) for the paired reading group: 9.75 / 19.04 = 0.51
Effect size (improvements) for the control group: 4.55 / 19.04 = 0.24

Overall, the effects sizes for all three groups are moderate to good, with that for the paired reading group being the largest and about twice that for the other two groups.

YARC reading comprehension

Table 21

ANOVA comparisons for YARC reading comprehension , pre and post intervention

Measure:MEASURE_1

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
intervention	1	46.593	1.177	44.269	48.918
	2	53.093	1.136	50.851	55.335
paired reading	1	43.605	1.771	40.108	47.102
	2	50.553	1.708	47.180	53.925
control	1	51.178	1.628	47.964	54.391
	2	53.289	1.570	50.190	56.388

Table 22: Comparisons of improvements over time within the three groups

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	2011.656	1	2011.656	47.260	.000
time * projcond1	Linear	340.814	2	170.407	4.003	.020
Error(time)	Linear	7065.920	166	42.566		

Table 23: Comparisons of improvements over time between the three groups

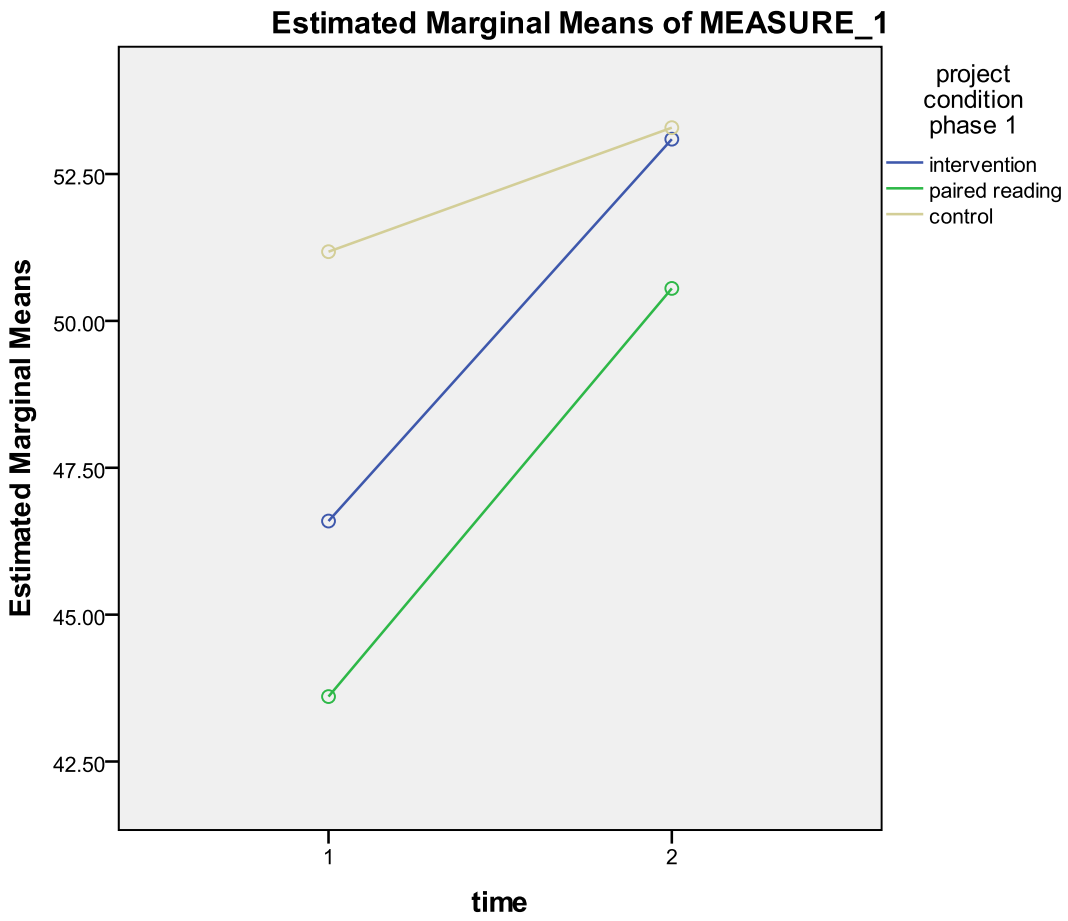
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	739531.788	1	739531.788	3943.487	.000
projcond1	1094.795	2	547.398	2.919	.057
Error	31130.388	166	187.532		

The interaction effect is significant ($F_{(2,166)}$=4.00, p=.020) and is presented in the graph.



The interaction effect, as shown in the graph, indicates that there are improvements in the intervention and paired reading groups that seem larger than those for the control: i.e., improvements differ for the intervention and paired reading groups compared to the control group. (These improvements can be seen in the graph and the table of pre and post mean scores.)

The following analyses compare improvements between each pair of groups: i.e., intervention against control, paired reading against control and intervention against paired reading. These use analyses of variance with 2 levels of the group factor and 2 levels of the repeated measures time factor.

Again, the interaction is the importance effect and the analyses indicate that there are significant interactions when intervention and control are compared ($F_{(1,129)}$=6.75, p=.010), and when paired reading and control are compared ($F_{(1,81)}$=7.67, p=.007), but not when intervention and paired reading are compared ($F_{(1,122)}$<1). This is consistent with the graph: i.e., significant improvements for the intervention and paired reading groups in contrast to the controls, though the improvements for the intervention and paired reading groups are about equivalent.

Tables 24a - c : Comparisons of improvements over time within the three groups

1. Intervention V Control a.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	1095.287	1	1095.287	25.978	.000
time * condP1	Linear	284.524	1	284.524	6.748	.010
Error(time)	Linear	5438.972	129	42.163		

2. Paired reading V Control b.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	845.276	1	845.276	26.890	.000
time * projcond1	Linear	240.939	1	240.939	7.665	.007
Error(time)	Linear	2546.170	81	31.434		

3. Intervention V Paired reading c.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	2382.895	1	2382.895	47.296	.000
time * projcond1	Linear	2.637	1	2.637	.052	.819
Error(time)	Linear	6146.697	122	50.383		

Tables 25 a – c Paired t-tests comparing improvements between the three groups

1. Intervention a

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre YARC reading comp raw - YARC reading comp post	-6.50000	10.31247	1.11202	-8.71100	-4.28900	-5.845	85	.000

2. Paired reading b.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre YARC reading comp raw - YARC reading comp post	-6.94737	9.37780	1.52128	-10.02977	-3.86496	-4.567	37	.000

3. Control c.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre YARC reading comp raw - YARC reading comp post	-2.11111	6.46396	.96359	-4.05310	-.16912	-2.191	44	.034

Improvements in scores for each group were assessed using paired t-tests. These indicated significant improvements for the intervention group ($t_{(85)}$=5.85, p<.001), for the paired reading group ($t_{(37)}$=4.57, p<.001), and for the control group ($t_{(44)}$=2.19, p=.034).

Effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort (N=176, SD=11.14) as an estimate of population variability.

Effect size (improvements) for the intervention group: 6.50 / 11.14 = 0.58
Effect size (improvements) for the paired reading group: 6.95 / 11.14 = 0.62
Effect size (improvements) for the control group: 2.11 / 11.14 = 0.19

Overall, the effects sizes for the intervention and paired reading groups are good and about equivalent; that for the control group is much smaller.

BPVS

Table 26

ANOVA comparisons for BPVS , pre and post intervention

project condition phase 1 * time

Measure:MEASURE_1

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
intervention	1	88.282	1.979	84.374	92.190
	2	97.129	1.962	93.255	101.004
paired reading	1	83.805	2.850	78.178	89.432
	2	93.171	2.826	87.592	98.749
control	1	98.455	2.751	93.023	103.886
	2	102.159	2.728	96.774	107.544

Table 27: Comparisons of improvements over time within the three groups

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	4079.117	1	4079.117	73.014	.000
time * projcond1	Linear	463.714	2	231.857	4.150	.017
Error(time)	Linear	9329.842	167	55.867		

Table 28: Comparisons of improvements over time between the three groups

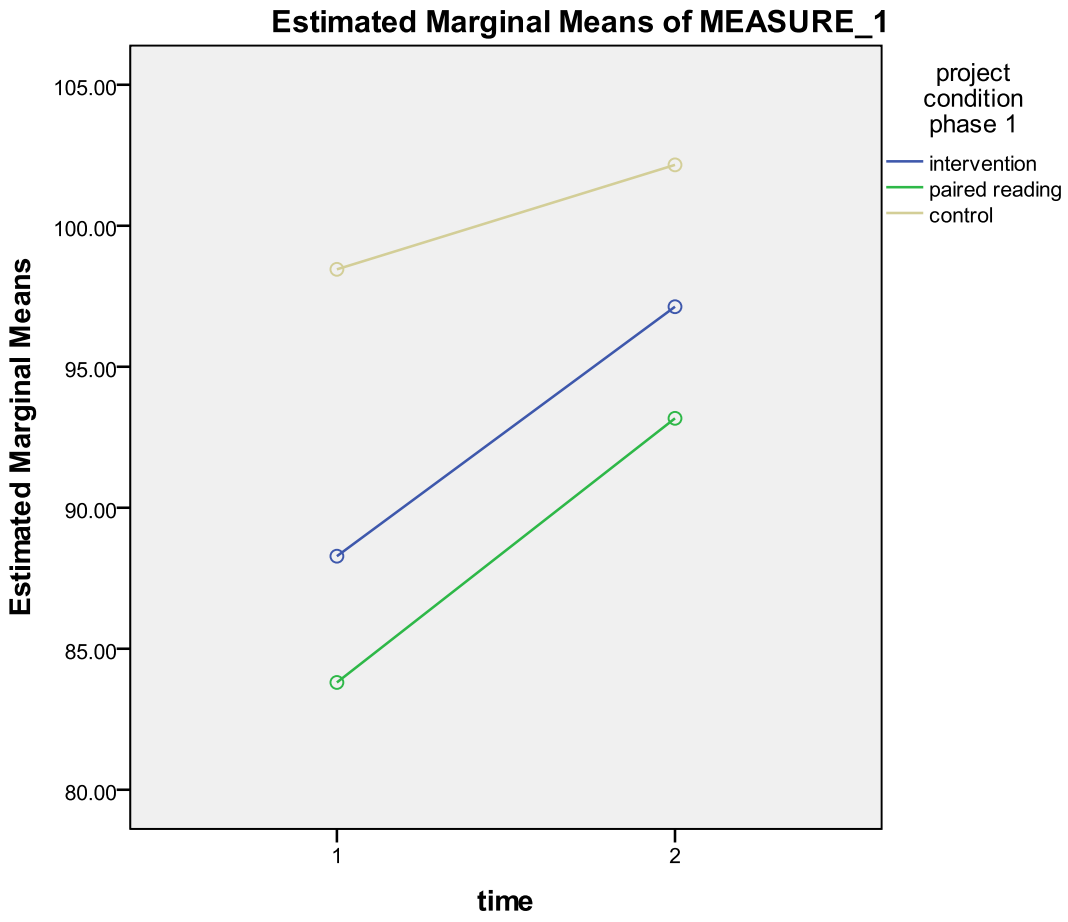
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2691560.582	1	2691560.582	4452.518	.000
projcond1	6236.240	2	3118.120	5.158	.007
Error	100951.998	167	604.503		

The interaction effect is significant ($F_{(2,167)}$=4.15, p=.017) and is presented in the graph.



The interaction effect, as shown in the graph, indicates that there are improvements in the intervention and paired reading groups that seem larger than those for the control: i.e., improvements differ for the intervention and paired reading groups compared to the control group. (These improvements can be seen in the graph and the table of pre and post mean scores.)

The following analyses compare improvements between each pair of groups: i.e., intervention against control, paired reading against control and intervention against paired reading. These use analyses of variance with 2 levels of the group factor and 2 levels of the repeated measures time factor.

Again, the interaction is the importance effect and the analyses indicate that there are significant interactions when intervention and control are compared ($F_{(1,127)}$=6.32, p=.013), and when paired reading and control are compared ($F_{(1,83)}$=9.64, p=.003), but not when intervention and paired reading are compared ($F_{(1,124)}$<1). This is consistent with the graph:

i.e., significant improvements for the intervention and paired reading groups in contrast to the controls, though the improvements for the intervention and paired reading groups are about equivalent.

Tables 29 a - c : Comparisons of improvements over time within the three groups

1. Intervention V Control a.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	2283.760	1	2283.760	37.633	.000
time * condP1	Linear	383.356	1	383.356	6.317	.013
Error(time)	Linear	7707.085	127	60.686		

2. Paired reading V Control b.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	1812.864	1	1812.864	51.366	.000
time * projcond1	Linear	340.111	1	340.111	9.637	.003
Error(time)	Linear	2929.336	83	35.293		

3. Intervention V Paired reading c.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	4587.341	1	4587.341	70.898	.000
time * projcond1	Linear	3.722	1	3.722	.058	.811
Error(time)	Linear	8023.262	124	64.704		

Tables 30: a – c Paired t-tests comparing improvements between the three groups

1. Intervention a.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre BPVS raw - BPVS post	-8.84706	12.34476	1.33898	-11.50976	-6.18436	-6.607	84	.000

2. Paired reading b.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre BPVS raw - BPVS post	-9.36585	9.00765	1.40676	-12.20902	-6.52269	-6.658	40	.000

3. Control c.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre BPVS raw - BPVS post	-3.70455	7.79558	1.17523	-6.07462	-1.33447	-3.152	43	.003

Improvements in scores for each group were assessed using paired t-tests. These indicated significant improvements for the intervention group ($t_{(84)}$=6.61, p<.001), for the paired reading group ($t_{(40)}$=6.66, p<.001), and for the control group ($t_{(43)}$=3.15, p=.003).

Effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort (N=184, SD=19.27) as an estimate of population variability.

Effect size (improvements) for the intervention group: 8.85 / 19.27 = 0.46
Effect size (improvements) for the paired reading group: 9.37 / 19.27 = 0.49
Effect size (improvements) for the control group: 3.70 / 19.27 = 0.19

Overall, the effects sizes for the intervention and paired reading groups are good and about equivalent; that for the control group is much smaller.

Non-word reading

Table 31

ANOVA comparisons for YARC reading comprehension , pre and post intervention

project condition phase 1 * time

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
intervention	1	16.025	.977	14.096	17.954
	2	22.663	.987	20.713	24.612
paired reading	1	17.439	1.365	14.744	20.134
	2	21.317	1.379	18.594	24.040
control	1	18.976	1.348	16.313	21.639
	2	20.976	1.362	18.286	23.667

Table 32: Comparisons of improvements over time within the three groups

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	1290.276	1	1290.276	81.811	.000
time * projcond1	Linear	316.905	2	158.452	10.047	.000
Error(time)	Linear	2523.439	160	15.771		

Table 33: Comparisons of improvements over time between the three groups

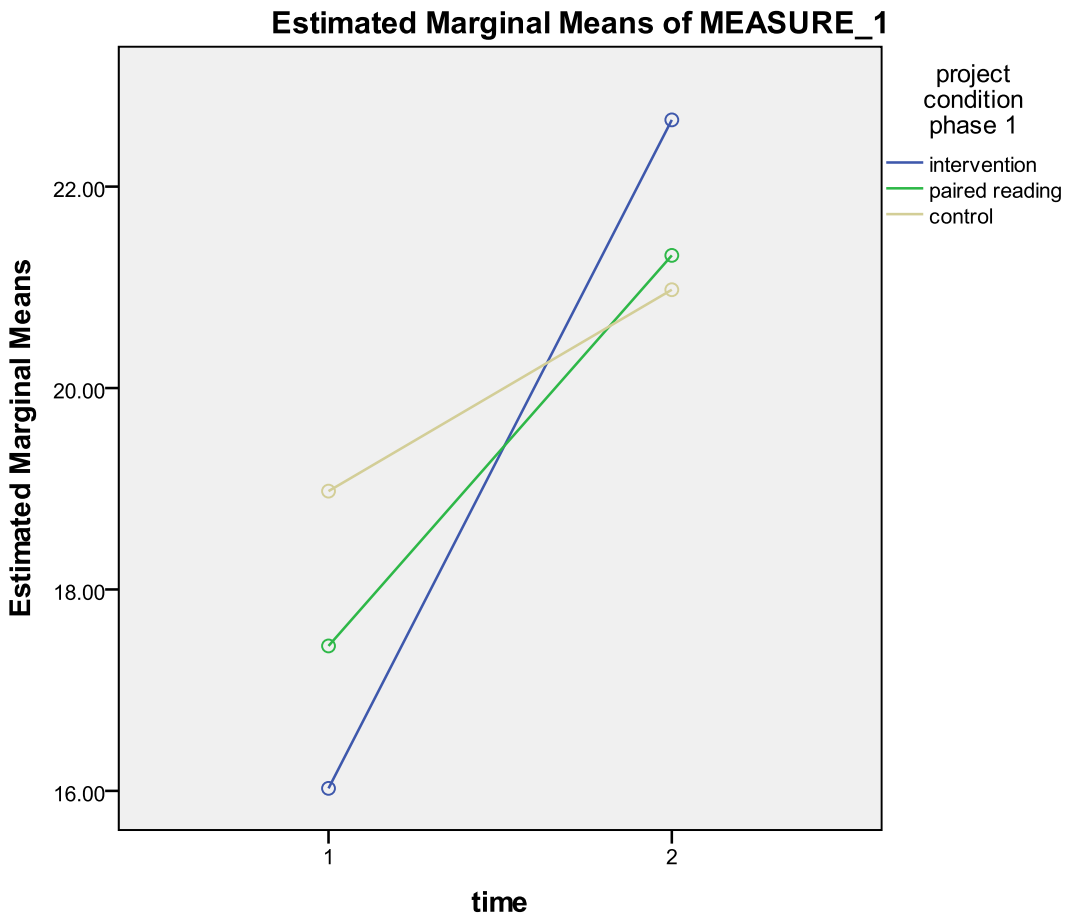
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	113524.452	1	113524.452	819.474	.000
projcond1	24.097	2	12.048	.087	.917
Error	22165.327	160	138.533		

The interaction effect is significant ($F_{(2,160)}$=10.05, p<.001) and is presented in the graph.



The interaction effect, as shown in the graph, indicates that there is an improvement in the intervention group which seems larger than that for the other two groups; though that for the paired reading group also seems somewhat larger than that for the controls. (These improvements can be seen in the graph and the table of pre and post mean scores.)

The following analyses compare improvements between each pair of groups: i.e., intervention against control, paired reading against control and intervention against paired reading. These use analyses of variance with 2 levels of the group factor and 2 levels of the repeated measures time factor.

Again, the interaction is the importance effect and the analyses indicate that there are significant interactions when intervention and control are compared ($F_{(1,120)}$=20.58, p<.001), and when intervention and paired reading are compared ($F_{(1,119)}$=5.85, p=.017), but not when paired reading and control are compared ($F_{(1,81)}$=2.43, p=.123). This is consistent with the graph: i.e., the intervention group showing much larger levels of improvement compared to the other two groups.

Tables 34 a – c ANOVA comparing effects across time within groups

1. Intervention V Control a

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	1027.367	1	1027.367	71.376	.000
time * condP1	Linear	296.154	1	296.154	20.575	.000
Error(time)	Linear	1727.244	120	14.394		

2. Paired reading V Control b.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	358.419	1	358.419	23.793	.000
time * projcond1	Linear	36.588	1	36.588	2.429	.123
Error(time)	Linear	1220.195	81	15.064		

3. Intervention V Paired reading c.

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	1498.726	1	1498.726	84.951	.000
time * projcond1	Linear	103.206	1	103.206	5.850	.017
Error(time)	Linear	2099.439	119	17.642		

Tables 35: a – c Paired t-tests comparing improvements between the three groups

1. Intervention a.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre non-word raw score - Non-word raw score post	-6.63750	5.74400	.64220	-7.91576	-5.35924	-10.336	79	.000

2. Paired reading b.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre non-word raw score - Non-word raw score post	-3.87805	6.30950	.98538	-5.86957	-1.88653	-3.936	40	.000

3. Control c.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre non-word raw score - Non-word raw score post	-2.00000	4.54785	.70175	-3.41721	-.58279	-2.850	41	.007

Improvements in scores for each group were assessed using paired t-tests. These indicated significant improvements for the intervention group ($t_{(79)}$=10.34, p<.001), for the paired reading group ($t_{(40)}$=3.94, p<.001), and for the control group ($t_{(41)}$=2.85, p=.007).

Effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort (N=176, SD=8.66) as an estimate of population variability.

Effect size (improvements) for the intervention group: 6.64 / 8.66 = 0.77
Effect size (improvements) for the paired reading group: 3.88 / 8.66 = 0.45
Effect size (improvements) for the control group: 2.00 / 8.66 = 0.23

Overall, the effects size for the intervention group is very good, that for the paired reading group is good and that for the control group is moderate.

Free writing words per minute

Table 36

ANOVA comparisons for free writing words per minute (writing speed) , pre and post intervention

project condition phase 1 * time

Measure:MEASURE_1

project condition phase 1	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
intervention	1	7.011	.345	6.328	7.693
	2	7.841	.377	7.096	8.587
paired reading	1	6.920	.522	5.888	7.952
	2	8.074	.570	6.947	9.201
control	1	7.234	.483	6.281	8.187
	2	7.915	.527	6.873	8.956

Table 37: Comparisons of improvements over time within the three groups

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	54.253	1	54.253	8.072	.005
time * projcond1	Linear	2.210	2	1.105	.164	.849
Error(time)	Linear	1028.367	153	6.721		

Table 36: Comparisons of improvements over time between the three groups

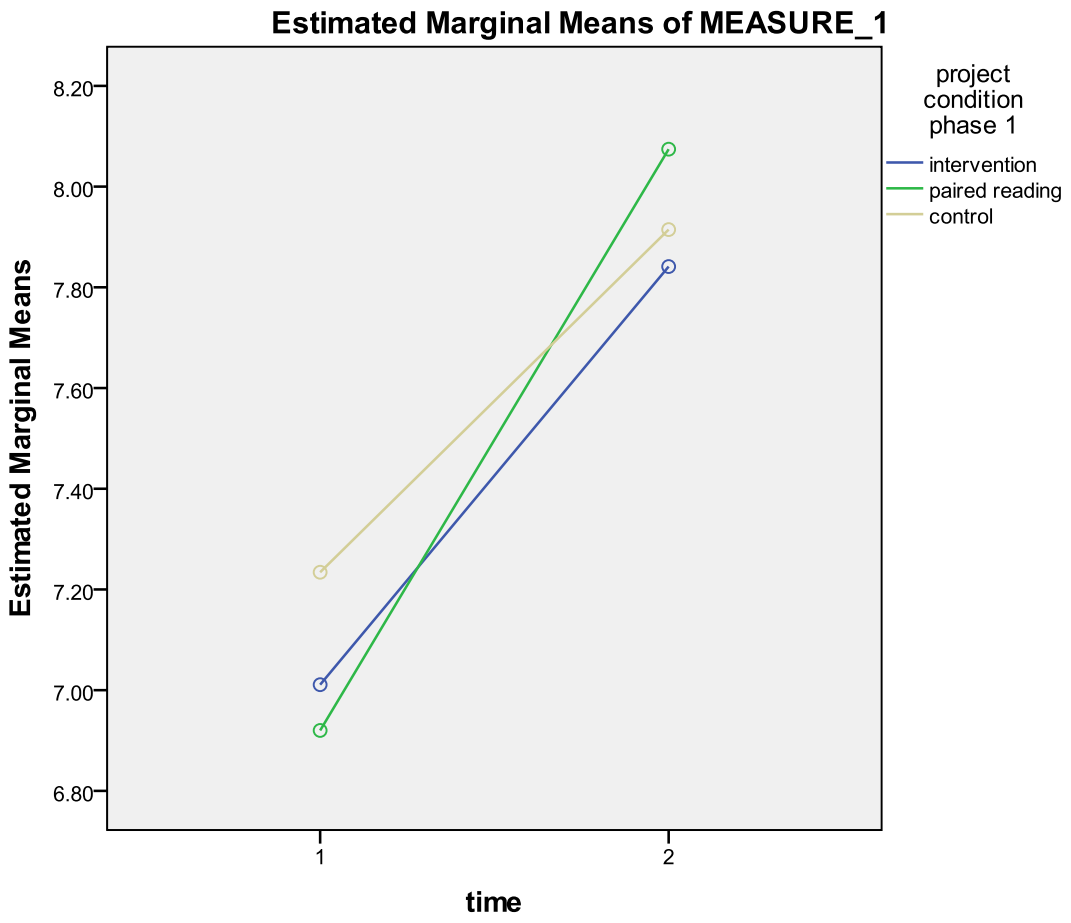
Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	15463.760	1	15463.760	1087.803	.000
projcond1	1.216	2	.608	.043	.958
Error	2174.984	153	14.216		

The interaction effect is non-significant ($F_{(2,165)}<1$) and is presented in the graph.



The non-significant interaction effect, as shown in the graph, indicates that there is no statistical evidence that improvements differ across the three groups. (These improvements can be seen in the graph and the table of pre and post mean scores.)

Given the non-significant interaction, comparisons across pairs of groups will not be performed.

Tables 38: a – c Paired t-tests comparing improvements between the three groups

1. Intervention a.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre freewriting words per min - Freewriting w per min post	-.83038	4.18618	.46803	-1.76196	.10121	-1.774	79	.080

2. Paired reading b.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre freewriting words per min - Freewriting w per min post	-1.15429	3.50934	.59319	-2.35979	.05122	-1.946	34	.060

3. Control c.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre freewriting words per min - Freewriting w per min post	-.68049	2.51796	.39324	-1.47525	.11428	-1.730	40	.091

Improvements in scores for each group were assessed using paired t-tests. These indicated non-significant improvements for the intervention group ($t_{(79)}$=1.77, p=.080), for the paired reading group ($t_{(34)}$=1.95, p=.060), and for the control group ($t_{(40)}$=1.73, p=.091) – though in each case there is a trend towards improved scores.

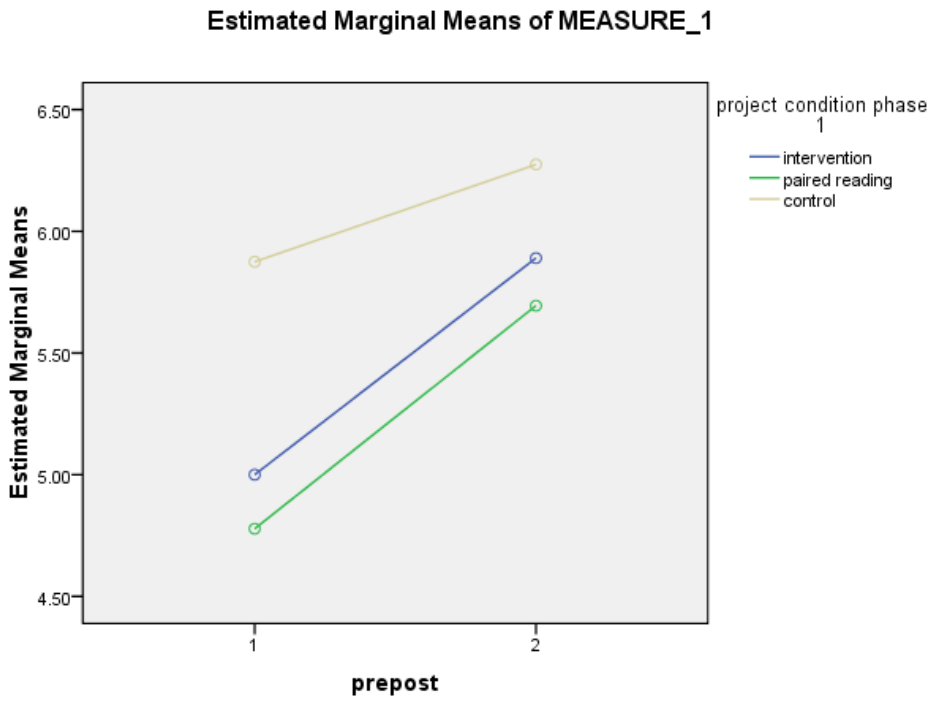
Effect sizes were calculated using the difference between the mean for the pre-intervention scores and the mean for the post-intervention scores for each group and dividing this by the standard deviation produced in the pre-intervention scores of the whole cohort (N=180, SD=4.05) as an estimate of population variability.

Effect size (improvements) for the intervention group: 0.83 / 4.05 = 0.20
Effect size (improvements) for the paired reading group: 1.15 / 4.05 = 0.28
Effect size (improvements) for the control group: 0.68 / 4.05 = 0.17

Overall, the effects sizes for all three groups are moderate to small.

National Curriculum Levels

The national curriculum level of each piece of free writing pre and post intervention was assessed by the class teacher /SENCo or (in the absence of a score) by the research team. ANOVA indicated that the interaction effect over time is significant (F = 47.16; df = 1 and 155; p <.001) as was the between group effect as presented in the graphs.



Improvements in scores for each group were assessed using paired t-tests. These indicated significant improvements for the intervention group ($t_{(81)}$=6.70, p<.001), for the paired reading group ($t_{(35)}$=4.98, p<.001), but not for the control group ($t_{(15)}$=2.50, p=.058).

Table 39 Paired t-tests comparing improvements between the three groups

Group/ N	Pre-Score Mean/SD	Post-score Mean/SD	t	df	Sig.	Mean diff	Effect size
Intervention/82	**5.00/ 1.98**	**5.89/ 1.72**	**-6.679**	**81**	**.000**	**0.89**	**.45**
Paired reading/36	**4.78/ 2.32**	**5.69/ 2.46**	**-4.977**	**35**	**.000**	**0.91**	**.39**
Control/16	**4.88/ 2.66**	**5.75/ 2.18**	**-2.049**	**15**	**0.58**	**0.87**	**.33**

Table 40, illustrates the items where the intervention and paired reading groups significantly outperformed the controls as indicated by the ANOVA analysesfor all the items above, which have displayed the F and df values.

Table 40:

Attainment	Test	Group	Significance
Reading Comprehension	YARC	Intervention/Cont	P = .010
		Paired Reading/Cont	P = .007
		Int/Paired reading	P = <1
	2. WRAT 4 Single word	Intervention/Cont	P = .036
		Paired Reading/Cont	P = .045
		Int/Paired reading	P = <1
Spelling	WRAT4 Single word	Intervention/Cont	P = .002
		Paired Reading/Cont	P = <.1
		Int/Paired reading	P = 0.06
Receptive Language	BPVS	Intervention/Cont	P = .013
		Paired Reading/Cont	P = .003
		Int/Paired reading	P =<1
Phonological decoding	Non-word decoding Turner (1994)	Intervention/Cont	P <.001
		Paired Reading/Cont	P = .017
		Int/Paired reading	P <1

Appendix 6

Technical appendix for Phase 2

Table 1: Mean and standard deviations for Intervention group at Times 2 and 3

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	WRATsingle word reading post	32.4691	81	5.81181	.64576
	WRAT word reading July	35.9383	81	6.24969	.69441
Pair 2	WRATsingle word spelling post	25.7901	81	4.51308	.50145
	WRAT spelling July	25.4938	81	4.03461	.44829
Pair 3	WRAT sentence comp raw post	15.5556	81	6.43623	.71514
	WRAT sentence comp July	16.9630	81	7.42200	.82467
Pair 4	YARC reading accuracy Post	45.0000	83	7.81025	.85729
	YARC reading accuracy july	46.6120	83	6.94047	.76182
Pair 5	YARC reading rate Post	52.7333	75	17.20413	1.98656
	YARC reading rate July	56.7867	75	17.03993	1.96760
Pair 6	YARC reading comp post	53.2941	85	11.55507	1.25332
	YARC reading comp July	55.8824	85	9.64910	1.04659
Pair 7	BPVS post	98.5584	77	20.42991	2.32820
	BPVS July	100.7532	77	20.86874	2.37821
Pair 8	Non-word raw score post	22.8571	70	6.98920	.83537
	Non-word July	24.7143	70	6.82311	.81552
Pair 9	Freewriting w per min post	7.6623	61	3.11882	.39932
	Freewriting words per minute July	7.1339	61	2.65255	.33962

Table 2: Table of t-test analyses for intervention group across time 2 and time 3

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	WRATsingle word reading post - WRAT word reading July	-3.46914	4.71457	.52384	-4.51161	-2.42666	-6.622	80	.000
Pair 2	WRATsingle word spelling post - WRAT spelling July	.29630	3.94792	.43866	-.57666	1.16925	.675	80	.501
Pair 3	WRAT sentence comp raw post - WRAT sentence comp July	-1.40741	4.90606	.54512	-2.49223	-.32259	-2.582	80	.012
Pair 4	YARC reading accuracy Post - YARC reading accuracy july	-1.61205	4.98773	.54747	-2.70115	-.52295	-2.945	82	.004
Pair 5	YARC reading rate Post - YARC reading rate July	-4.05333	9.82948	1.13501	-6.31489	-1.79177	-3.571	74	.001
Pair 6	YARC reading comp post - YARC reading comp July	-2.58824	8.65791	.93908	-4.45570	-.72077	-2.756	84	.007
Pair 7	BPVS post - BPVS July	-2.19481	11.94179	1.36089	-4.90526	.51565	-1.613	76	.111
Pair 8	Non-word raw score post - Non-word July	-1.85714	5.36841	.64165	-3.13720	-.57709	-2.894	69	.005
Pair 9	Freewriting w per min post - Freewriting words per minute July	.52836	3.07469	.39367	-.25910	1.31583	1.342	60	.185

Table 3: Mean and standard deviations for control group at Times 2 and 3

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	WRATsingle word reading post	32.7273	44	8.96340	1.35128
	WRAT word reading July	37.6591	44	9.32350	1.40557
Pair 2	WRATsingle word spelling post	24.0476	42	4.94335	.76278
	WRAT spelling July	25.9048	42	4.36063	.67286
Pair 3	WRAT sentence comp raw post	16.9524	42	7.08813	1.09372
	WRAT sentence comp July	18.4762	42	7.66124	1.18215
Pair 4	YARC reading accuracy Post	46.0667	45	11.21160	1.67133
	YARC reading accuracy july	47.5111	45	8.13137	1.21215
Pair 5	YARC reading rate Post	55.3023	43	16.37148	2.49663
	YARC reading rate July	59.4419	43	15.16466	2.31259
Pair 6	YARC reading comp post	52.0444	45	9.38557	1.39912
	YARC reading comp July	56.9333	45	8.46222	1.26147
Pair 7	BPVS post	100.9268	41	17.03730	2.66078
	BPVS July	108.0244	41	18.20232	2.84272
Pair 8	Non-word raw score post	19.2143	42	10.13455	1.56379
	Non-word July	23.6429	42	9.53254	1.47090
Pair 9	Freewriting w per min post	7.7483	29	3.16709	.58811
	Freewriting words per minute July	8.2393	29	3.60452	.66934

Table 4: Table of t-test analyses for control group across time 2 and time 3

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	WRATsingle word reading post - WRAT word reading July	-4.93182	5.30203	.79931	-6.54378	-3.31985	-6.170	43	.000
Pair 2	WRATsingle word spelling post - WRAT spelling July	-1.85714	4.58827	.70799	-3.28695	-.42734	-2.623	41	.012
Pair 3	WRAT sentence comp raw post - WRAT sentence comp July	-1.52381	4.92499	.75994	-3.05854	.01093	-2.005	41	.052
Pair 4	YARC reading accuracy Post - YARC reading accuracy july	-1.44444	9.39428	1.40042	-4.26680	1.37791	-1.031	44	.308
Pair 5	YARC reading rate Post - YARC reading rate July	-4.13953	8.19867	1.25029	-6.66271	-1.61636	-3.311	42	.002
Pair 6	YARC reading comp post - YARC reading comp July	-4.88889	7.34606	1.09509	-7.09589	-2.68189	-4.464	44	.000
Pair 7	BPVS post - BPVS July	-7.09756	8.22741	1.28491	-9.69445	-4.50067	-5.524	40	.000
Pair 8	Non-word raw score post - Non-word July	-4.42857	5.19448	.80153	-6.04728	-2.80986	-5.525	41	.000
Pair 9	Freewriting w per min post - Freewriting words per minute July	-.49103	3.99938	.74267	-2.01232	1.03025	-.661	28	.514

Table 5: Mean and standard deviations for paired reading group at Times 2 and 3

Paired Samples Statistics

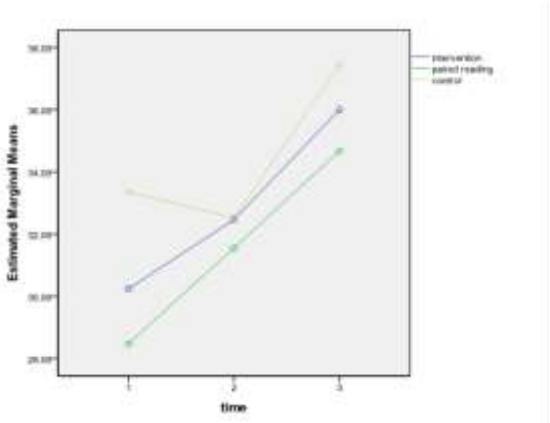
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	WRATsingle word reading post	31.5500	40	6.96493	1.10125
	WRAT word reading July	34.6750	40	7.79016	1.23173
Pair 2	WRATsingle word spelling post	23.6250	40	4.69417	.74221
	WRAT spelling July	25.5250	40	4.75550	.75191
Pair 3	WRAT sentence comp raw post	14.7250	40	8.52744	1.34831
	WRAT sentence comp July	15.4750	40	6.45294	1.02030
Pair 4	YARC reading accuracy Post	42.8333	36	7.90479	1.31747
	YARC reading accuracy july	45.8333	36	9.44911	1.57485
Pair 5	YARC reading rate Post	45.6061	33	18.48976	3.21865
	YARC reading rate July	50.7576	33	16.56621	2.88381
Pair 6	YARC reading comp post	50.0556	36	9.63904	1.60651
	YARC reading comp July	51.9444	36	7.85200	1.30867
Pair 7	BPVS post	92.3684	38	12.17756	1.97546
	BPVS July	98.2105	38	14.15581	2.29638
Pair 8	Non-word raw score post	20.9744	39	8.69509	1.39233
	Non-word July	24.2564	39	9.27282	1.48484
Pair 9	Freewriting w per min post	7.3533	30	2.91473	.53216
	Freewriting words per minute July	8.5040	30	2.77628	.50688

Table 6: Table of t-test analyses for paired reading group across time 2 and time 3

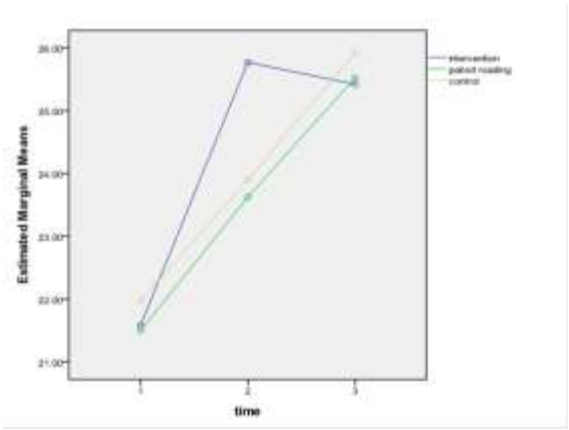
		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	WRATsingle word reading post - WRAT word reading July	-3.12500	4.79951	.75887	-4.65996	-1.59004	-4.118	39	.000
Pair 2	WRATsingle word spelling post - WRAT spelling July	-1.90000	4.40745	.69688	-3.30957	-.49043	-2.726	39	.010
Pair 3	WRAT sentence comp raw post - WRAT sentence comp July	-.75000	7.31612	1.15678	-3.08981	1.58981	-.648	39	.521
Pair 4	YARC reading accuracy Post - YARC reading accuracy july	-3.00000	4.36218	.72703	-4.47595	-1.52405	-4.126	35	.000
Pair 5	YARC reading rate Post - YARC reading rate July	-5.15152	17.97241	3.12860	-11.52426	1.22122	-1.647	32	.109
Pair 6	YARC reading comp post - YARC reading comp July	-1.88889	9.38320	1.56387	-5.06371	1.28593	-1.208	35	.235
Pair 7	BPVS post - BPVS July	-5.84211	11.94928	1.93843	-9.76973	-1.91448	-3.014	37	.005
Pair 8	Non-word raw score post - Non-word July	-3.28205	5.45773	.87394	-5.05124	-1.51286	-3.755	38	.001
Pair 9	Freewriting w per min post - Freewriting words per minute July	-1.15067	2.42716	.44314	-2.05698	-.24435	-2.597	29	.015

Figures one and two show the results of three groups across the three time points are presented in the series of graphs illustrating the changes for each item. The intervention group line from time 2 to time 3 indicates the level of maintenance of improvement following intervention withdrawal. The lines from time 2 to time 3 for the paired reading and control groups indicate improvements with the intervention.

WRAT Individual word reading



WRAT individual word spelling



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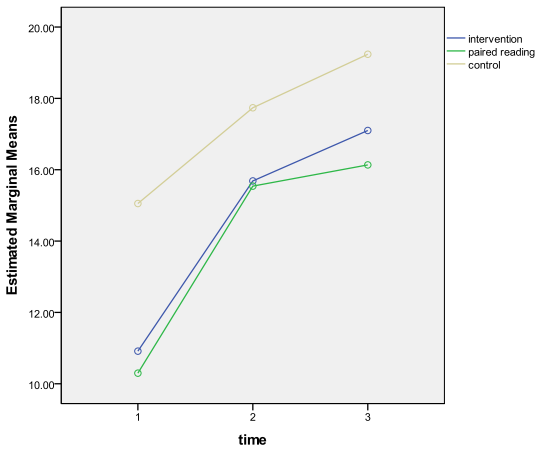
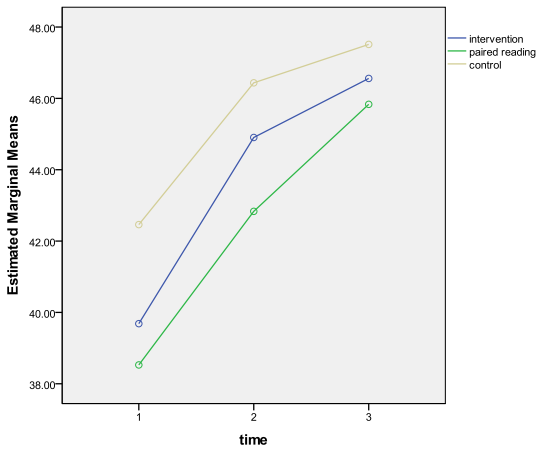
WRAT Sentence comprehension



YARC Reading accuracy



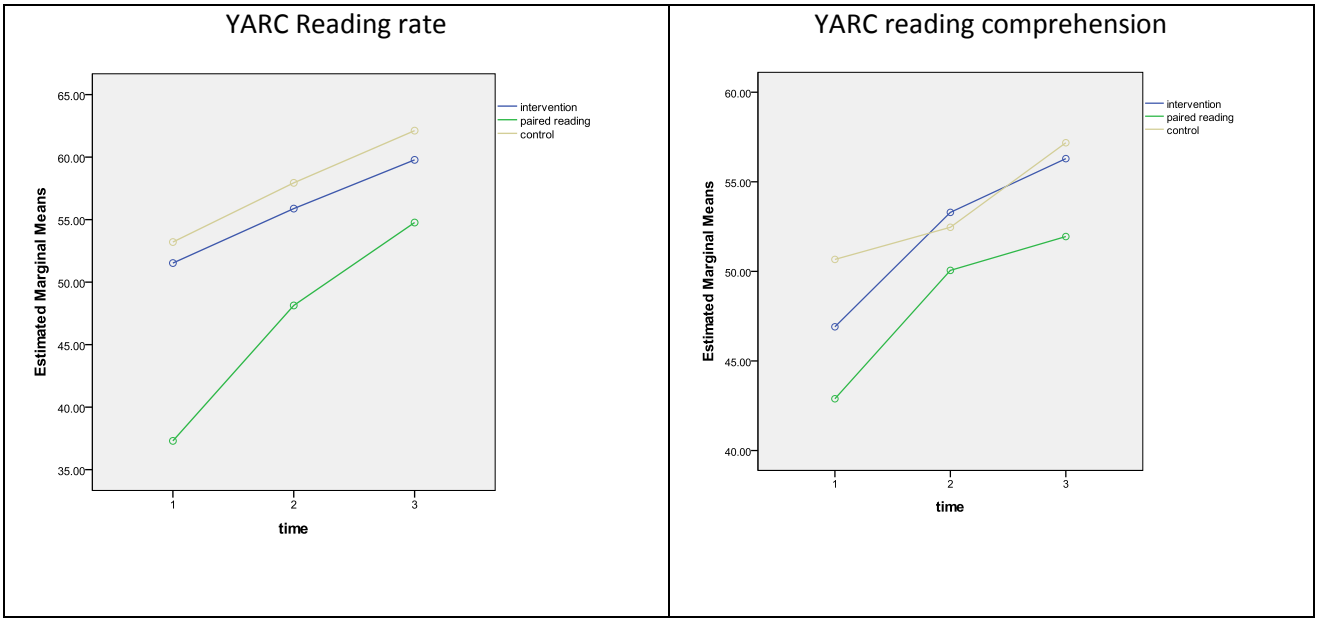
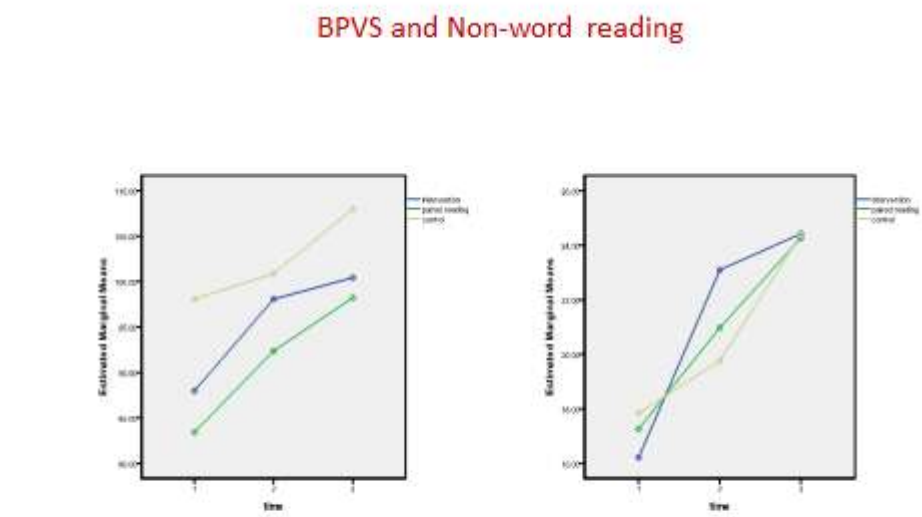


Figure One:

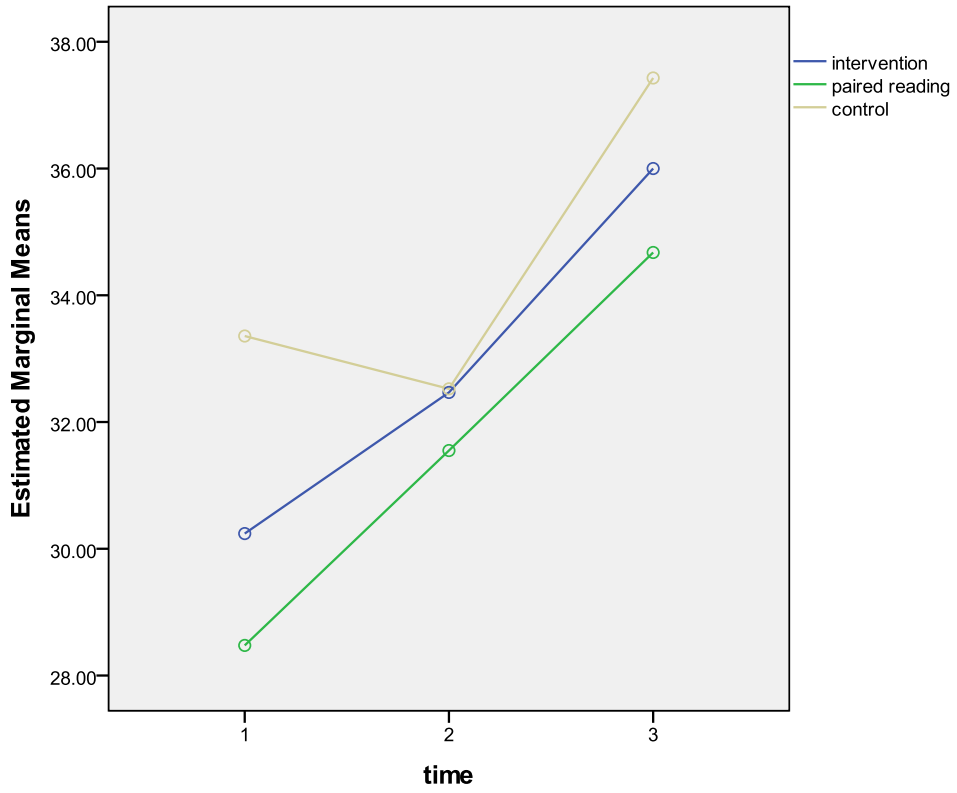
Changes across the three testing points. Brown = control; blue = intervention ; green = paired reading

Figure Two: Changes across time: BPVS and non-word reading



Graphs and effect sizes for items across the two phases of the project.

WRAT word reading



Tables showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.26	0.34
Paired reading group	0.32	0.31
Control group	-0.07	0.49

Effect sizes were moderate to good for all three groups, similar to that found during the time 1 to 2 intervention period. These improvements are in contrast to those for the control group when no intervention was implemented. This is consistent with the intervention leading generally to moderate to good levels of improvements in performance on this task, but also with continued improvements following the period of intervention.

WRAT word spelling

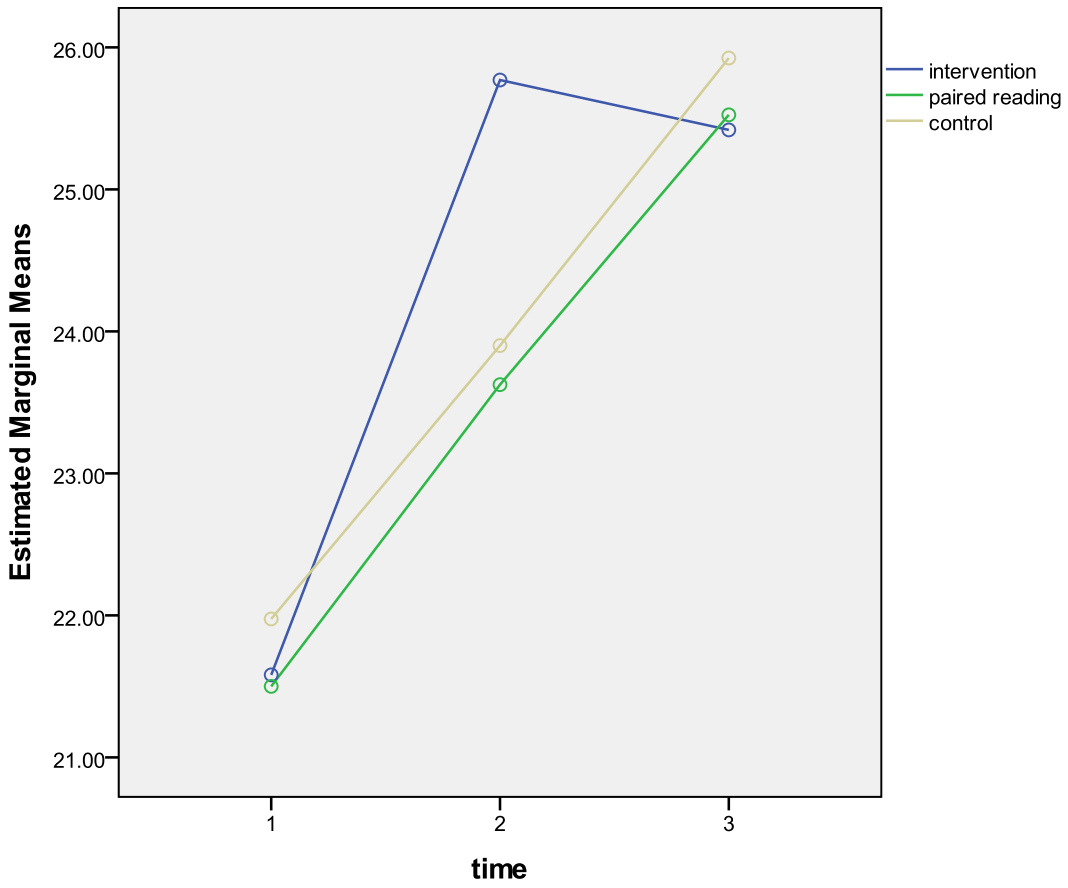


Table showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.84	-0.06
Paired reading group	0.45	0.37
Control group	0.38	0.37

Effect sizes were moderate to good for the two groups experiencing the intervention between time 2 and time 3, and these were similar to that found during the time 1 to 2 intervention period. This is consistent with the intervention leading generally to moderate to good levels of improvements in performance on this task. However, although the scores did not return to the previous low levels, there was no evidence for maintenance of improvements in spelling skills learnt during intervention.

WRAT comprehension

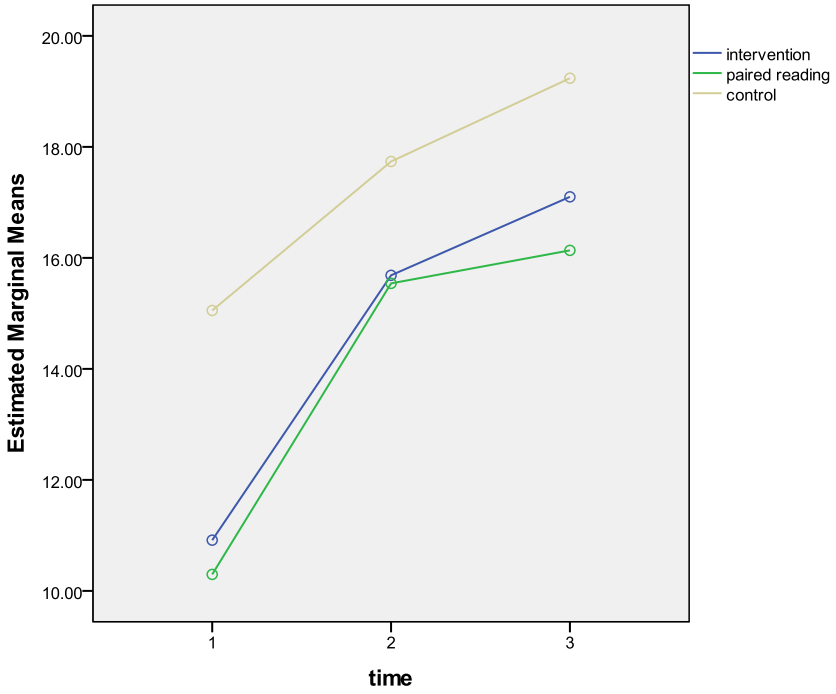


Table showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.61	0.20
Paired reading group	0.72	0.11
Control group	0.39	0.22

Effect sizes were small for all three groups between time 2 and 3, and smaller than between time 1 and 2.

YARC reading accuracy

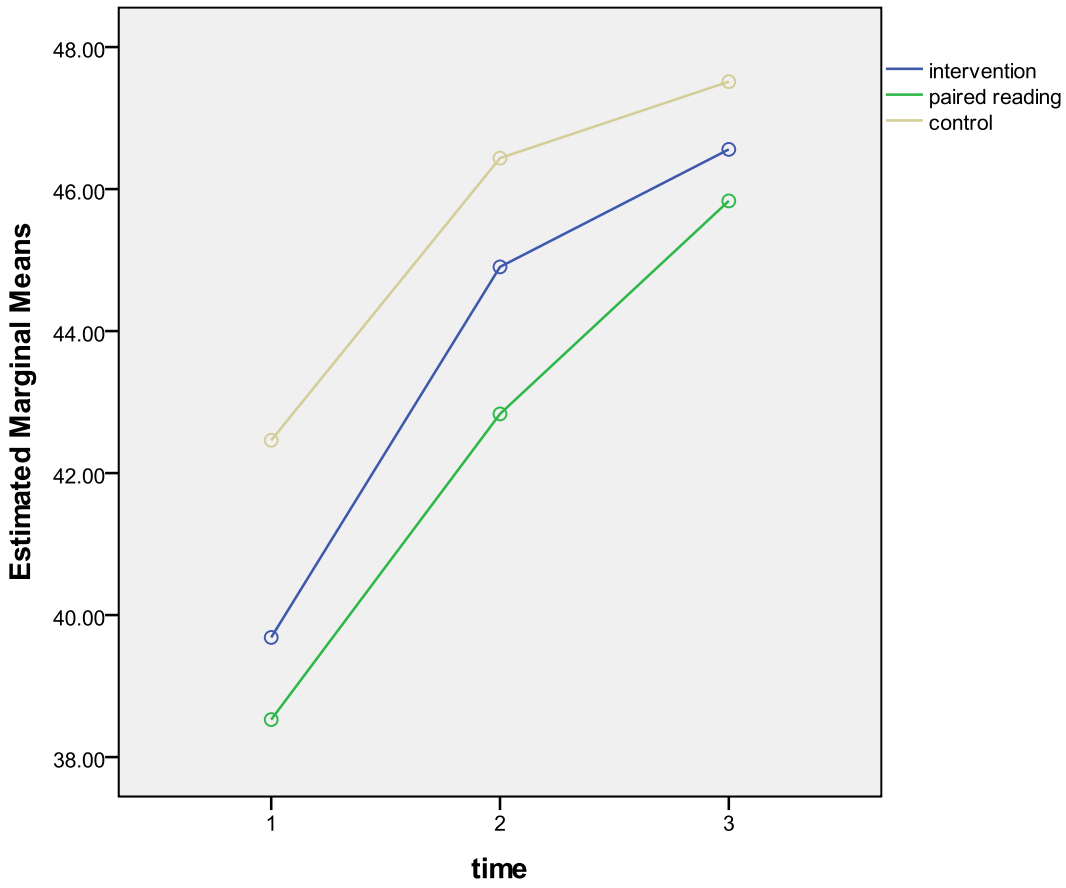


Table showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.62	0.20
Paired reading group	0.55	0.38
Control group	0.53	0.18

Effect sizes were small to moderate for the three groups, with the paired reading group showing the largest effect size.

YARC reading rate

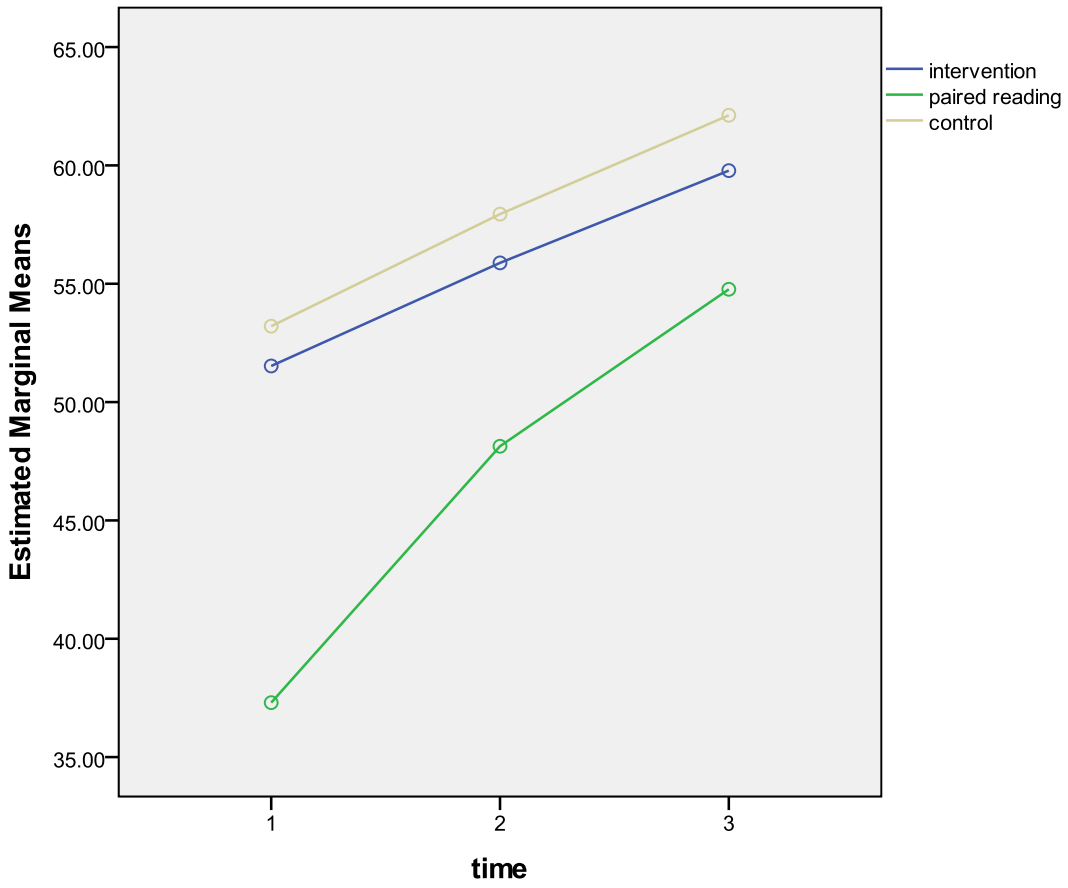


Table showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.28	0.21
Paired reading group	0.51	0.27
Control group	0.24	0.22

Effect sizes were small for all three groups; though consistent with the effect size for the intervention between time 1 and 2.

YARC reading comprehension

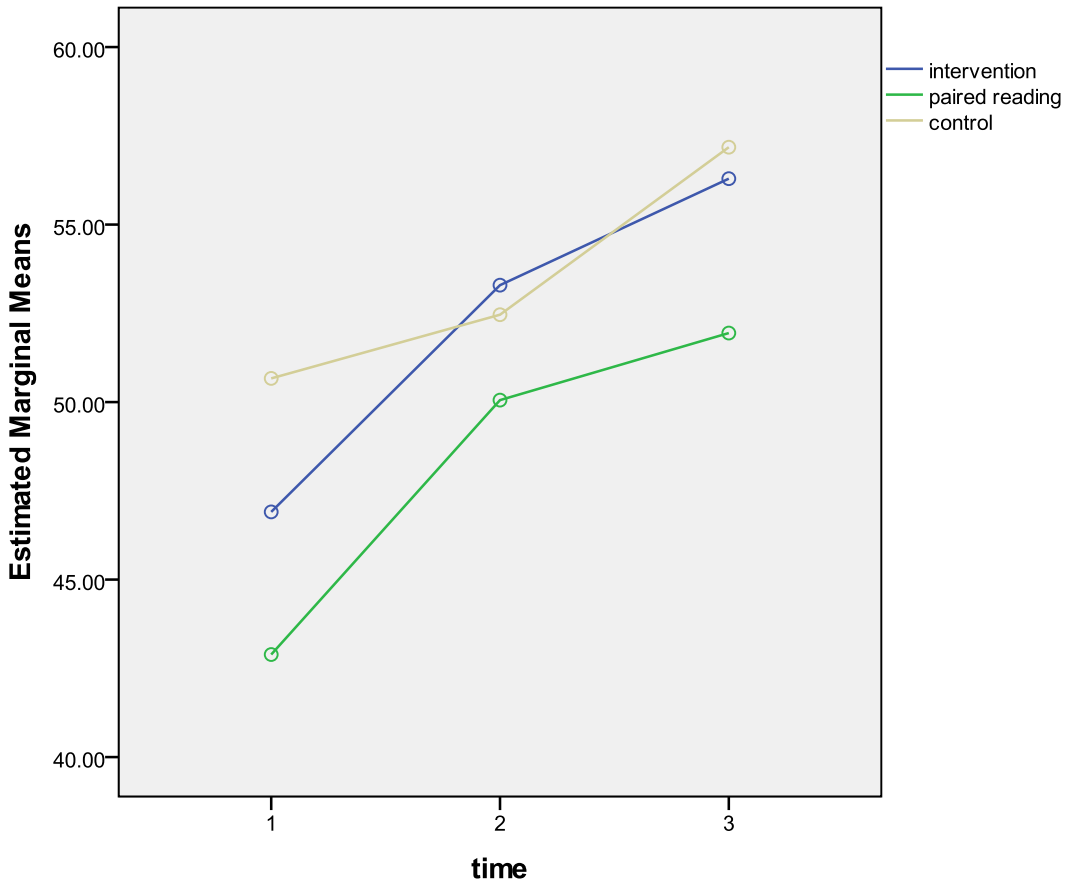


Table showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.58	0.23
Paired reading group	0.62	0.17
Control group	0.19	0.44

Effect sizes were small for the intervention and paired reading groups, but good for the control group and near levels shown by the intervention group between time 1 and 2.

BPVS

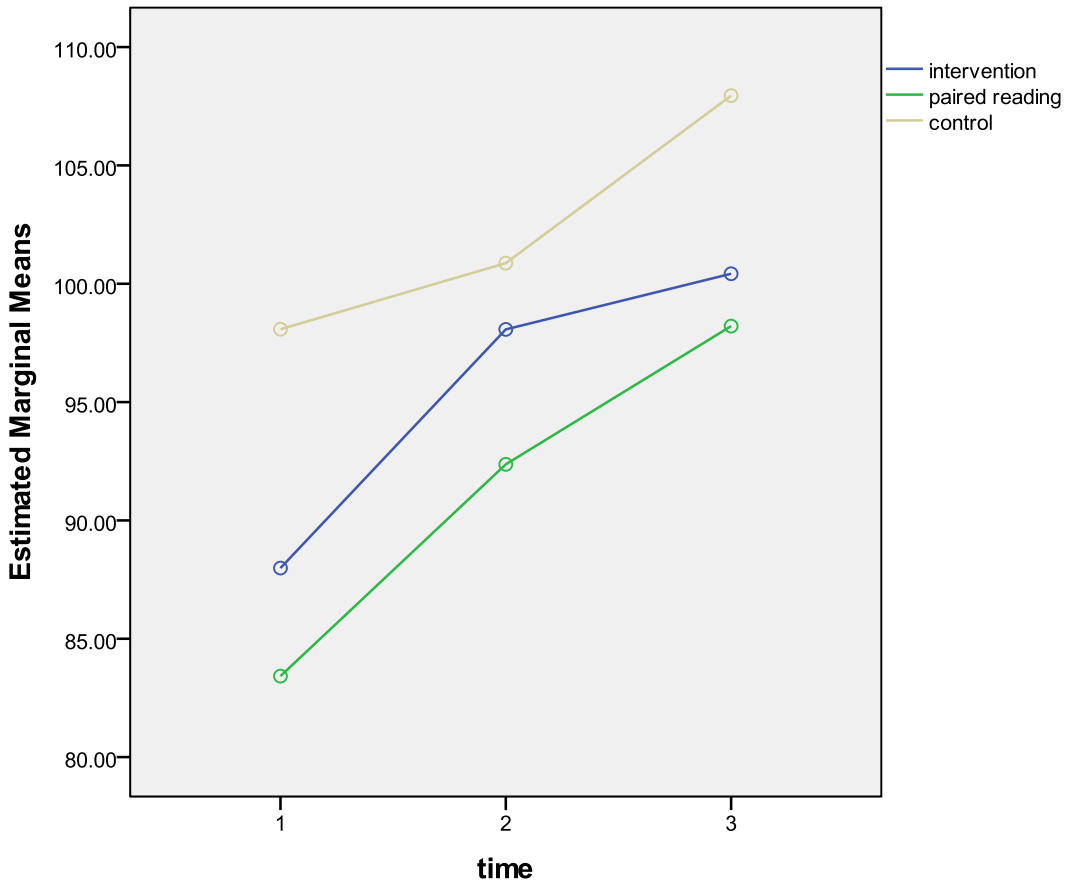


Table showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.46	0.11
Paired reading group	0.49	0.30
Control group	0.19	0.37

Effect sizes were moderate for the two groups experiencing the intervention between time 2 and 3, but small over the follow-up period for the intervention group. These results look similar to those at the time 1 to 2 intervention period.

Non-word reading

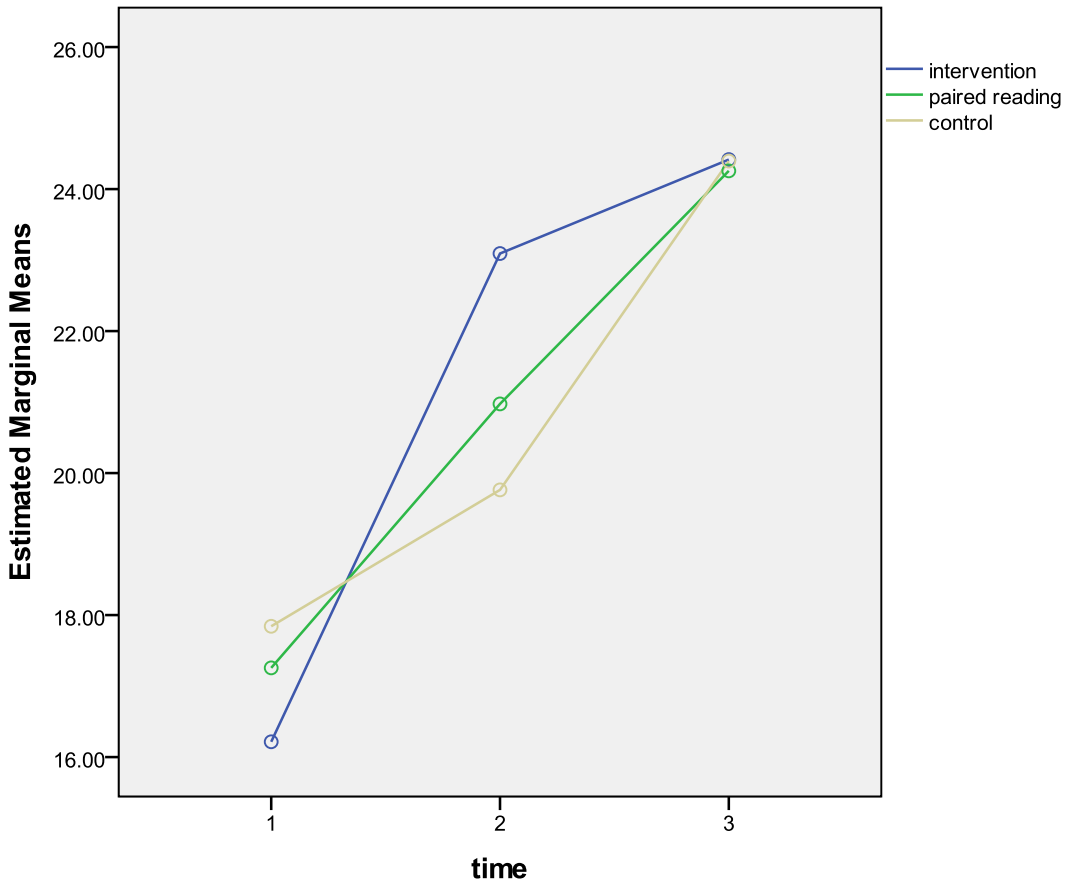


Table showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.77	0.21
Paired reading group	0.45	0.38
Control group	0.23	0.52

For the control group, the effect size was good, though smaller than for the intervention group over the time 1 to 2 intervention. The time 2 to 3 effect size for the intervention group was small, suggesting only minor levels of maintenance following intervention. The effect size for the paired reading group was moderate.

Free-writing words per minute

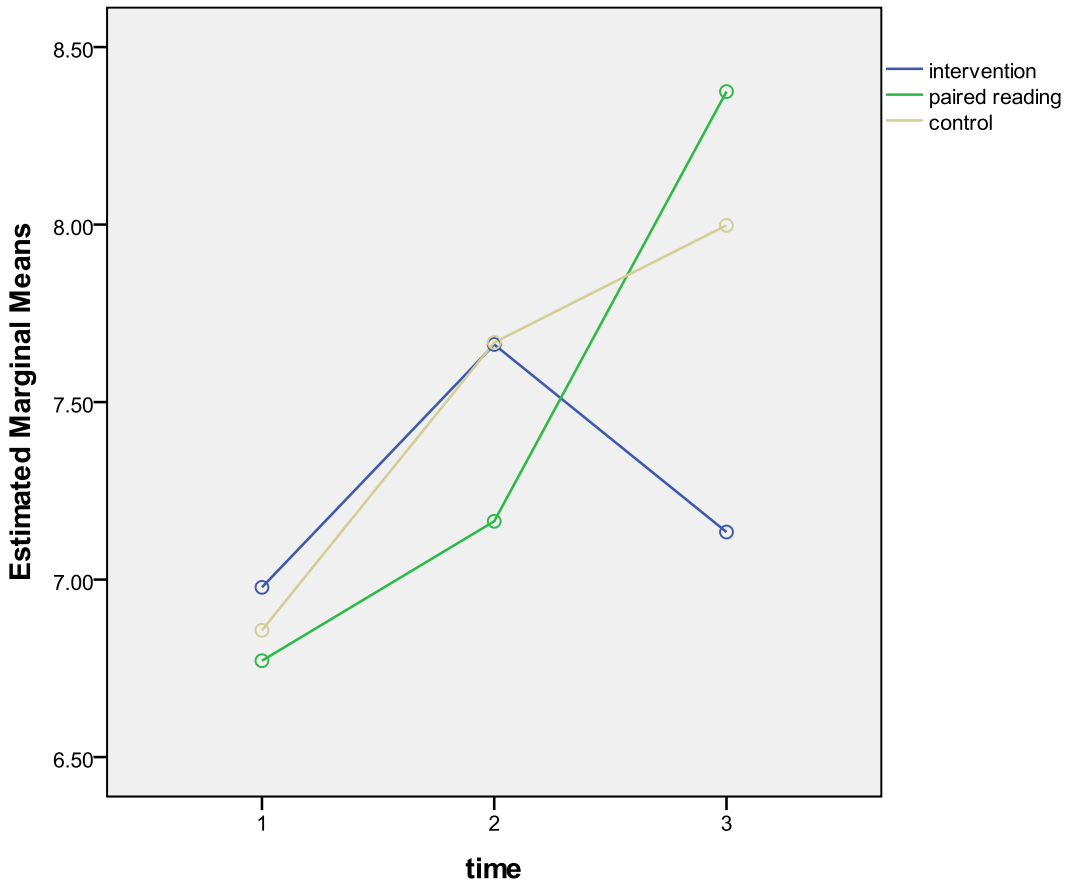


Table showing effect sizes for the three groups over the two phases of interventions

	Time 1 to 2 improvements	Time 2 to 3 improvements
Intervention group	0.20	-0.13
Paired reading group	0.28	0.28
Control group	0.17	0.12

Effect sizes were small for all groups, and the negative growth in the intervention group argues against maintenance of any potential improvements during the time 1 to 2 intervention.

Appendix 7

Technical tables: Assessment Chapter

Table 5 Distribution of Working Memory Risk across the sample.

Table 5 Alloway working mem score

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	low 0	91	43.1	45.5	45.5
	some 1	74	35.1	37.0	82.5
	high 2	35	16.6	17.5	100.0
	Total	200	94.8	100.0	
Missing	missing	6	2.8		
	other	4	1.9		
	System	1	.5		
	Total	11	5.2		
Total		211	100.0		

Table 6 Distribution of children across the Dyslexia checklist

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	125	59.2	85.0	85.0
	no	22	10.4	15.0	100.0
	Total	147	69.7	100.0	
Missing	missing	4	1.9		
	other	59	28.0		
	System	1	.5		
	Total	64	30.3		
Total		211	100.0		

Table 8 **Assessment outcome across gender**

		gender		
		girl	boy	Total
Assessment outcome	Risk of dyslexia	4	6	10
	Possible risk of dyslexia	5	8	13
	No risk of dyslexia	12	9	21
Total		21	23	44

Table 9 Assessment outcome across Year at school

		Year at school			
		4	5	6	Total
Assessment outcome	Risk of dyslexia	4	4	2	10
	Possible risk of dyslexia	6	6	1	13
	No risk of dyslexia	11	7	3	21
Total		21	17	6	44

Table 10 Assessment outcome across number of years in Eng school

		Years in Eng school						
		2	3	4	5	6	missing	Total
Assessment outcome	Risk of dyslexia	1	1	3	0	3	2	10
	Possible risk of dyslexia	1	3	1	6	1	1	13
	No risk of dyslexia	6	2	3	5	4	1	21
Total		8	6	7	11	8	4	44

Table 11 **Assessment outcome across Support for SpLD/dyslexia**

		Support for SpLD/dyslexia		
		no	1/1 small group	Total
Assessment outcome	Risk of dyslexia	7	2	9
	Possible risk of dyslexia	11	1	12
	No risk of dyslexia	18	0	18
Total		36	3	39

Table 12 **Assessment outcome across Support for EAL**

		Support for EAL			
		no	1x1 small group spec	genera lEAL support	Total
Assessment outcome	Risk of dyslexia	5	4	0	9
	Possible risk of dyslexia	7	4	1	12
	No risk of dyslexia	9	9	0	18
Total		21	17	1	39

Table 13 Assessment outcome across On SEN register

		On SEN register		
		yes	no	Total
Assessment outcome	Risk of dyslexia	6	2	8
	Possible risk of dyslexia	9	3	12
	No risk of dyslexia	10	7	17
Total		25	12	37

Table 14 Assessment outcome by LDI spld risk

		LDI spld risk						
		1	2	3	4	5	6	Total
Assessment outcome	Risk of dyslexia	0	1	0	3	3	0	7
	Possible risk of dyslexia	1	1	1	8	3	0	14
	No risk of dyslexia	1	2	3	9	3	2	20
	Total	2	4	4	20	9	2	41

Table 15 Comparison of Full assessment outcome groups on LASS measures

	DvND	N	Mean	Std. Deviation	Std. Error Mean
LASS1cave	risk of dyslexia	21	22.4762	6.27391	1.36908
	no risk of dyslexia	21	19.8571	6.62786	1.44632
LASS2mobile	risk of dyslexia	21	6.0476	1.85678	.40518
	no risk of dyslexia	21	5.7619	1.60950	.35122
Non-words	risk of dyslexia	21	11.3333	10.43711	2.27756
	no risk of dyslexia	21	15.7143	7.21902	1.57532
Segments	risk of dyslexia	21	14.7619	8.74016	1.90726
	no risk of dyslexia	21	12.9048	9.18643	2.00464
Sight word read	risk of dyslexia	21	30.2381	11.13959	2.43086
	no risk of dyslexia	21	34.5238	9.02562	1.96955
Reading comp	risk of dyslexia	21	28.6667	19.36578	4.22596
	no risk of dyslexia	21	32.8571	17.19385	3.75201
Spelling	risk of dyslexia	21	41.0476	16.56948	3.61576
	no risk of dyslexia	21	47.0476	17.32188	3.77994
Non-verbal reasoning	risk of dyslexia	21	36.5714	15.13794	3.30337
	no risk of dyslexia	21	35.5714	8.03475	1.75333
Verbal reasoning	risk of dyslexia	21	90.5714	7.74965	1.69111
	no risk of dyslexia	21	92.6364	14.49974	3.09135

Table 16: Mean and SD for pre-intervention literacy test across the two groups

	DvND	N	Mean	Std. Deviation	Std. Error Mean
Pre WRAT single word reading raw	risk of dyslexia	22	27.3636	7.94352	1.69356
	no risk of dyslexia	19	32.2632	10.36469	2.37782
Pre WRAT single word spelling raw	risk of dyslexia	22	20.2727	6.08027	1.29632
	no risk of dyslexia	19	23.2105	5.45261	1.25092
Pre WRAT sentence comp raw	risk of dyslexia	21	8.5714	7.06804	1.54237
	no risk of dyslexia	18	12.5000	7.11461	1.67693
Pre YARC reading accuracy raw	risk of dyslexia	20	37.3500	8.41224	1.88103
	no risk of dyslexia	19	41.6842	9.32769	2.13992
Pre YARC reading rate raw	risk of dyslexia	14	41.1429	22.42203	5.99254
	no risk of dyslexia	17	53.9412	14.72018	3.57017
Pre YARC reading comp raw	risk of dyslexia	20	43.7500	10.83306	2.42235
	no risk of dyslexia	19	46.3158	12.98740	2.97951
Pre BPVS raw	risk of dyslexia	21	91.8095	17.95165	3.91737
	no risk of dyslexia	21	82.1905	19.42066	4.23793
Pre non-word raw score	risk of dyslexia	22	13.0000	8.32666	1.77525
	no risk of dyslexia	21	18.6667	8.11993	1.77191
Pre free writing total words	risk of dyslexia	22	74.1364	36.30072	7.73934
	no risk of dyslexia	19	122.0000	54.72862	12.55561
Pre free writing words per min	risk of dyslexia	22	6.1364	3.16010	.67374
	no risk of dyslexia	18	8.0611	3.36542	.79324

Table 17: Mean and SD for the full assessment item scores across the *at risk* and *no risk* groups

	DvND	N	Mean	Std. Deviation
WRAT single word reading post	risk of dyslexia	20	29.6500	7.16185
	no risk of dyslexia	21	35.0000	6.55744
WRAT single word spelling post	risk of dyslexia	20	23.2000	3.88790
	no risk of dyslexia	21	27.0952	3.16077
WRAT sentence comp raw post	risk of dyslexia	20	13.8500	9.84231
	no risk of dyslexia	21	15.3333	7.09460
Auditory comprehension	risk of dyslexia	22	22.3636	7.06127
	no risk of dyslexia	20	21.0500	6.87846
Phon proc segmenting	risk of dyslexia	22	25.7273	4.47407
	no risk of dyslexia	21	30.0476	3.80100
Blending TAPS	risk of dyslexia	22	19.5000	5.94218
	no risk of dyslexia	21	23.3333	6.37443
RAN digits	risk of dyslexia	22	87.6818	15.29826
	no risk of dyslexia	21	95.7143	11.21224
RAN letters	risk of dyslexia	22	87.8636	15.25434
	no risk of dyslexia	21	94.0476	8.74915
RAN colours	risk of dyslexia	22	84.2273	14.13180
	no risk of dyslexia	21	131.0000	197.45886
RAN objects	risk of dyslexia	22	83.7273	15.47404
	no risk of dyslexia	21	89.0476	14.37176

Significance levels for WRAT single word reading and spelling, phonological processing and non-word decoding for *at risk* and *no risk* children

WRAT single word reading: At risk (M = 29.65, SD =1.60) and no risk [M = 35, SD = 6.56; t(39)= -2.50, p = .017]

WRAT single word spelling: At risk(M = 23.30, SD =3.89) and no risk [M = 27.09, SD = 3.16; t(39)= -2.50, p = .001]

Phonological processing – segmenting: At risk (M = 25.72, SD =4.47) and no risk [M = 30.05, SD = 3.80; t(41) = -3.41, p = .001]

Blending: At risk M = 19.50, SD =5.94) and no risk [M = 23.33, SD = 6.37; t(41)= -2.04, p = .048]

Non-word decoding : At risk (M = 14.79, SD = 8.12) and no risk [M = 24.23, SD = 6.41; t(38)= -4.10, p = .000]

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