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Recent Advances in the Study of Dyslexia

Edited by Jonathan Glazzard

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Education and Human Development

Volume 9

Aims and Scope of the Series

Education and Human Development is an interdisciplinary research area that aims to shed light on topics related to both learning and development. This Series is intended for researchers, practitioners, and students who are interested in understanding more about these fields and their applications.

Meet the Series Editor

Katherine Stavropoulos received her BA in Psychology from Trinity College, in Connecticut, USA and her Ph.D. in Experimental Psychology from the University of California, San Diego. She completed her postdoctoral work at the Yale Child Study Center with Dr. James McPartland. Dr. Stavropoulos' doctoral dissertation explored neural correlates of reward anticipation to social versus nonsocial stimuli in children with and without autism spectrum disorders (ASD). She has been a faculty member at the University of California, Riverside in the School of Education since 2016. Her research focuses on translational studies to explore the reward system in ASD, as well as how anxiety contributes to social challenges in ASD. She also investigates how behavioral interventions affect neural activity, behavior, and school performance in children with ASD. She is also involved in the diagnosis of children with ASD and is a licensed clinical psychologist in California. She is the Assistant Director of the SEARCH Center at UCR and is a faculty member in the Graduate Program in Neuroscience.

Meet the Volume Editor

Professor Jonathan Glazzard's research focuses on the experiences of minoritized individuals and groups. He sits on the editorial boards of several journals, including the *International Journal of Educational and Life Transitions and Equity in Education & Society.* He is a co-convenor of the British Educational Research Association Special Interest Group, Mental Health and Wellbeing in Education. His current research focuses on the experiences of LGBTQ+, disabled youth. Recent publications have focused on mental health, educational and life transitions, and early reading development in children. Professor Glazzard holds visiting professorships in England at Bishop Grosseteste University (BGU), Birmingham Newman University, and the University of Northampton.

Contents

Preface

Dyslexia is a learning difficulty characterized by problems with reading, writing, and spelling, despite adequate instruction. Characteristic features also include difficulties in phonological awareness, verbal memory, and verbal processing. Difficulties in motor coordination, concentration, personal organization, and with sequencing and mental calculation are co-occurring but should not be taken as indicators of dyslexia by themselves. Dyslexia is unrelated to intelligence and is a life-long condition that can have adverse effects on a person's life. It typically co-occurs with dyspraxia, dyscalculia, and attention-deficit hyperactivity disorder. Common difficulties also include difficulties with phoneme deletion tasks, phoneme addition, and phoneme substitution.

The challenge for individuals with dyslexia is that we live in a society that typically evaluates intelligence based on a person's literacy skills. Consequently, dyslexic people are often made to feel that they are less intelligent, and thus, they are exposed to stigma. They tend to become proficient in reading, but it often takes them longer to achieve fluency. Spelling may improve, but it can also become a life-long difficulty, even if reading is mastered. They may need ongoing support for tasks that require literacy skills, including tasks that require information processing, form filling, and writing. However, despite these difficulties, it is often the case that many people with dyslexia have strong visual, creative, and problem-solving skills. They may be able to think laterally, and their skills in oral communication can be extremely strong. It is therefore important to focus on their strengths rather than highlighting the things that they find most difficult.

If unsupported, there is a risk that children with dyslexia will develop low self-esteem and poor mental health. However, in the United Kingdom alone it can be challenging for parents to secure a timely diagnosis of dyslexia. There is a need to strengthen teacher professional development in this area so that teachers can identify the indicators and provide appropriate support. There is also a need to strengthen the training of pre-service teachers so that they have better knowledge of dyslexia and other disabilities. Training can help to develop knowledge but also change teachers' mindsets and dispel common misconceptions. Children with dyslexia are not less intelligent than their peers. They have a specific learning difficulty rather than a general learning difficulty and their literacy skills can improve with appropriate intervention, including opportunities for overlearning. With high-quality teaching and support, including the creation of a 'can-do' culture in schools, children can attain and achieve good long-term outcomes. Their dyslexia must not become a barrier to their success.

I am very grateful to the authors who contributed to this book.

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Chapter 1

Introductory Chapter: The Application of Cognitive Science in Supporting Learners with Dyslexia

Jonathan Glazzard

1. Introduction

According to the Education Endowment Foundation [EEF] [1], 'Cognitive science is being used increasingly to inform interventions, practice and policy in education' (p. 5). However, to date, there is a paucity of research which explores the benefits of applied cognitive science to learners with dyslexia. This chapter will explore the benefits of spaced/distributed learning, dual coding, interleaving and retrieval practice for students with dyslexia. It will start by exploring working memory and cognitive load before moving on to consider the benefits of these specific approaches. According to the EEF, 'Cognitive science principles of learning can have a real impact on rates of learning in the classroom. There is value in teachers having working knowledge of cognitive science principles' (p. 7). Despite this, it is important to acknowledge that the research base on the impact of cognitive science on student outcomes is currently limited and there is a need for further research which investigates the impact of these approaches on students with disabilities. The principles of cognitive science are derived from both cognitive psychology and cognitive neuroscience and therefore it is important to consider the role of memory in the process of learning. This chapter does not present evidence of the efficacy of the identified approaches but instead opens a debate about the possibility of the identified approaches for students with dyslexia.

2. Working memory

The model of the working memory was developed by Baddeley and Hitch [2]. The following diagram is an adapted version of the original model (**Figure 1**).

The central executive controls the working memory. The information which is received *via* the central executive is sent to either the visuospatial sketchpad or the phonological loop for processing. These are slave systems of the working memory. The visuospatial sketchpad processes visual and spatial information. The phonological loop processes spoken language and written information. The episodic buffer is a temporary storage system for holding information and was a later addition to the original model proposed by Baddeley and Hitch [2]. Information is processed in the relevant processing chambers and then sent to the long-term memory for storage. The capacity of the working memory is extremely limited. The working memory can only process a small amount of information at any time, unlike the long-term memory. If the working

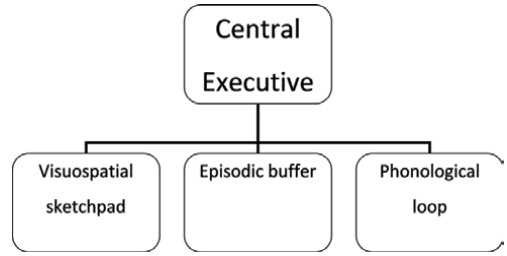

Figure 1.
Model of the working memory (adapted from Ref. [2]).

memory is overloaded, learners experience cognitive load. When this occurs, the working memory becomes less efficient, and students might struggle to process the information that is being received.

The implications of working memory for students with dyslexia need to be considered carefully. When students are being taught new knowledge, that knowledge is being processed in the working memory. The working memory is an active component of the memory. It enables us to complete tasks as we are doing them, and it helps us to remember what we need to do next. New information is processed in the working memory. When a single processing chamber (i.e., the phonological loop or the visuospatial sketchpad) is overloaded, this reduces the capacity of the working memory to process information. However, it is possible for both processing chambers to work concurrently, processing different types of information (auditory, written visual and spatial) without experiencing cognitive load. This is because auditory and written information are processed in the phonological loop and visual and spatial information are processed in the visuospatial sketchpad. The implications of this are important for educators to consider. We know that dyslexic students tend to experience difficulties with working memory. Educators therefore need to reduce the amount of information that enters the working memory at any time. Overloading the phonological loop by introducing too much auditory information will reduce its efficiency and dyslexic students are likely to struggle when they are given too many instructions or lengthy auditory explanations. This is because the auditory information is processed in the phonological loop. It quickly becomes overloaded, and learners experience cognitive load. Introducing dyslexic students to multiple phonemes in a phonics lesson will also result in the same effect. In a similar way, the visuospatial sketchpad quickly becomes overloaded when learners are exposed to too much visual information which is required to process. An example might be introducing students to multiple diagrams in a lesson.

Understanding the limitations of working memory is particularly important for dyslexic students because their working memory capacity is limited. It is important to break new knowledge into smaller, manageable chunks so that the working memory does not become overloaded. This approach is likely to benefit all students but is particularly beneficial for dyslexic students because the capacity of their working memory is reduced.

3. Cognitive load

Cognitive load occurs when the working memory becomes overloaded. This reduces the efficiency of the working memory in relation to information processing.

There are three main types of cognitive load which occur: intrinsic, extraneous and germane. Intrinsic load occurs when too much information enters the working memory, even when new knowledge can easily be assimilated into existing knowledge and existing schemas do not need to be modified. Extraneous load occurs when irrelevant content is introduced in lessons, which is not essential to the core learning taking place. This essentially gives students too many things to think about and reduces the capacity of the working memory to process the intended learning. Germane load occurs when new knowledge is not easily assimilated into existing knowledge. In this case, existing schemas need to be modified to accommodate new knowledge, resulting in more advanced understanding and transformative learning.

There are clear implications of cognitive load for dyslexic students. It is important to reduce intrinsic load by limiting the number of instructions that students need to follow, reducing the amount of auditory information that is transmitted to students in lessons and reducing the number of diagrams or other visual images that students need to visually process at any time. In addition, it is important to keep lessons focused on the core intended learning. This places a responsibility on teachers to focus sharply on the new knowledge that students need to learn rather than introducing additional content that serves as a distraction. In addition, overloading classroom environments with visual information, which requires visual processing, can serve as a distraction and reduce the efficiency of the visuospatial sketchpad.

Germane load occurs when existing schemas require modification. An example of this is in early reading when children progress from learning a simple alphabetic code to a complex code. This is problematic in languages such as English where a grapheme can represent several phonemes and a phoneme can be represented by several graphemes. One example of this is as follows: in the simple alphabetic code, children associate the grapheme 'ch' with the phoneme /ch/ in church, chip and chocolate. In the complex alphabetic code, they subsequently learn that the same grapheme represents the phoneme/k/ in 'chemist' and/sh/in 'chef'. This results in disequilibrium because the original schema that they have formed for the grapheme 'ch' now needs to be extended to incorporate multiple phonemes rather than just one. Given that we know many dyslexic learners struggle to make associations between graphemes and phonemes, as well as experiencing difficulty with phoneme addition (adding a phoneme to a word), phoneme deletion (removing a phoneme from a word and phoneme substitution (substituting one phoneme for another to change the word) due to the affected area of the brain, it is important to consider how to support them through this process of schema modification when they progress from the simple alphabetic code to the complex alphabetic code. Mastery of the alphabetic code is important for all learners because knowledge of sounds becomes a key strategy to aid spelling throughout life, even if they rely on more visual strategies to support reading. In this example, it is important that dyslexic learners can focus on the new knowledge that they are accommodating so that they can focus on the accommodation of one schema at a particular time rather than being exposed to multiple schema modifications. They also need opportunities to overlearn that new knowledge by revisiting it in different ways on multiple occasions.

4. Worked examples

Providing dyslexic students with worked examples reduces cognitive load because the worked examples serve to remind students of the steps that they need to complete to solve a problem and remind them what the expected standards are in a particular task.

5. Dual coding

The EEF [1] states:

Dual coding theory is based on the theory that working memory has two distinct components, one that deals with visual and spatial information and another that deals with auditory information. By presenting content in multiple formats, it is possible that teachers can appeal to both subsystems of the working memory, which subsequently strengthens learning (p. 37).

Dual coding is essentially the practice of providing students with information in different formats. One example of this is when teachers support a verbal explanation with a diagram. This is particularly effective when the diagram helps students to understand the information that is being presented in an auditory form. This pedagogical approach should not be confused with learning style theory, which has now been largely discredited. In the example provided here, the auditory information that the teacher is providing is processed in the phonological loop. Students will process the diagram in the visuospatial sketchpad. Both slave systems of the working memory can work concurrently to process different types of information, resulting in no cognitive load. The dual coding is beneficial to dyslexic students because knowledge that is being transmitted in one form is then reinforced using a different mode of communication. In practice, teachers could support their verbal explanations with different types of visual information including diagrams, photographs and objects at different times. However, it is important to limit the amount of information that a single slave system is required to process. Therefore, introducing many different types of visual information in a lesson alongside verbal explanations could result in cognitive load because the visuospatial sketchpad would become overloaded. In addition, if information in one form does not support understanding of the subject content, which has been introduced using a different mode, this can become distracting and result in cognitive load.

6. Concept mapping

Concept maps are essentially visual representations of subject-specific concepts. They are commonly used in science and mathematics, but they can also be used in other subjects. Subject-specific concepts (for example, states of matter in science) can be represented through pictures, diagrams, cartoons and other forms of presentation. Concept maps are helpful to dyslexic students because they may struggle to process lengthy teacher explanations.

7. Spaced/distributed learning

According to the EEF [1], 'Spaced practice (also referred to as spaced learning, distributed practice, distributed learning, and the spacing effect) applies the principle that material is more easily learnt when broken apart by intervals of time. Spaced practice is often contrasted with 'massed' or 'clustered' practice, whereby material is covered within a single lesson or a linear and sequential succession of learning' (p. 15).

This approach is particularly beneficial to dyslexic students because it provides them with opportunities to revisit (and overlearn) key components of knowledge before deepening their understanding. It involves retrieval of knowledge from the

long-term memory after a period of time has elapsed. The knowledge that is stored in the long-term memory can then be re-processed in the working memory before being channelled back into the long-term memory. This retrieval of knowledge supports long-term knowledge retention.

8. Interleaving

The EEF [1] states that:

Interleaving involves sequencing tasks so that learning material is interspersed with slightly (but not completely) different content or activities, as opposed to undertaking tasks through a blocked and consecutive approach. While similar to spaced practice, interleaving involves sequencing tasks or learning content that share some likeness whereas a spaced practice approach uses intervals that are filled with unrelated activities (p. 19).

Interleaving forces students to think hard in lessons because they must switch between different types of tasks. Additionally, tasks might be interleaved across a sequence of lessons. There is a need for further research to explore the benefits of interleaving for students with dyslexia.

9. Retrieval practice

The EEF [1] states that 'Retrieval practice describes the process of recalling information from memory with little or minimal prompting' (p. 21). Students with dyslexia (and other types of disabilities) are likely to benefit from regular retrieval activities. Regular visiting of knowledge supports the development of automaticity. When learning becomes automatic, students do not need to think as much about it. This frees up the working memory. Regular retrieval tasks support dyslexic students to master foundational knowledge. Low-stakes quizzes, sorting and matching activities, talking to a partner, making lists, labelling diagrams and drawing a diagram are examples of useful retrieval activities.

10. Conclusion

This chapter has briefly introduced several pedagogical approaches that potentially could benefit dyslexic students. The application of cognitive science into the classroom has not been fully researched across a range of subjects and age phases and therefore there is a need for further research in this field. However, the potential of these strategies for dyslexic students is worthy of further consideration and further research.

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Chapter 2

Screening, Assessment and Identification Tools for Dyslexia

Vinutha U. Muktamath, Priya R. Hegde, Ramya Koneru and Rekha Lakashetti

Abstract

The special education process relies heavily on assessment to ascertain a student's disability. In order to target the areas of need that call for differentiated or specialized education, teachers can target students' strengths through an ongoing process of data collection and analysis. In order to properly diagnose Specific Learning Disability (SLD) or Dyslexia, the student's planning and placement team (PPT), consisting of the parents of the child and trained professionals, must conduct a thorough evaluation process. People who have dyslexia are frequently misdiagnosed or completely overlooked. The assessment of dyslexia presents with difficulties, such as the use of a variety of terms, the inadequacy of current assessment models, and the dependence on phonological awareness as the only linguistic risk factor. This chapter's goal is to address the difficulties associated with diagnosing and screening for dyslexia in children, including the use of a variety of terms, the use of phonological awareness as the single linguistic risk factor for dyslexia. In an effort to give parents, educators, and researchers a consolidated and comprehensive source of information, the chapter examines the accessibility and usefulness of screening and assessment instruments for the diagnosis and identification of dyslexia in children of various age groups.

Keywords: dyslexia, screening, assessment, definitions, linguistic risk

1. Introduction

Reading and other language-based processing difficulties are referred to as dyslexia, a specific learning disability. It is also known as a reading handicap and is the most prevalent reading disorder, accounting for about 80% of all learning disabilities. Reading difficulties start even before learning to read. Children in kindergarten may not be as proficient in letter recognition and letter writing as their peers. Children with dyslexia have trouble relating the sounds of letters to the letters they see on a page. Reading for them thus becomes a lengthy, laborious, and non-fluent process, which can co-exist with other linked problems and affect reading fluency, decoding, reading comprehension, recall, writing, spelling, and occasionally speech. When possible, people with dyslexia may want to avoid tasks that involve reading (e.g., reading for pleasure, reading instructions). They might frequently favor other forms of expression like images, audio, or video.

The neuro-diversity of dyslexia is widespread and prevalent in all societies, ages, and cultures. According to studies, one in ten persons worldwide has dyslexia and it affects between 5 and 17% of school-age children in India, up to 10% of the population in the United States [1, 2], 7% of the population in the United Kingdom [3], and up to 10% of the population in the United States [4]. Reading development for kids happens at their own speed, just like other skill development. It is typical for school pupils to occasionally find reading difficult; however, it is possible that a youngster has dyslexia if learning to read becomes a constant problem that causes them to lag behind their peers [5]. The current research clearly provides evidence for dyslexia as the most widespread type of learning difficulty among people with a learning disability and is two to three times more common in men than in women [6, 7]. Research indicates that reading disability (RD) is strongly familial and heritable. The disorder affects up to 50% of children with RD, and 50% of a child with RD's siblings also have it. Strong concordance rates for RD have been found in twin studies, showing that genetic factors account for 69–87% of the prevalence and environmental factors for 13–30% Reading disability (RD) is substantially familial and heritable as per the research and about 50% of children with RD are affected by the disorder, and also the chances of a child having siblings with RD is also 50%. Twin studies have demonstrated strong concordance rates for RD, with genetic variables accounting for 69–87% of the prevalence and environmental factors accounting for 13–30% [8].

2. Dyslexia: Definition, causes and types

The most researched and highly reckoned learning disability globally is dyslexia. Although more than 120 years after Pringle Morgan's initial description, there is still only partial agreement on its definition and the diagnostic standards applied in the clinical and scientific domains [9, 10]. As a type of learning disability, dyslexia was described by Kirk in 1963 as "an unexpected difficulty in mastering one or more of one instrumental school talents." Since Kirk's early work, the concept of "an unexpected difficulty" which has two different interpretations—has affected research and clinical practice [11]. The International Dyslexia Association states that dyslexia are distinguished by problems with accurate and/or fluent word recognition as well as by subpar spelling and decoding skills. This is sometimes caused by a phonological deficiency in language, which is often unexpected considering other cognitive abilities and the efficacy of instruction in a school. Issues with reading comprehension and a diminished reading experience may have downstream effects that hinder the development of background knowledge and vocabulary [12].

Lyon et al., [7], defined the condition in the following manner that is concurred by both practitioners and experts.

After years of discussion, the American Psychiatric Association amended the worldwide diagnostic criteria for learning disabilities in DSM-5 in 2013, which marks a new stage in the study of this condition [13–15]. The newly proposed diagnostic criteria have undergone several significant changes, including the removal of the "Discrepancy Criterion," a mention of the "Response to Intervention Approach," and a new perspective that views learning disorders as a subset of the neuro developmental disorders group [13]. The term "dyslexia" is no longer used outside of the clinical setting; instead, the phrase "Specific learning condition with impairment in [...a specific academic ability]" has been used. The umbrella term "specific learning condition" encompasses a variety of learning problems. For reading disorders, it is

specified which reading-related skills (word reading accuracy, reading rate or accuracy, and/or reading comprehension) are wholly or partially disturbed. As a subset of the more comprehensive category of Neurodevelopmental Disorders, dyslexia is classified as a reading disorder (dyslexia) in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013). Mathematical and written expression impairments are also included in the category of dyslexia [9, 12, 16–18].

For a specific set of learning problems, the following characteristics are the criteria for diagnosis;

a. The persistence of symptoms for at least six months despite particular therapies; criterion

b. The impairment of one or more talents with detrimental impacts on academic performance; criterion

c. The onset in a school-age, even if the disorder may not completely appear for a while;

Last but not least, there are several exclusion standards. Absence of an intellectual handicap is the first exclusion condition. The second concerns the omission of a haphazard and subpar instruction. The third speaks to a student's ability to communicate in the language of academic teaching. The fourth pertains to the absence of sensory issues (visual and auditory sensory issues that are severe enough to account for the learning difficulties [8, 16, 17].

3. Causes

Dyslexia appears to be a very intriguing and contentious phenomenon that has been extensively examined from different points of view. It includes an interdisciplinary study and consensus of neuroscience, cognitive science, and learning theory. Although the precise causes of dyslexia are still unknown, morphological and brain imaging investigations have revealed abnormalities in how the brains of those who have the condition develop and work. Additionally, it has been discovered that the majority of dyslexics struggle to recognize the many speech sounds that make up a word and/or learn how those sounds are represented by letters, which is a major contributor to their reading difficulties. Dyslexia is not a result of a lack of intelligence or disinterest to study; with the right teaching strategies, dyslexic students may learn well. People of all ages and intellectual abilities can develop dyslexia. Dyslexics can be incredibly intelligent people. In subjects like art, computer science, design, theater, electronics, math, mechanics, music, physics, sales, and sports, they frequently excel or are even found to be naturally talented. Additionally, because dyslexia runs in families, the chance of developing it also rises if one has a parent or sibling who is dyslexic. While some people have dyslexia identified from an early age, others do not find out until they are much older. The past few decades have seen a significant amount of research committed to determining its likely causes; yielding some significant findings from scientific frameworks that were not previously extensively employed to support the nature of dyslexia. Undoubtedly, the remarkable advancements in the disciplines of neuroscience, brain imaging, and genetics have supported a number of intuitively tenable hypotheses that lacked prior empirical validation and have uncovered a number of previously

un-recognized facts highlighting the complexity of dyslexia. In addition, different causes may apply to different children, and last but not least, there may be several causes of dyslexic issues with respect to a certain child. It may be produced by a number of factors functioning independently or interacting with one another to produce the outcome. A distinct brain activity profile shown with magnetic resonance imaging (fMRI) supports the neurological and genetic reasons of dyslexia as the condition's etiology. Three systems are active on the left side of the brain: a left parietotemporal system that analyses written language, a left occipitotemporal system that performs automatic word recognition, and an anterior system in the left inferior frontal region that influences phoneme production (articulating words aloud or silently). Conversely, dyslexic children exhibit higher activity in the left inferior frontal gyrus, right temporal, and tempoparietal regions, as well as decreased activity in both posterior systems (left temporoparietal, left occipitotemporal). People still have trouble reading unexpected words because they rely more on their right-sided posterior brain regions for memorization when they read than on sound-symbol linkages [8, 14, 15].

4. Common characteristics of dyslexia

One or two of these features are present in most persons. It does not follow that everyone has dyslexia from that. A person with dyslexia typically exhibits several of these traits, which last over time and hinder learning [8, 13–15, 18, 19].

4.1 Oral language

- Delayed talk
- Having trouble with word pronunciation, learning new words, or using grammar that is appropriate for their age.
- Errors with understanding of words that refer direction like right/left, before/after, and other terms
- Difficulty picking up songs, nursery rhymes, or the alphabet
- Compatibility issues with concepts and relationships
- A naming issue or difficulty with word retrieval

4.2 Reading

- Problems of linguistic awareness where difficulties with reading comprehension and identifying or creating rhymes can be observe. Also, trouble to come up with or recognizing rhymes, or counting the syllables in words can be found.
- Trouble in knowledge of phonemes which can be identified in children when they find difficulty perceiving and interpreting sounds in speech
- Difficulty in phonetic interpretation where children fail to identify distinct tones inside words

- Having trouble differentiating and learning the phonics of letters
- Unable to recall letters' names, forms, or names rapidly
- Reading or spelling letters in the wrong order
- Misreading or omitting frequently used short words
- Fumbles over longer words
- Poor reading comprehension when reading aloud or silently as a result of inaccurate word reading
- Exasperated and slow reading

4.3 Written language

- Trouble putting ideas on paper
- Makes numerous spelling mistakes
- Spelling errors may occur in daily work even though one performs well on spelling tests
- Trouble in proofreading

4.4 Other common symptoms that occur with dyslexia

- Trouble in sequentially naming colors, objects, and letters quickly
- Poor memory for lists, directions, or facts
- Requires repeated exposure to concepts in order to fully grasp them; easily distracted by visual or auditory
- Repeatedly shows declined trend in school performance
- Inconsistent school work
- Recognized as lazy by teachers

4.5 Dyslexia symptoms in preschoolers

- Speech delay and pronunciation issues
- Difficulties learning rhymes and rhyming phrases
- Find challenging to learn shapes, colors and even in writing their own name
- Narrating a story in the right sequence can be challenging.

- Often show disinterest in playing games that requires language skills like using rhyming words, etc.
- Unable to identify the letters in their own name
- Having problems recalling the names of letters, numbers, or days of the week [5, 8, 11, 16, 17].

5. Screening, diagnosis and early intervention

Reading comprehension is a necessary skill in today's environment for both academic success and full participation in society. Thus, problems with reading can have detrimental effects on both the person and the society as a whole. For students who exhibit the warning symptoms of dyslexia, early detection and intervention are crucial for improved outcomes in the long run. It is now possible to test, identify, and correct reading challenges early on thanks to research that has pinpointed the exact skill deficiencies that predict subsequent reading difficulties. Programs at the kindergarten and first-grade levels, which require roughly 30–45 min each day, can solve problems for the majority of kids.

Prior to the second grade, it is more crucial to concentrate an examination on the reading development precursors. The Simple view of reading represents the definition of reading as the result of decoding and comprehension as the equation: reading = decoding (listening) comprehension [20]. This equation states that reading success requires both decoding and (listening) comprehension. Therefore, decoding issues, more widespread language issues, such inadequate vocabulary, or both may contribute to children's reading difficulties. Developmental dyslexia is the term used to describe sudden decoding difficulties in children.

Young children's linguistic abilities, phonological awareness, memory, and quick naming tests are more indicative of dyslexia risk than tests of word reading, decoding, and spelling. As a result, phonological awareness, memory, and rapid naming measures are frequently included in screening tests for kindergarten and the first few months of first grade in order to help identify students who need specialized instruction in order to develop these crucial abilities so they can achieve grade-level standards [1, 2, 20, 21].

6. Challenges in evaluation and eligibility process

Assessment of dyslexia faces a number of difficulties, including a lack of understanding of various terminologies, reliance on phonological awareness as the only linguistic factor, SES, inappropriate use of assessment models, under diagnosis of exceptional students, co-occurring disorders, and ignorance of reliable psychometric tools. Many people have the misconception that people who write letters backwards all have dyslexia, or that children with dyslexia write letters backwards. In order to detect pupils who have reading issues, including dyslexia, schools and teachers are crucial. Making ensuring that teachers are able to recognize reading issues early and use the information obtained via the assessment process to determine eligibility is a difficulty. Early detection of dyslexia is crucial to minimizing these social and emotional challenges and ensuring that the student not only learns to read but also comprehends why reading is difficult.

As of right now, eligibility assessments can be determined in a variety of ways or by combining different approaches, such as: a difference in the person's ability (typically based on an IQ score) and performance (Usually determined by the results of a norm-referenced or individual achievement tests); A pattern of an individual's strengths and weaknesses, as well as a pattern of symptoms, can be observed among their academic accomplishment and cognitive scores [8, 22–24].

7. Framework for eligibility as a student with a reading disability

Step 1: Gather information on reading proficiency of children from teachers, parents and intervention.

Step 2: Individually administer the norm-referenced achievement and cognitive processing tests, state-wide assessments, and curriculum-based measures can all be used to evaluate reading proficiency to find the evidence that the student is not performing up to grade or age norms.

Step 3: Verify that the exclusionary criteria (limited English proficiency, lack of instruction, emotional disturbance, cultural factors, visual, hearing, or motor disability, intellectual disability, emotional disturbance, or environmental disadvantage) are not the major causes of the student's poor reading performance.

Step 3: Examine the cognitive functioning to see if there are any reading-related impairments in any particular area. Phonological processing, orthographic awareness, quick naming, processing speed, and working memory are specific cognitive processes associated with reading. Rule out executive functioning disorders as a possible source of attention problems.es associated with reading. Rule out executive functioning disorders as a possible source of attention problems.

Step 4: Indicate the likelihood that the child needs special education and that their learning challenges necessitate particularly tailored instruction due to the impact of their reading disability (in accordance with IDEA, [25]).

Step 5: Indicate the likelihood that the child needs special education and that their learning challenges necessitate particularly tailored instruction due to the impact of their reading disability (in accordance with DSM-5).

The frame work has been asdapted from Lindstrom [22].

8. Battery of assessments targeting language and reading

It is customary to rule out any potential hearing acuity issues before testing. Language, Phonological awareness, rapid naming/word fluency, Reading fluency, Reading comprehension, Spelling, and Writing are the fundamental areas to be examined for a dyslexia diagnosis.

8.1 Language

The foundation for reading and writing is oral language; hence people with oral language issues typically also develop literacy disorders. Because dyslexia inhibits reading over time, which may also unintentionally artificially lower IQ results, language tests that provide information about an individual's receptive and expressive language abilities, language processing, morphological skills, and pragmatic language skills are required. A formal evaluation of language using a standardized test must be

combined with an informal evaluation of a person's pragmatic language abilities, such as a language sample and inquiries to parents and teachers.

8.2 Phonographical awareness

Poor phonological awareness, which emerges in an inability to recognize and combine separate phonemes in words, is the most defining characteristic of dyslexia. People who struggle with phonemic awareness may have trouble making rhymes and recognizing words that rhyme, counting phonemes in a word (a process known as segmenting), adding, removing, or moving sounds around in a word (a process known as elision), and hearing sounds in isolation and blending them together to form words (blending). It had been discovered that a reading disability was strongly predicted by a lack of phonemic awareness.

8.3 Reading fluency

The score of reading accuracy plus the rate (speed) at which one can read is known as reading fluency. Children's reading comprehension can be tested by having them read longer or shorter passages. It represents the typical number of words successfully read each minute. Poor reading fluency may be a sign of issues with vocabulary, comprehension, decoding, or phonemic awareness. Dyslexic children read accurately at a slower rate.

8.4 Reading comprehension

The ability to comprehend printed material is known as reading comprehension. Children with dyslexia may learn just enough information from reading brief paragraphs to perform well on reading comprehension tests.

8.5 Spelling

Spelling tests can offer insightful diagnostic data on phonemic awareness and language in general. Spelling proficiency sheds light on additional knowledge needed for written communication. Poor spelling may be an indication of a hearing deficiency or auditory processing problem. It may also reflect inadequacies in one or more of the following language components: phonemic awareness, orthographic knowledge, semantic knowledge, and morphological knowledge.

8.6 Writing

The most intricate type of language is writing. A child's language problems are frequently most obvious in his or her writing. There could be deficiencies like misspellings, syntactic, semantic, and morphologic problems, deletions of words or word ends, and general inconsistencies.

8.7 Other-multicultural considerations

When evaluating literacy, cultural and linguistic context must be taken into account. The conventions of narrative vary among cultures. When English is not the primary language spoken at home, issues with language and, consequently, reading comprehension may arise. Additionally, some kids can come from households where

neither parent has a college degree, and they might not be exposed to books that help kids learn to read and write.

8.8 Other-school issues

School-related problems can take the form of acting out or behaving extremely quietly in the classroom to avoid being chosen to read aloud. They can also choose books to read that have already been read to them. Being awful is preferable to feeling foolish. Another red signal is when a parent is doing homework or when a youngster takes a long time to complete their assignments. Finally, and most significantly, the youngster is still not learning to read despite the additional support at school.

9. Diagnosis and assessment tools of dyslexia

Dyslexia diagnosis can frequently seem like a daunting, complex task. For parents, educators, doctors, and other professionals working with troubled students, it is truly a multi-step challenge. Finding out "who on earth actually diagnoses dyslexia?" is the first issue faced by parents of struggling pupils. Typically, parents visit the school for the first time when they see their child is having difficulties. If they have done any research or have heard of dyslexia, they question the school staff if that could be the reason for their child's difficulties. Although they can identify red flags, school personnel are unable to make a diagnosis of dyslexia; hence a competent outside specialist must do so. Clinical psychologists, neuropsychologists, speech-language pathologists, educational diagnosticians, academic learning centres, or medical experts with relevant training in diagnostic evaluations for learning disorders are examples of qualified professionals.

The diagnosis should be made as with any diagnosis, using information from the case history, casual observation and conversation, and the standardized measures. It's critical to assess for evidence of poor decoding, low reading fluency, poor reading comprehension, spelling, and writing challenges, as well as difficulties with phonological processing like phonological awareness, phonological memory, or rapid automatic naming. Consequently, the diagnosis should call for action on,

9.1 Measures of single-word (real word and nonsense word) reading in both timed and untimed measures

There are several measures of single-word reading that are timed and untimed. Some of them with great options are

a. Word Reading Efficiency (TOWRE-2)

b. Wechsler Individual Achievement Test (WIAT-4) real and nonsense word reading, 3. Word Identification and Spelling Test (WIST),

c. The Phonological Awareness Test (PAT – 2NU)

9.2 Measures of oral reading fluency

It is important to know how students are reading connected text as well as how quickly a child can read and also how accurately they are reading which requires

hearing them reading out loud. The tools which are available to measure oral reading fluency include,

a. Gray Oral Reading Test (GORT-5), This test places equal favor on how quickly a student reads and also measures student's accuracy as inaccurate reading impacts reading comprehension.

b. Woodcock-Johnson IV Tests of Achievement (Oral Reading*, Sentence Reading Fluency*)

c. Test of Word Reading Efficiency–2 (Sight Word Efficiency**, Phonemic Decoding Efficiency**)

d. Kaufman Test of Educational Achievement, 3rd ed. (Word Recognition Fluency**)

e. Process Assessment of the Learner, 2nd ed. (RAN-Words**, Morphological Decoding Fluency**, Sentence Sense*)

f. Wechsler Individual Achievement Test, 3rd ed. (Oral Reading Fluency*)

The tools include tasks like Silently read a series of simple sentences and indicate if they are true or false (timed), read a passage orally as quickly as possible, orally read a list of single words or nonsense words (timed).
(Rate*, Fluency*)

9.3 Measures of reading comprehension versus listening comprehension

The end goal of reading is comprehension as it is important to know how well students comprehend the material they read and that is provided orally. It is important to assess whether students perform better when listening to information or when reading the information or do they struggle with both that requires specific intervention strategies.

a. Gray Oral Reading Test (GORT-5)

b. The Wechsler Individual Achievement Test (WIAT-4)

c. Woodcock-Johnson IV Tests of Achievement (Letter- Word Identification)

d. Kaufman Test of Educational Achievement, 3rd ed. (Letter and Word Naming)

e. Wechsler Individual Achievement Test, 3rd ed. (Word Reading/Reading Comprehension)

f. Process Assessment of the Learner, 2nd ed. (Does It Fit?, Sentence Sense Accuracy score; Sentence Structure)

These tests include reading aloud a passage and responding to questions based on it, reading a passage that has a word or phrases missing and providing the missing word(s), and silently reading three sentences—two of which are illogical because they

contain a silly word. (e.g., "The boy cames [sic] home late") and circle the sentence that makes sense.

9.4 Measures of spelling

Sometimes students may have a strong visual memory for words while reading but really struggle to apply these rules at a higher level like in writing and it is also important to know students' single-word spelling ability by making them write single letters and spell words that are dictated, find the correctly spelled word among a group of four words of which three are misspelled.

Common tests used are,

a. Wechsler Individual Achievement Test (WIAT-4) (Spelling)

b. The Word Identification and Spelling Test (WIST)

c. Woodcock-Johnson IV Tests of Achievement (Spelling)

d. Kaufman Test of Educational Achievement, 3rd ed. (Spelling)

e. Process Assessment of the Learner, 2nd ed. (Word Choice)

9.5 Measures of written content and grammar usage

Assessing writing at higher levels is equally important as reading to assess reading at higher levels (fluency and comprehension). It is necessary to see how pupils employ linguistic structures and spell in their writing in order to comprehend this one. A variety of exams are available to evaluate written content and grammatical usage.

a. Wechsler Individual Achievement Test (WIAT-4) Sentence and Essay level writing subtests

b. The Test of Written Language (TOWL-4)

9.6 Measures of phonological awareness

Measures of phonological awareness helps to identify whether students can break down sentences, syllables, sounds and if they can blend or repeat sentences, syllables, and sounds. Measures available to test phonological awareness are,

a. Comprehensive Test of Phonological Processing (CTOPP-2)

b. Phonological Awareness Test (PAT-2NU),

c. Phonological Awareness Screening Test (PAST)

d. Woodcock-Johnson IV Tests of Achievement (Word Attack, Spelling of Sounds)

e. Kaufman Test of Educational Achievement, 3rd ed. (Letter Naming Facility, Letter Checklist)

f. Wechsler Individual Achievement Test, 3rd ed. (Naming Letters, Letter-Sound Correspondence)

These tests consist of the following tasks: writing single letters and letter patterns delivered verbally, pronouncing nonsensical words of increasing difficulty, identifying individual letters, making sounds for a limited selection of single letters, and spelling gibberish words. Repeat a non-word without including the intended sound. (say stem without saying /t/); blend /c/ /a/ /t/ to form the word cat. Identify specific phonemes in words (e.g., first, middle, last sound); break the word sun into its component sounds: /m/ /a/ /n/'

9.7 Measures of orthographic competence

The capacity of a learner to perceive the visual representation of a letter or number and promptly interpret the symbol is known as orthographic competence.. Diagnosis tools include tasks like,

a. Comprehensive Test of Phonological Processing (CTOPP-2)

b. Rapid Naming subtests,

9.8 Measures of language processing

Language processing tools assess student's expressive and receptive vocabulary and their listening/oral comprehension ability.

a. Wechsler Individual Achievement Test (WIAT-4).

9.9 Letter–sound knowledge

Letter-sound knowledge is assessed through writing, production, and recognition exercises which describes how well-versed a pupil is in letter names, forms, and related sounds. To measure letter–name fluency, the student may be given a random list of uppercase and lowercase letters and asked to identify the names of as many letters as possible in 1 min. A random list of capital and lowercase letters and 1 min test to name as many letters as possible can be used to gauge a student's letter-name fluency.

Similar to this, students may be given a random selection of uppercase and lowercase letters on tests of letter-sound fluency, and they have 1 min to identify as many letter sounds as they can. Additionally, a pupil can be required to write individual dictated letters or the letter or combination of letters that matches to an oral sound that is delivered. (e.g., "Write a letter that makes "n" sound").

Common tests used are

- Letter/Word Recognition (real words) AIMSweb Tests of Early Literacy or Reading for letter naming fluency and oral reading fluency.
- Dynamic Indicators of Basic Early Literacy Skills, 6th Edition (DIBELS)*
- Letter Naming Fluency

- Oral Reading Fluency
- Dynamic Indicators of Basic Early Literacy Skills Next (DIBELS Next)*
- Oral Reading Fluency
- Feifer Assessment of Reading (FAR)
- Isolated Word Reading Fluency
- Gallistel-Ellis Test of Coding Skills
- Gray Dignostic Reading Tests, 2nd Edition (GDRT-2)
- Letter/Word Recognition
- Reading Vocabulary
- Kaufman Test of Educational Achievement, 3rd Edition (KTEA-3)
- Letter and Word Recognition (both timed and untimed subtests)
- Test of Word Reading Efficiency, 2nd Edition (TOWRE- 2)
- Sight Word Efficiency (timed)
- Wechsler Individual Achievement Test, 3rd Edition (WIAT-III)
- Word Reading(timed)
- Wide Range Achievement Test, 4th Edition (WRAT-4)
- Word Reading
- Word Identification and Spelling Test (WIST)
- Word Identification
- Woodcock Reading Mastery Tests, 3rd Edition (WRMT-III)
- Letter Identification
- Word Identification
- Woodcock-Johnson III Diagnostic Reading Battery (WJ III-DRB)
- Letter-Word Identification
- Woodcock-Johnson Tests of Achievement, 4th Edition (WJ-IV)
- Letter-Word Identification (untimed) [1, 8, 9, 12, 21, 22, 26–35]

10. Description of popularly used tools to diagnose dyslexia

1. Test of Word Reading Efficiency - 2 (TOWRE-2) by Joseph Torgesen, Richard Wagner, Carol Rashotte

   The TOWRE-2 is a rapid and accurate method for evaluating how well adults and children between the ages of 6 and 24 recognize sight words and use phonemic decoding. It is a valid and reliable measure for professionals in schools and clinics to measure word-reading skills. It helps to identify children in the early elementary grades who requires more intensive or explicit instruction in word reading skills in order to make adequate progress in learning to read. It is also frequently used and takes only 5–10 min to complete as part of a battery of tests for the diagnosis of particular reading problems in older children and adults.

2. Word Identification and Spelling Test (WIST) by Barbara A. Wilson and Rebecca H. Felton

   The WIST can be used to detect specific areas of weakness for struggling readers as well as identify kids who are struggling with basic literacy abilities. It is available in two versions: an elementary version for grades 2–5 and a secondary version for grades 6–12. It evaluates word identification, spelling, and sound symbol knowledge. It can be useful in creating intervention strategies for students and involves both informal and norm-referenced assessments.

3. Process Assessment of the Learner –II (PAL-II) by Virginia Wise Berninger

   To evaluate the cognitive processes involved in academic tasks in kindergarten through sixth grade, the PAL-II can be utilized as an individual or group administered tool. It enables the examiner to determine underachievement causes and link these shortcomings to remedies. Two distinct tests are included in the PAL-II: the PAL-II RW for reading and writing and the PAL-II M for math.

4. Kaufman Test of Educational Achievement, Third Edition (KTEA–3) by Alan S. Kaufman and Nadeen L. Kaufman

   The Kaufman Test of Educational Achievement, Third Edition (KTEA–3) helps to quickly and easily identify strengths and weaknesses of children to determine the right intervention and provides a deeper understanding of achievement gaps in students and to provide intervention to achieve their potential. It is a thorough, individually conducted assessment of academic achievement that looks at important math, reading, writing, and oral communication abilities. It incorporates two independent, concurrently normed parallel forms (A and B) to correctly measure academic progress and minimize practice effects. It covers a wide variety of achievement and language areas. The age range for it is 4:10 to 25:11.

5. Gray Oral Reading Test (GORT) by Wiederholt, J. Lee Bryant, Brian R

   GORT, a norm-referenced test determines children's (6–18 years) oral reading pace, accuracy, fluency, and understanding by objectively measuring growth in oral reading and diagnose oral reading difficulties. It is an appropriate research tool that determines the reading strengths and weaknesses of individual pupils, to identify students who perform less well in oral reading than their peers, and to

track reading development following intervention; can be completed between 15 and 45 min.

6. Phonological Awareness Test-2: Normative Update (PAT-2: NU), Robertson and Salter

   PAT-2: NU is a standardized test used to assess children between the ages of 5 and 9 years, 11 months on their phoneme-grapheme correspondence, phonological awareness, and phonemic decoding abilities. The instrument consists of two supplementary subtests (Phoneme-Grapheme Correspondence and Phonemic Decoding) in addition to six core subtests (Segmentation, Rhyming, Deletion, Isolation, Substitution, and Blending). Both standard item analysis and differential analysis will be used to evaluate each item. The Phonological Awareness Index and the Phoneme-Grapheme Index comprise the Total Score.

7. Wechsler Individual Achievement Test-III (WIAT-III), Wechsler, [36]

   The WIAT-III is a standardized academic achievement test which assesses previously learned knowledge related to Reading, Mathematics, Written Language and Oral Language of individual whose age ranges from 4:0–50:11. The WIAT-III includes subtests and observations (Early Reading Skills, Word Reading, Pseudo Word Decoding, Reading Comprehension, Oral Reading Fluency, Total Reading, Basic Reading, Reading Comprehension and Fluency, Numerical Operations, Math Problem Solving, Math Fluency, Alphabet Writing Fluency, Spelling, Sentence Composition, Essay Composition, Writing Expression, Listening Comprehension, Oral Expression and Oral Language).

8. Wechsler Individual Achievement Test – IV (WIAT-IV)

   The assessment is intended to determine the ability of an individual to utilize cognitive abilities and acquired knowledge to meet grade-level requirements in reading, math, and written and vocal language for people ranging in age from preschoolers to postsecondary students. It can be effectively used in academic placement, diagnoses of SLD and Dyslexia screening and evaluation. Language, Reading, Speaking, Writing and Listening are the major domains of the tool. The sub domains include Language Comprehension; Reading Comprehension; Fluency and Decoding.

9. Woodcock Johnson IV [37]

   Woodcock Johnson IV is used to measure academic achievement, oral language, and cognitive abilities. The Woodcock-Johnson IV Tests of Achievement (WJ IV ACH), The Woodcock-Johnson IV Tests of Cognitive Abilities (WJ IV COG), and The New Woodcock-Johnson IV Tests of Oral Language (WJ IV OL) are the three complimentary, independent, and co-normed batteries of this tool. The tests of achievement include 20 tests to measure four broad academic domains: written language, reading, academic knowledge and mathematics. The Woodcock-Johnson IV Tests of Cognitive Abilities tests and clusters draws important diagnostic information which are useful in identifying exceptionalities and disabilities; and it includes 18 tests to measure verbal attention, letter-pattern matching, phonological processing, non-word repetition and visualization. The New Woodcock Johnson IV Tests of Oral Language comprises 12 battery of tests which are useful for oral language

assessment, determination of English (and Spanish) language proficiency, compares strengths and weaknesses in oral language related abilities for a more complete reading, writing, and dyslexia assessment; this also includes distinct clusters for evaluation of Listening Comprehension and Oral Expression.

10. Comprehensive Test of Phonological Processes – 2nd Edition (CTOPP-2) by Richard K. Wagner, Joseph K. Torgesen, Carol A. Rashotte, Nils A. Pearson

The C-TOPP can be used as a measuring tool in phonological processing research studies, to identify people who are significantly perform below the children in their age group in critical phonological skills, identify advantages and disadvantages in phonological processing, and to document pupil's progress as a result of special intervention programs. This tool is intended for use by anyone between the ages of 4 and 24. The CTOPP-2 is a 40-min test with two subtests that produces developmental scores, age and grade equivalents, composite indices, percentile ranks, and subtest scaled scores [1, 2, 8, 9, 12, 13, 15, 17–24, 27, 38].

11. Conclusion

Dyslexia is a specific learning disability which refers to difficulty with reading and related language-based processing skills. It is also known as a reading handicap and is the most prevalent reading disorder, accounting for about 80% of all learning disabilities. Reading difficulties start even before learning to read.

The neuro-diversity of dyslexia is widespread and prevalent in all societies, ages, and cultures. According to studies, one in ten persons worldwide has dyslexia. After years of discussion, the American Psychiatric Association amended the worldwide diagnostic criteria for learning disabilities in DSM-5 in 2013, which marks a new stage in the study of this condition. The newly proposed diagnostic criteria have undergone several significant changes, including the removal of the "Discrepancy Criterion," a mention of the "Response to Intervention Approach," and a new perspective that views learning disorders as a subset of the Neurodevelopmental disorders. Although the precise causes of dyslexia are still unknown, morphological and brain imaging investigations have revealed abnormalities in how the brains of those who have the condition develop and work. Young children's linguistic abilities, phonological awareness, memory, and quick naming tests are more indicative of dyslexia risk than tests of word reading, decoding, and spelling. As a result, phonological awareness, memory, and rapid naming measures are frequently included in screening tests for kindergarten.

Assessment of dyslexia faces a number of difficulties, including a lack of understanding of various terminologies, reliance on phonological awareness, SES and inappropriate use of assessment models. In order to detect pupils who have reading issues, including dyslexia, schools and teachers are crucial. Making ensuring that teachers are able to recognize reading issues early and use the information obtained via the assessment process to determine eligibility is a difficulty. Early detection of dyslexia is crucial to minimizing these social and emotional challenges and ensuring that the student not only learns to read but also comprehends why reading is difficult.

To make a diagnosis, data must be triangulated from the case history, informal observation and conversation, and the standardized measures. This will help identify any signs of spelling and writing difficulties, poor decoding, poor reading fluency, poor reading comprehension, or difficulties with phonological processing.

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Chapter 3

Multivariate Treatment of Dyslexia, Dysgraphia and Dyscalculia

Charles Potter

Abstract

This chapter focuses on the implementation of a response to intervention model for assessment and treatment of dyslexia, dysgraphia and dyscalculia, which is illustrated through a longitudinal case study. The model links learning and adjustment difficulties to multivariate treatment, and through this to firm diagnosis and classification. In applying the model, initial diagnosis of learning disabilities is treated as provisional, based on functional indicators as well as test data. Treatment is then multidimensional, using graded materials that are applied in clinical teaching. The case study shows how firm classification becomes possible through longitudinal assessment and progress evaluation, analysis of response to multivariate intervention as well as response to specific treatment programmes. Diagnosis can then be linked both to concessions and ongoing treatment of areas of functional difficulty in learning and adjustment to school.

Keywords: dyslexia, dysgraphia, dyscalculia, reading, writing, spelling, numeracy, working memory, assessment, evaluation, response to intervention, incremental validity, multivariate treatment

1. Introduction

This chapter provides a longitudinal case study of a dyslexic child (Child H), whose programme included work on a number of fluency-based interventions focused on his difficulties with reading, writing and spelling. Assessment has been based on a response to intervention model (Note 1), linked to treatment using a multivariate approach based on Luria's theories of cerebral organisation [1–4]. In applying the model in working with Child H over a five-year period, labels such dyslexia, dysgraphia or dyscalculia were avoided until such time as treatment programmes had been implemented and Child H was both physically and neurologically mature.

At time of initial assessment, there were a number of different areas in which Child H's reading, writing and spelling were below age level, indicating the need for multivariate treatment. This involved a number of different interventions that were implemented over Child H's years at primary school. In his final year at primary

school, response to intervention assessment was conducted. At this point, a dyslexic label was applied, with a view to motivating for concessions at high school level.

The aim of this chapter is to demonstrate that classification of learning disabilities based on response to intervention is not only possible, but also enhances validity. The case study should be read in conjunction with previous publications in which the approaches and methods used in multivariate assessment and treatment are described in more detail [5–9]. These can be accessed from the publisher free of charge online.

1.1 What is an response to intervention approach to classifying learning difficulties?

The multivariate assessment and treatment programme implemented with Child H follows Luria's theories in conceptualising competencies in reading, writing, spelling and numeracy as hierarchical and based on the development of automaticity [10]. Automaticity in reading, writing and spelling is linked to fluency on both functional and neurological levels [11], and provides a basis for the development of higher-order mental processing. Following Luria, there is thus value in providing fluency-based interventions which can develop basic skills and competences in reading, writing, spelling as well as numeracy, as these can then form a platform on which the scaffolding necessary to develop higher order functions can be built [12–14].

In working with Child H, the aim was to provide this type of functional platform, by focusing on those areas of his functioning in which he had not yet developed competencies based on automaticity. These areas were identified through assessment based on ICD10 linked indicators (Note 2), which enabled Child H's development as well as his difficulties to be described functionally. Functional assessment then enabled labelling to be avoided until such time as Child H had benefit of focused multivariate treatment, and until such time as he was more developmentally and neurologically mature.

As maturation took place, firm diagnosis and classification as dyslexic then became to Child H's benefit, as the classification could be linked both to longitudinal response to interventions as well as to concessions related to his areas of ongoing difficulty. Firm classification of Child H's learning disability could also be based on incremental validity [15–17] as the dyslexic label could be linked both to cross-sectional assessment as well as longitudinal progress evaluation of his response to multivariate treatment using particular types of methods and materials.

1.2 What is the logic of response to intervention classification?

There has been intense debate in the literature on assessment and classification of learning difficulties between those who have advocated or rejected the practice of classifying and labelling different types of reading disabilities, as outlined by Elliott and Grigorenko [18]. The debate is based on a number of issues [19], in terms of which response to intervention classification offers the possibility of more valid evidence-based classification of learning disabilities.

The theoretical basis of the response to intervention model we use has been described by others in the literature [20–23] as well as in a previous publication on our work in this practice [9]. A response to intervention approach to classification of learning disabilities has potential benefits in enabling labelling of learning difficulties to be avoided until such time as there is compelling longitudinal evidence concerning the particular nature of a child's learning difficulties. This can be based both on

assessment and evidence concerning how a child copes with school while being provided with learning support.

There are a number of reasons why response to intervention classification of learning disability is logical. One reason is that there is lack of agreement as to typologies of learning disabilities, as well as to how these apply to children and adults. Another is that there is a lack of consensus as to whether it is better to base diagnosis of learning disabilities on purely functional descriptions of the behaviours associated with how learning disabilities manifest in particular children (using terms such as "backward reading", "specific learning disorder, with impairment in reading" or "specific reading retardation"). A third reason is that there is also concern as to whether it is helpful to apply a label such as "dyslexia", "developmental dyslexia", "dysgraphia" or "dyscalculia" to children for diagnostic purposes, and whether this type of labelling can be prejudicial to children and their families.

In addition, much of the literature is based on the evidence that children's learning difficulties are specific [24–40], indicating that some developmental learning difficulties in children may be built-in and immutable, whilst others may be trainable. Assessment procedures and treatment programmes based on a response to intervention model of classification are thus potentially valuable both to therapists and children [20–22], as they work from the standpoint that classifications of learning difficulties are provisional and emergent until such time as they can be based on treatment validity [41].

On the one hand, this standpoint is based on the belief that it makes more sense scientifically to work from a standpoint that treatment validity is increased if one focuses on the evidence one sees, and if one bases treatment directly on evidence of functioning, as well as the errors made by children. On the other hand, it is based on clinical evidence that it makes more sense to work from diagnoses which have the potential of changing from hypotheses to firm and persistent categories as treatment progresses, based on a process of incremental validity [15, 17]. This is the logic of the case study presented in this chapter.

2. Methodological issues

Unlike my doctoral research which involved an evaluative case study of curriculum development in a programme based on participant observation [42–45], the case study reported in this chapter has been based on a single case (N = 1) design involving longitudinal observation and repeated measurement [46–50]. One purpose has been to implement a changing criterion design to identify the effects of treatments that have been continuously applied as well as varied [51, 52]. Another purpose has been to analyse evidence from a number of indicators to establish gains made over time [49, 53]. A third purpose has been to use common indicators to enable aggregation with the results of other similar N = 1 case studies [54–57].

One limitation is that this case study is based on ex post facto analysis [58, 59]. As human memory is limited and ex post facto analyses are subject to misinterpretation [60–63], a behavioural diary based on a computer-based treatment file supported by longitudinal written file notes has been used to record work done in the sessions worked with the child [64–66]. This activity-based evidence of focuses and types of longitudinal intervention has then been combined with analysis of school reports as well as repeated measurement of outcomes based on use of psychometric testing. The aim has been to link both focuses and sequences of treatment to progress

in a time line recording use of methods and materials focused on the development of basic skills in reading, writing and spelling as well as working memory for both written words and written words in sequence. This type of treatment evidence has then been combined with psychometric testing to enable firm classification of learning disability, based on the suggestions made by Vaughn and Fuchs [21], and Fletcher and Vaughn [22].

As readers may have interests in methods and materials used in treatment, instruments used in assessment as well methods used for evaluation of progress, this chapter describes methods used in treatment, materials used in treatment as well as evidence of outcomes based on longitudinal psychometric testing, using the types of psychometric instruments commonly used in our country as indicators of underlying learning disabilities [6, 7]. Progress and outcomes are then presented descriptively, linked to graphs.

There are many limitations in this type of descriptive case study on a methodological as well as on an inferential level. One limitation is that ex post facto analysis is best suited to description of relationships as opposed to statistical testing of results [60, 62], and for this reason the case study focuses on practical as opposed to statistical significance of test results [67, 68]. Other limitations are implicit in the use of interpretive multimethod analysis and reporting [69, 70], based on evidence from repeated measurement, analysis of trends in school reports as well as visual analysis of graphs of standard scores on psychometric tests [71, 72]. To counter these limitations and increase the likelihood of unbiased and valid interpretation, a colleague has been involved in both the psychometric testing and the analysis of Child H's progress and results [Note 3]. The aim has been to enable data, investigator and time triangulation of longitudinal evidence, based on the suggestions for prolonged engagement and use of multiple data points and multiple investigators made by Denzin [73, 74], and by Guba and Lincoln [75, 76].

Ethically, in addition to parental permission, this case study follows the suggestions made by Yin [59], who has recommended use of pseudonyms for purposes of anonymity in reporting, and the checking of both reporting and interpretation both by participants and by at least one external source [77]. The use of testing and test data would comply with the standards applied by other practitioners working in our country [6], as well as the suggestions for use of response to intervention assessment made by others working internationally [23, 78].

2.1 Classification of particular type of learning disability on the basis of response to intervention: a longitudinal case study

The purpose of the rest of this chapter is to present a longitudinal case study of a single child (Child H), which illustrates the way in which children can be assessed and then taught using a response to intervention approach. Learning difficulties in children are defined as functional difficulties in learning and adjustment to school and conceptualised as multivariate [79–82] requiring a combination of different types of interventions (Note 4).

Initial assessment is thus conducted functionally, with the aim of establishing the child's areas of difficulty. Interventions are then normally longitudinal and conducted side by side with the curriculum taught in the child's school. Firm classification as dyslexic, dysgraphic or dyscalculaic can then be based on evidence which is incremental as well as multimethod, based on a process of both cross-sectional and longitudinal triangulation [83–85].

The model for classification has been described in a previous publication [9], and the aim of the case study provided in this chapter is to provide evidence of how the model can be applied in practice. This will be done through an extended case study of a child with learning difficulty, who has been involved in working with my practice for a number of years. The child's development will be described longitudinally from the time he was first assessed at age nine through to the time of transition from primary school to high school at age thirteen. At this point, based on longitudinal evidence, firm classification as dyslexic was made, linked to concessions in reading, spelling and rate of work.

The model for response to intervention classification of learning disabilities is reflected in **Figure 1** below. It will be noted that the model is multimethod, based on summative assessment linked to progress evaluation of longitudinal interventions conducted across a number of areas of functional difficulty. The model enables incremental validity, based on triangulation across different data points over time [15, 86].

Figure 1.
Classification of learning disabilities based on response to multivariate fluency-based interventions.

In applying the model, firm classification of Child H's learning disability was avoided until such time as there was longitudinal and cumulative evidence concerning his response to the particular methods used in his multivariate treatment programme. At the point of transition from primary school to high school level, classification as dyslexic, dysgraphic or dyscalculaic could be based on both incremental and treatment validities, through analysis of evidence of his response to particular methods, materials as well as teaching techniques. It could also be based on a combination of assessment methods [17, 41].

2.1.1 Child H's background

Child H was at a Model C government school in Grade 3 at time of initial assessment (Note 5). His parents made contact with me in September 2016, indicating that Child H had difficulties with learning which had not been evident at the start of his primary schooling. These started to manifest as he moved from the foundation level into middle school.

As Child H was engaging, cooperative, well-spoken and well mannered, his school reports made no mention of any reading, writing, spelling or learning issues. However, as Child H moved up primary school, his difficulties with reading, writing, spelling and rate of work were increasingly evident to his parents.

There was a family history of learning difficulties. Child H's father had learning problems as a child. Child H's younger brother also had reading, writing and spelling difficulties from the start of his schooling, but overcame these through focused therapy. For these reasons, Child H's parents referred Child H to me for assessment.

2.1.2 Problems highlighted in initial interview and parent questionnaire

- Issues with writing and completing work.
- Spelling and phonic difficulties.
- Difficulties with phonetic spelling.
- Reading fluency difficulties.
- Guessing rather than analysing words, affecting both reading and rate of work.
- Difficulties with completing creative writing tasks.
- Lowered confidence due to awareness of difficulties.
- Familial difficulty (dad had learning difficulties as child; younger brother also had learning difficulties).

2.1.3 Strengths highlighted in initial interview and parent questionnaire

- Social abilities and friendships at school.
- Leadership in scouting and cubs.

- Good visual memory which is used for remembering spelling.
- Good at swimming and other sports.
- Interest in outdoor activities such as fishing.
- Spatial competence as indicated by interests in Lego and computers.

2.1.4 Initial assessment

The following tests were administered in the initial sessions with Child H:

Buck's House Tree Person Test, the Bender Gestalt Test, the Peabody Picture-Language Vocabulary Test, the Schonell One Word Spelling Test, the Holborn Reading Scale and the Schonell Graded Dictation Tests (Tests A and B). These test-based evidences were supplemented by implementation of a set of Phonic Inventories (Note 6) as well as pragmatic language tasks involving (a) analysis of a spontaneous writing sample, (b) analysis of school books and (c) analysis and comprehension of a picture story, as well as an IQ (the WISC IV UK) (**Figure 2**).

2.2 Child H: profile of results from initial testing of basic skills here

Initial testing indicated that Child H had adequate vocabulary for age level, but had one word reading difficulties, sentence reading difficulties, one word spelling difficulties, sequential spelling difficulties and problems with sound/letter associations indicating difficulties with phonics. There were also a number of reversals in writing (e.g. b/d) as well as difficulties with rate of work. Observation indicated that Child H was a very well-mannered and engaging child, but that there was evidence of both attentional and focus difficulties. There were also indicators of under-confidence in Child H's drawings as well as anxiety indicators in the Bender Gestalt Test, suggesting that his attentional difficulties could be linked to performance anxiety.

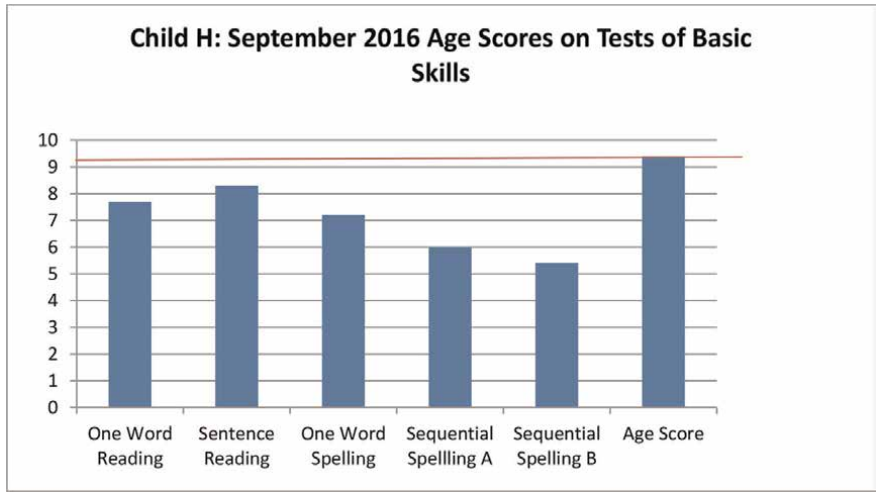

Figure 2.
Child H – profile of results from initial testing of basic skills.

There were a number of indicators of potential learning disability in the case history, as well as evidence of lowered scores in reading, writing and spelling from the two initial sessions conducted with Child H. In addition, there was evidence of phonic errors made on both short and long vowel sounds as well as beginning and ending blends and clusters, slow rate of reading, slow rate of work and spelling errors on pragmatic tasks as well as rate of work difficulties and spelling errors in Child H's schoolwork.

As there was evidence of fluency-based difficulties affecting accuracy and rate of reading, as well as evidence of difficulties with rate and spelling of written work, more in-depth testing was conducted to establish Child H's cognitive profile, as well as testing using the Phonic Inventories [87–90] to establish Child H's patterns of phonic errors. These results are reported below.

2.2.1 Child H's profile on the WISC IV (UK)

Child H's performance on the different subtests of the WISC IV (UK) [91] is summarised in **Table 1**, which presents the profile of standard scores obtained in the

Verbal Comprehension			**Perceptual Reasoning**		
Subtest	**What subtest measures**	**Standard score**	**Subtest**	**What subtest measures**	**Standard score**
Similarities	Verbal abstract reasoning and word finding ability.	14	Block Design	Abstract non-verbal reasoning, spatial perception and organisation.	9
Vocabulary	Ability to explain the meaning of words.	9	Picture Concepts	Abstract ability to analyse and classify pictorial information.	11
Comprehension	Social understanding and judgement.	10	Matrix Reasoning	Non-verbal abstract reasoning and concept formation.	8
Working Memory			Processing Speed		
Subtest	What subtest measures	Standard Score	Subtest	What subtest measures	Standard score
Digit Span	Short-term auditory memory.	11	Coding	Ability to work at speed in applying a simple code accurately and in sequence.	5
Letter-Number Sequencing	Ability to manipulate letters and numbers sequentially by holding them in short term and working memory.	12	Symbol Search	Ability to work at speed in establishing whether particular symbols are present or absent.	8

Note. In the above table, a standard score is a scaled score relative to a normal curve, where the average score would be a score of 10. Scores higher than 12 indicate above average performance relative to age level, indicating potential areas of cognitive strength. Scores lower than 8 indicate below average performance relative to age level, indicating potential areas of cognitive weakness. This type of profile interpretation needs to be conducted cautiously and substantiated against other information, as any scaled score is subject to measurement error.

Table 1.
Child H – profile of standard scores on WISC IV (UK) (September 2016).

verbal comprehension, perceptual reasoning, working memory and processing speed areas of the test. This was analysed for indicators of strength and weakness in cognitive processing, as well as indicators of the strategies Child H employed in processing information of different types.

2.2.2 Profile of child H on the WISC IV (UK) about here

It was evident from the profile that Child H's performance in all areas of the IQ was in the normal range. However, there was evidence of scatter in level of performance both within and across different areas of the test, indicating that he was likely to have adapted to his difficulties at school using particular learning strategies linked to strengths and weaknesses in how he perceived, processed and remembered information (Note 7). The verbal comprehension scores indicated that Child H had well-developed verbal reasoning ability, and average vocabulary, comprehension, general knowledge and verbal classification abilities relative to age level. The perceptual reasoning side of the test indicated adequately developed perceptual and spatial abilities relative to age level, but weakness in non-verbal reasoning, while the scores in the working memory side indicated good short-term auditory memory as well as good sequential memory for letters and numbers.

There were, however, difficulties in the processing speed areas of the test, with weakness in symbol search and particular weakness in coding. Low scores on the 20 coding test of the WISC are often associated with difficulties in reading and spelling [92–95]. Combined with low scores in symbol search, this indicated difficulties with rate of processing symbolic information, as well as difficulties in coding information as well as recoding information from memory.

Overall the IQ profile provided evidence of scatter in the test scores indicative of strengths and weaknesses in particular types of cognitive and language processing. This will be evident from the graph presented below, in which the standard scores on the test are grouped by cognitive area (**Figure 3**).

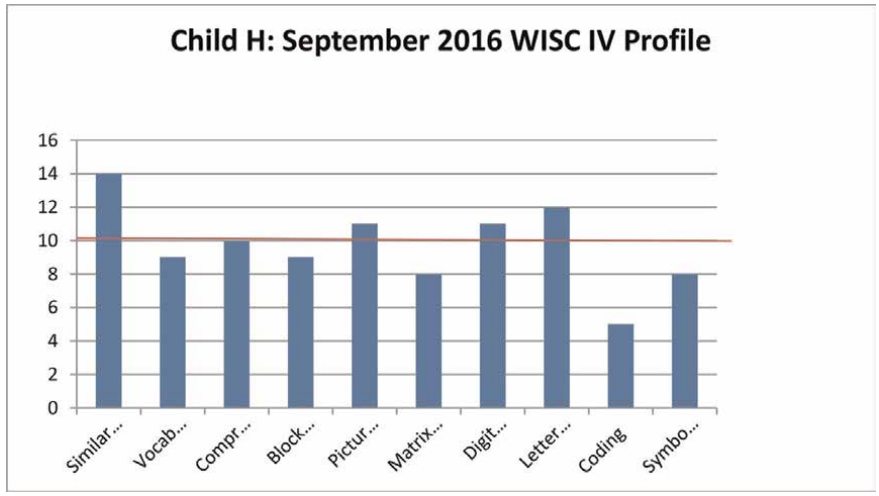

Figure 3.
Child H – profile of standard scores on WISC IV (UK) (September 2016) grouped by cognitive area.

2.2.3 Child H profile of standard scores on WISC IV (UK) (September 2016) grouped by cognitive area here

Overall, the indications from the profile were that Child H had particular strengths in verbal reasoning and working memory, but weaknesses affecting perceptual development as well as processing speed. Coding was a particular area of difficulty indicating needs for intervention in developing sequential working memory for words. There were also indications from the IQ that Child H's strengths in other working memory areas could be used as the basis for interventions to improve his functioning in writing and spelling.

2.2.4 Child H's profile on the phonic inventories

As Child H was in Grade 3 at school, the first of the three levels of the Phonic Inventories were also administered, and error analysis conducted. Child H's profile indicated high error scores on:

- Beginning consonant blends.
- Ending consonant blends.
- Medial vowels in words based on short vowel sounds.

Overall, Child H's pattern of errors on the phonic inventories provided indicators of both phonological and phonic difficulties. A high incidence of errors on ending consonant blends on this instrument [96–98] is associated with learning disabilities. Number of medial vowel errors is also an indicator of learning disability both in primary school age children [99, 100] and in high school children [101].

The profile of errors on the instrument was thus used as corroborating evidence of the presence of a learning disability, while also providing evidence of specific areas of learning need. In addition, the profile was analysed to identify specific phonic errors and error types which could be targeted for instruction [102–104].

3. Functional classification of child H's learning difficulties

The conclusion was that the tests of basic reading, writing and spelling skills fell well below what would be expected in terms of age level as well as Child H's overall level of cognitive performance, enabling diagnosis of a reading disorder under DSM-IV code 315.00 (Note 8), as well as a disorder of written expression in terms of the diagnostic criteria for DSM-IV code 315.2 (Note 9). As there were also attentional and focus difficulties possibly linked to anxiety and emotionality around school performance or to neurological immaturity or to a combination of both physiological and emotional factors, an additional ICD10 classification of Z 73.3 (Stress, not elsewhere classified) could be applied in working with Child C.

Based on the results from assessment, Child H was thus classified for medical aid purposes as having developmental learning difficulties affecting a number of areas of scholastic functioning. The classification provided was functional, based on the use of ICD10 indicators linked to the presence of a number of areas of difficulty, as

presented in **Tables 2** and **3** below. This was done to avoid labelling Child H as either dyslexic or dysgraphic until such time as the different types of intervention in his programme had been implemented.

3.1 Child H—areas of functional difficulty identified in initial assessment here

3.1.1 Child H—linking areas of assessment with focuses of treatment here

The steps summarised in **Table 2** and **3** were taken in order to ensure that the ICD10 indicators would be linked to different areas and different types of intervention in a multivariate treatment programme. If Child H's learning difficulties

Sources of Evidence			**Areas of Difficulty**
Initial Interview		###	Oral Reading Fluency
Child and Family History		###	Silent Reading
Previous Assessments and School Reports		###	Phonic Analysis and Synthesis
Scholastic Testing		###	Oral Reading Comprehension
Cognitive Testing		###	Silent Reading Comprehension
	Verbal Processing		Oral Language Expression
	Non-verbal Processing	###	Written Language Expression
	Dimensions of Working Memory	###	Working Memory: Single Words
	Processing Speed	###	Working Memory: Words in
	Sequence		
Potential Mediating Variables			Number Concepts
###	Focus and Attentional Indicators		Arithmetic Processes
###	Indications of Hyperactivity	###	Reading of story sums
	Auditory Processing Indicators	###	Comprehension of story sums
	Indicators of Phonological Difficulties		Units of Measurement
###	Indicators of Phonic Difficulties		Dates and Time
###	Visual processing indicators		Fractionation
###	Emotional or anxiety factors	###	Maths problem-solving

Key: ### Indicators linked to ICD 10 Descriptors Present.

Table 2.
Child H – areas of functional difficulty identified in initial assessment.

Sources of Evidence		**Focuses of Treatment**	
Initial Interview	###	Oral Reading Fluency	
Child and Family History	###	Silent Reading	
Previous Assessments and School Reports	###	Phonic Analysis and Synthesis	
Scholastic Testing	###	Oral Reading Comprehension	
Cognitive Testing	###	Silent Reading Comprehension	
	Verbal Processing	Oral Language Expression	
	Non-verbal Processing ###	Written Language Expression	
	Dimensions of Working Memory ###	Working Memory: Single Words	
	Processing Speed ###	Working Memory: Words in sequence	
Identification of Mediating Variables		Number Concepts	
###	Focus and Attentional Indicators	Arithmetic Processes	
###	Indications of Hyperactivity	###	Reading of story sums
	Auditory Processing Indicators	###	Comprehension of story sums
	Indicators of Phonological Difficulties	Units of Measurement	
###	Indicators of Phonic Difficulties		Dates and Time
###	Visual processing indicators		Fractionation
###	Emotional or anxiety factors	###	Maths problem-solving
Key: ### Indicators linked to ICD 10 Descriptors Present.			

Table 3.
Child H – linking areas of assessment with focuses of treatment.

persisted, firm classification as learning disabled could then be based not only on cross-sectional psychometric testing, but also on evidence from gain scores (Note 10) linked to progress evaluation of Child H's response to the interventions in his programme.

Progress evaluation would thus be based on the one hand to analysis of the continuing low areas in his assessment, and on the other to Child H's response to specific areas and types of intervention. Firm classification and labelling of type of learning disability could then be linked to concessions.

3.1.2 Development of an individual programme

As initial assessment indicated that Child H had difficulties affecting a number of functional areas, his individual programme was conceptualised as multivariate, requiring a number of interventions. These are summarised in **Figure 4** below.

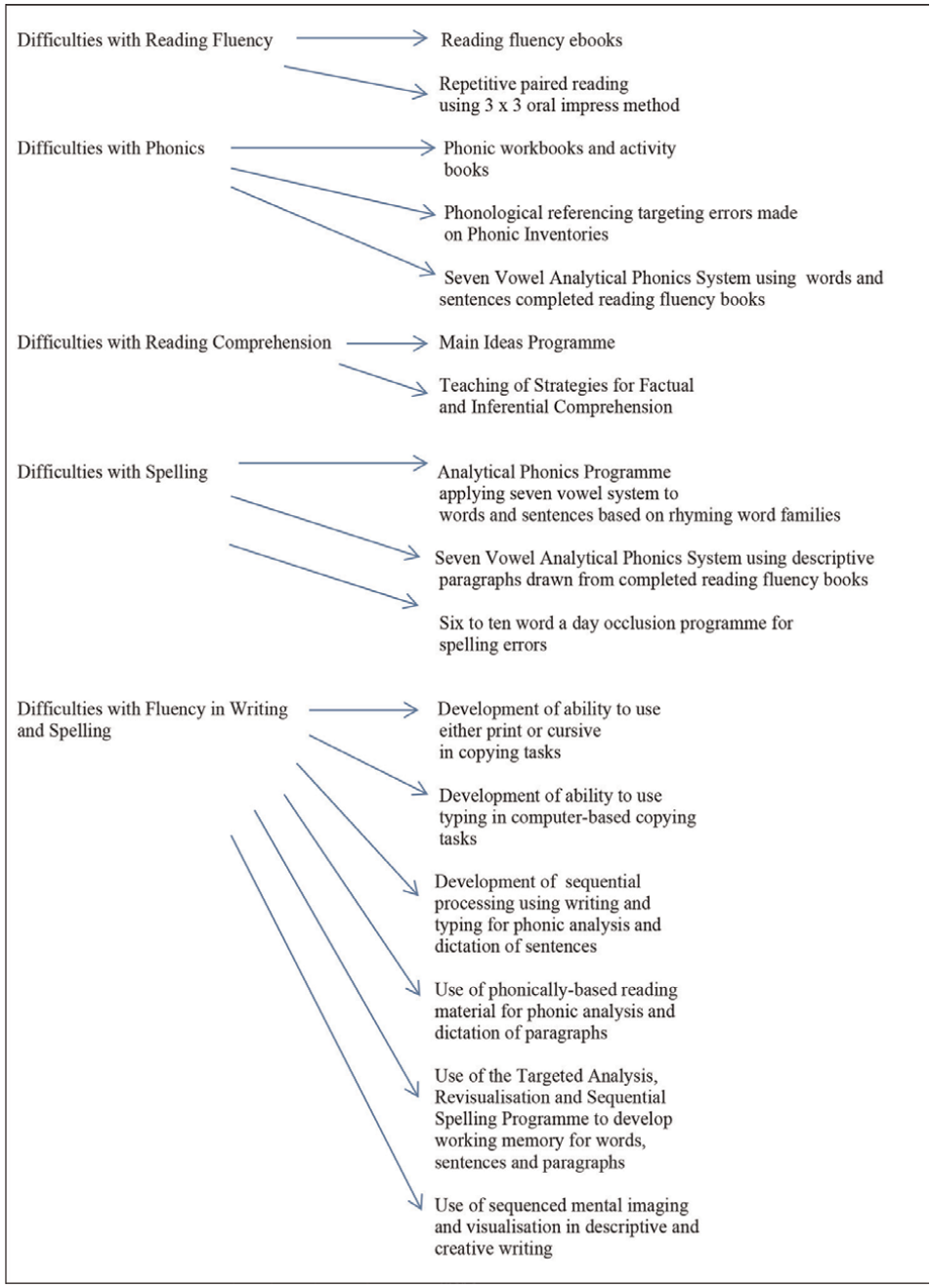

Figure 4.
Child H's individual programme.

3.1.3 Child H's individual programme here

Child H's programme was thus conceptualised as linked to a number of areas of need. The reading side of the programme would be based on interventions aimed at establishing basic phonological and phonic skills, as well as skills in both synthetic, and analytical phonics. In addition, there would be interventions designed to improve Child H's skills in word reading as well as to establish his fluency in sequential reading as the basis for improving reading comprehension. These areas would then form the basis for learning support enabling Child H to improve in the types of language and reading comprehension tasks he was being given in the classroom in Grade 4, as well as to cope with the reading and comprehension requirements of word and story sums at Grade 3 level.

In addition to the reading side of the programme, there would be interventions aimed at establishing basic skills in spelling and writing, which were also influencing Child H's ability to achieve in classroom-based tasks, as well as to keep up with the amount of work and rate of work required. These areas of the programme would be commenced by teaching Child H how to use phonological referencing to analyse the structure of the words he was being asked to learn for his spelling tests at school. This would be done by focusing on the consonant blends and vowel digraphs in these words using a seven vowel analytical system, with the aim of making the vowel system used in English orthography transparent.

Use of the Seven Vowel Phonic Analysis System would initially be introduced through work with graded phonically based material. In order to link the writing and spelling side of the intervention with the work being done in the reading side of Child H's programme, this would be done using graded written material drawn from the reading fluency books Child H had completed. This would work from Child H's spatial strengths, using methods which combined phonic analysis with word, sentence and paragraph revisualisation to develop sequential working memory for words. This would then form the basis for work with a variety of written material directed at establishing fluency in sequential writing and spelling.

The different interventions would be implemented in therapy conducted in hour long sessions conducted once per week, with carry-over through reinforcement by Child H's parents at home using electronic materials drawn from the practice's database (Note 11). There would also be a family-based counselling intervention to enable the different areas of the programme to be implemented side by side with as well as linked to Child H's school work. Work ethic and motivation would be maintained through a reward system based on hundred squares and points (Note 12).

3.1.4 Child H's initial programme: focus on reading fluency side by side with the development of phonic skills

Owing to the evidence that Child H's reading, writing and spelling problems were linked to phonological and phonic difficulties, the methods and materials used in Child H's initial programme targeted reading, writing and spelling fluency linked to interventions focusing on the development of phonic skills. The methods and materials used in the reading fluency side of Child H's programme are described in more detail in Potter [5], while the methods and materials introduced at the initial stage of Child H's writing and spelling fluency programme are described in Potter [6] as well as in Potter [8, 9].

The interventions for the development of phonic skills involved use of phonogram and rime cards to target Child H's errors on the phonic inventories, to support work done using phonological referencing [105, 106]. This focused on teaching Child H how to code from the letters used in rhyming word families back to the movements of the mouth accompanying the sounds made when reading the words, and then how to reverse code from the sequence of sounds made in the spoken word back to the written words.

Focus was initially placed on working with families of rhyming words based on similar phonological and phonemic elements. The sequence of the materials used followed the phonologically and phonically based stages in spelling described by Moats [107, 108], as well as the phonically based stages in teaching spelling in South African primary schools, which are based on use of word families. Phonic associations based on short and long vowel sounds were then reinforced by being introduced side by side with reading fluency activities using our foundation level and then our basic level readers, with the aim of developing the variety of phonic associations as well as the span of working memory necessary to read, write and spell words in sequence [105].

3.1.5 Use of phonological referencing and revisualisation in developing writing and spelling fluency

The materials used in Child H's phonological referencing programme were designed to target the specific phonic errors as well as the types of phonic errors he had made on the Phonic Inventories, whilst at the same time developing the working memory skills necessary to write words individually and in sequence. These were thus written and then taught with these two aims in mind.

These were introduced working from Child H's spatial strengths. One reason for this was that his cognitive test profile indicated that he was a spatially competent child. Another was that pragmatic testing indicated that he had the ability to use eidetic imagery in recalling letter strings and written words (Note 13). These cognitive strengths indicated that phonic associations could be taught using phonological referencing in conjunction with revisualisation. These methods implied building the areas of phonic weakness through methods enabling Child H to use his good visualisation and visual memory abilities in recalling words.

For this reason, focus was placed on working with families of between five and seven words, each of which was based on use of a similar consonant blend of cluster. As the IQ profile indicated that Child H had coding difficulties, the aim was to use Child H's visualisation and visual memory integrities to develop the phonological and phonic working memory integrities necessary to write individual words accurately, as well as the ability to write words accurately in sequence (Note 14).

In teaching the tch ending in short vowel words, for example, the following words were written in Child H's writing book.

- ditch.
- patch.
- fetch.

- botch.
- hutch.
- stretch.

The letters making the vowel sound in each of the words in the /tch/ family were then identified and underlined in colour. The phonological referencing process then involved teaching Child H how to code from the sequence of written letters in each word back to the mouth movements accompanying the sounds made when the word was spoken orally, and then how to recode from the sounds back to the sequence of letters in the word.

These associations were taught through activities in which the hand was placed under the chin, as well as through use of a mirror tile to enable Child H to match the way his mouth opened in making each vowel sound and the way his mouth closed in making each consonant sound. This was done through an activity-based process, in which Child H was asked to:

a. Point to the written word on the page and say it.

b. Look at the consonant letters at the beginning of the written word. Say the sound of these letters out loud.

c. Look at the vowel letter in the middle of the written word. Say the sound of this letter out loud.

d. Look at the consonant letters at the end of the written word. Say the sound of these letters out loud.

e. The ch phonic rule at the beginning of words and the tch phonic rule at the end of short vowel words was then taught by focusing on how the beginning sound, the middle sound and the ending sound work together to make each word, and how the tch phonic rule applied in each word.

This sequence of activities was first used to teach Child H how to code from the component sounds and letters in each word in the tch family, by linking when the word was spoken out loud with the letters used when the word was written down, and to recode from the sequence of sounds back to the written sequence of letters. Each of the words in the tch family was then contextualised in language by being used in sequence in a short sentence. The sentence was then written down by Child H, and the vowel or vowels in each word in the sentence then underlined in colour. Once this had been done, each word in the sentence was revisualised in sequence, and the sentence was then written by Child H from memory (Note 15).

The aim was thus to teach Child H how to identify the letters making particular sounds as well as combinations of letters making particular sounds in written words, and then to recode from particular sounds back to particular letters and sequences of letters in these words. This type of instruction was introduced side by side with work targeting other areas of difficulty identified in the initial assessment, as described in the following section.

3.1.6 Development of formats to support side by side implementation of treatment in a number of areas

The materials used in Child H's phonological referencing programme focused initially on specific errors made on the phonic inventories. This was introduced side by side with reading fluency work, as well as work in language, reading comprehension and maths.

As the aim was to provide graded materials in each of the areas in which Child H needed developmental work, his initial programme was implemented using a format system (Note 16), based on graded activities linked to electronic materials in the practice's database (**Table 4**).

3.1.7 Child H—Learning cycle four implemented 15th October 2016 here

Child H's initial programme was thus conceptualised as multivariate, and based on sequences of activities which had the common aim of developing fluency in reading, writing and spelling. Reading comprehension and proficiency in both processing and use of written language were conceptualised as linked to fluency in these areas, as well as to the development of working memory for individual words and sequence of words. Graded materials were then used to support work in each of these areas.

4. Linking the development of phonic associations, visual memory and sequential working memory skills

The aim of Child H's programme was to focus on needs identified in the assessment process, using strategies and methods linked to his strengths in cognitive processing and working memory. As the evidence indicated that he had underlying phonological and phonic difficulties, phonological referencing would be used to teach Child H how to code from the component sounds and letters in written words, by linking specific letters and sequences of letters with the sounds made when the words were spoken out loud with the letters used when the words were written down.

Focus would also be placed on teaching Child H how to recode from the sequence of sounds back to the written sequences of letters in words. This would be done both to teach Child H specific phonic associations between sounds and letters, as well as to attempt to address the difficulties with coding identified during the initial assessment process.

Once Child H had established the use of phonological referencing as a method for analysing the letters used to represent vowel sounds in rhyming words presented in families, colour coding of vowel letters and use of visualisation would be used to enable Child H to remember the sequences of letters used to represent the sequences of sounds in individual words, and the sequences of letters used to represent the sequences of sounds made in sequences of words in sentences. The aim was to link reading, writing and spelling through activities which used Child H's strengths in visualisation to teach the phonic associations he had difficulty in learning and remembering.

This was done using the following method:

- Child H was taught how to use phonological referencing to identify the letters used to represent the vowel. Sound in words with one syllable, the vowel sounds in words with more than one syllable and the vowel sounds in sequences of words.

	First activity	Second activity	Third activity
Day One	Repetitive Paired Reading Using 3 x 3 Oral Impress Method	Use Level One and Two Phonogram and Rime Cards to build word families based on errors from phonic inventory The tch word family ditch patch fetch botch hutch stretch Write the words in the family in your writing book. Phonologically reference and then underline the vowel in each word in colour using coloured pencils. Draw a picture next to each word to show its meaning.	Now write the following sentences based on each word: The witch has a black hat. Can the string stretch? That man will botch the job. She has a red patch on the back of her dress. My dog will run and fetch this stick. Underline the vowels in each word in each sentence in colour. Revisualise words in each sentence in sequence. Learn the words in each sentence in order. Test each sentence by dictation.
Day Two	Paired reading 3 x 3 Oral Impress Method	Test-based Language Programme: Level One Test 4 Creative writing	Maths problem-solving Level One Test 3 Working with Story Sums
Day Three	Test-based Language Programme: Level One Test 4 Written language exercises	Underline vowels in sentences in written language work on Level One Test 4 in colour. Learn these sentences using revisualisation. Test sentences through dictation.	Test-based Maths System Level Three Test 4 2 Times Table: Numerical Reasoning 5 Times Table: Numerical Reasoning 10 Times Table: Numerical Reasoning
Day Four	Reading comprehension activity Reading comprehension Comprehension level two. Snow White	Maths extension activity: level-2-multiplication-table-2-5-10-missing-factor-a level-2-multiplication-table-2-5-10-missing-factor-b Maths reinforcement activity: level-2-multiplication-table-5-missing-factor-b level-2-multiplication-table-10-missing-factor-b	Self-structured language development work using audible book "Harry Potter and the Philosopher's Stone"

Notes for Child H's parents:
Note 1: As your child has reading fluency difficulties, it will greatly assist if you can undertake repetitive paired reading working with him. Use the method outlined in your parent implementer's manual for this, working for a 20 minute session four times a week.
Note 2: As discussed, the initial assessment also indicates that your child also has a number of difficulties with phonics. These affect his use of consonant blends as the beginning and end of words.
These affect the following beginning blends.
sk/ cl/ qu/.
and the following ending blends.
/ft. /st /ff /nk /sh /tch /dge /ngth.
He also has some difficulties with identifying the correct letter to represent the /a/ and /e/ and /i/ short vowel sounds. He still reverses the /b/ and /d/ in certain words.
These difficulties indicate underlying phonological problems which affect writing and spelling. These need to be worked within his writing book using our Level One phonogram and rime cards to build word families targeting the errors highlighted above. The words in the word families then need to be used in sentences, learned and then tested.
Note 3: I have provided you with electronic materials to support the activities in the format by email. These can be used for additional sessions conducted at home to reinforce and support your child's programme.

Table 4.
Child H – learning cycle four implemented 15th October 2016.

- The letters representing the vowel sounds in each word in the sentence were then underlined in colour.
- Once this had been done, each word in the sentence was revisualised in sequence.
- The sentence was then written by Child H from memory.

Writing and spelling fluency was thus conceptualised as linked to Child H's ability to retrieve the sequences of letters used to represent sounds in words accurately and quickly. Accuracy and rate of writing would then be developed through a hierarchy of methods which aimed to link the development of phonic associations, visual memory and working memory for individual words and sequences of words, as outlined in **Figure 5** below.

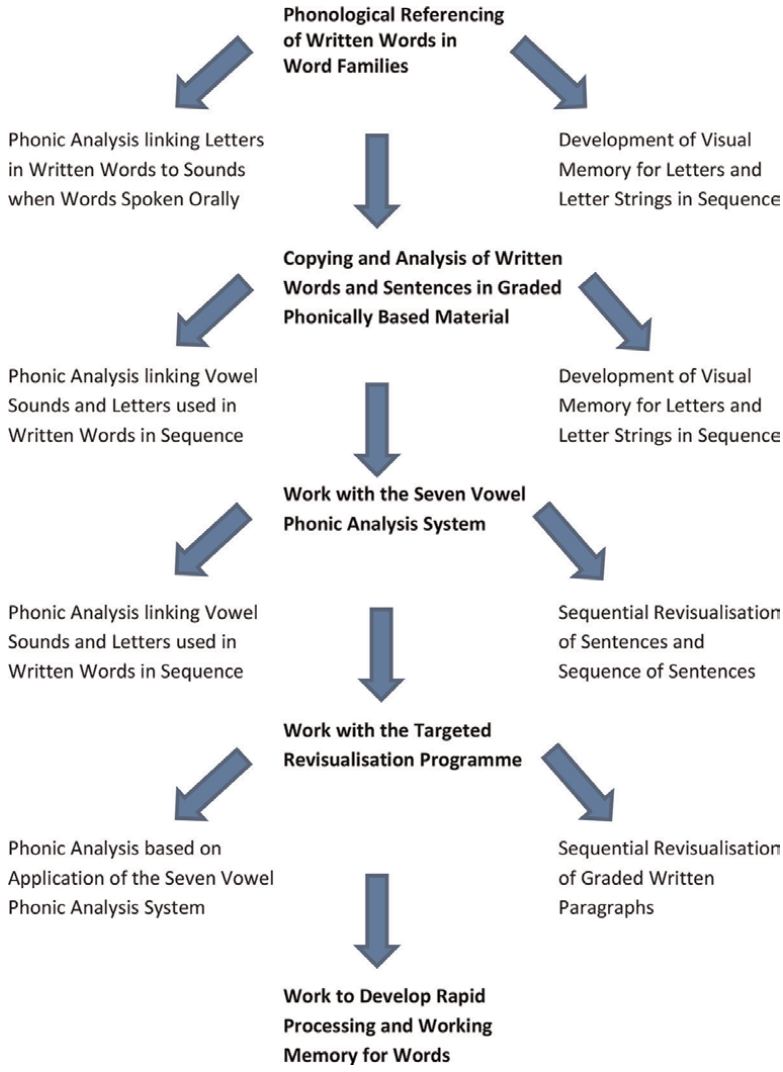

Figure 5.
Methods linking phonic analysis, visual memory for strings of letters and words and sequential working memory for written words, phrases, sentences and paragraphs.

4.1 Methods linking phonic analysis, visual memory for strings of letters and words and sequential working memory for written words, phrases, sentences and paragraphs here

4.1.1 Methods to develop rapid processing and working memory for words

The aim at each level in Child H's writing and spelling fluency programme was to link the development of phonic analysis, working memory for individual words and sequential working memory skills. This would be done using methods which combined phonological referencing and phonic analysis with use of Child H's strengths in visualisation as well as in visual memory.

Phonological referencing and phonic analysis would be used as a means of coding the sequences of letters used in representing sounds in individual words and sequences of words. Visualisation and revisualisation would then be used to develop working memory for individual words and sequences of words.

This was done at each of the stages in Child H's writing and spelling fluency programme, as described in the sections following.

4.1.2 Stage one in child H's writing and spelling fluency programme: using phonological referencing to code and recode phonic associations

Stage One of Child H's writing and spelling fluency programme involved a process in which:

- Child H was taught to map the associations between the sequences of letters.
- used in words and the sequences of sounds used when words are spoken orally.
- through phonological referencing, as well as through use of phonogram and rime cards.
- He was taught that each written word is logical and can be analysed on the principle that "what we say is what we write".
- He was asked to read words, and then cover them and write them from memory.
- He was then shown how to use revisualisation to remember the sequences of letters used in individual words and the sequences of words in used in sentences.

As Child H had phonological difficulties affecting the development of his phonic skills, the aim was to develop his phonological and phonic abilities, while at the same time developing the sequential working memory integrities necessary to store individual words as well sequences of words in working memory. This was done by working with rhyming words in the context of single sentences, and then with sequences of sentences.

At this stage Child H's working memory for individual words was tested orally and in writing. His sequential working memory for words was tested through dictation of the words he had revisualised in sequence. Any words on which spelling errors were made were then relearned using occlusion (Note 17).

4.1.3 Stage two in child H's writing and spelling fluency programme: increasing the transparency of written English through use of a seven vowel phonic analysis system

Child H's phonic inventories indicated that he made many errors on words based on long vowel sounds. He also had difficulties with remembering the sequences of letters used to represent long vowel sound in words. These difficulties affected his ability to write and spell fluently in the classroom.

Child H had been taught at school through use of word families and weekly spelling tests, but had difficulties in retaining and remembering the words he had been taught. For this reason in Stage Two of Child H's writing and spelling fluency programme he was taught using a Seven Vowel Phonic Analysis System designed to increase the transparency of written English.

The logic of teaching seven as opposed to five vowels was based on the consistencies in the way the English language is written down on paper. Phonological referencing was used to teach Child H that the two main consistencies are that:

- the long vowel sounds are usually written using combinations of the five letters a, e, i, o and u. These are usually written in pairs (called vowel digraphs).

- the long vowel sounds can be mapped from the combinations of letters used to write long vowel sound in words back to the sounds made when the words at spoken orally. These can be identified from the sounds made when the mouth opens to make the vowel sounds.

Child H was then shown that there are also other consistencies in the way the English language is written down on paper, as follows:

- the letter /y/ can act as a vowel at the end of words (as in "my", "try" and "fly").

- the letter /y/ can act as a vowel when written in combination with another vowel letter at the end of words (as in "day" or "toy", or "guy").

- in addition, the letter /w/ can also act as a vowel when written in combination with another vowel letter at the end of words (as in "cow" or "law" or "few" or "grew").

This was the logic applied in the Seven Vowel Phonic Analysis System, which was taught using Phonological Referencing based on two simple rules:

a. The letters a, e, i, o and u act as vowels in all positions in words.

b. The letters y and w can act as vowels at the end of words and also at the end of syllables in words.

5. Applying the seven vowel phonic analysis system in stage two of child H's writing and spelling programme

In Stage One of Child H's writing and spelling fluency programme, he had been taught that the vowel sounds are made when the mouth opens, and consonant sounds

are made when the mouth closes. This had been done working with a mirror tile so that he could listen to and speak the sounds in words while looking at how his mouth moved when making the consonant and the vowel sounds. He was also shown that he could phonically analyse words by putting his or her hand under his chin to feel how his mouth moved when saying words while as the same time using the mirror to look at how his mouth moved when saying words.

At Stage Two of his writing and spelling fluency programme, written words and printed words drawn from the content of our reading fluency books were used to show Child H that each word is based on at least one vowel sound, and that what we say is what we write. This consistency was taught by analysing both single words and sequences of words in sentences. This was done by using printed material drawn from reading fluency books from our series, which Child H had read and used both for repetitive paired reading and had also used as workbooks for drawing and illustration.

The method used was as follows:

- Child H was asked to copy a short paragraph from a completed reading fluency book into his writing book.

- Phonic analysis of each word in each sentence was then undertaken using coloured pencil crayons to map from the spoken words map to the letters used in the written words.

- The letters used to represent the vowels in each word he had written in his writing book were then underlined in colour.

Phonological referencing was thus used in conjunction with colour coding to teach Child H how to phonically analyse individual words and sequences of words in sentences, and then in paragraphs drawn from the phonically based written material in our reading fluency books (Note on the fact that these are both phonically based and graded). Phonological referencing provided a simple activity-based process for identifying the letters which made the vowel sounds in each written word.

This then enabled the logic of the Seven Vowel Phonic Analysis System to be used to code from the written words back to the spoken words, and then to recode from the spoken words back to the written words in sequence. After being phonically analysed, these colour coded words were then revisualised in sequence and written from memory.

5.1 Stage three: increasing span of sequential working memory for words

Once Child H was able to recall sentences of between five and seven words accurately, span of sequential working memory was increased by work with sentences of increasing length, as well as by work with increasing numbers of sentences in sequence. As our reading fluency materials are graded and phonically based, words, sentences and paragraphs could be drawn from these as the basis for Stage Two activities which linked reading, writing, spelling and sequential working memory work.

Span of sequential working memory could then be increased by initially revisualising single sentences and then more than one sentence at a time. This took place gradually, first focusing on developing Child H's ability to analyse, revisualise

and then write the sequences of phonically based words in a single sentence accurately, and then on increasing his span of sequential working memory by developing his ability to write more sequence of words in more than one sentence accurately.

Once it was apparent from Child H's written output that he was able to memorise and write three sentences drawn from a phonically based paragraph accurately, more complex graded paragraphs and sequences of paragraphs were then introduced. This was done in Stage Three of Child H's writing and spelling fluency programme using targeted revisualisation.

This was done using materials and methods from the Targeted Analysis, Revisualisation and Sequential Spelling Programme, which is described in the section following.

5.1.1 Stage four in child H's writing and spelling fluency programme: introducing the targeted analysis, revisualisation and sequential spelling programme

As its name implies, the Targeted Analysis, Revisualisation and Sequential Spelling Programme aims to use targeted revisualisation to develop the ability to recall the words used in individual sentences and sequences of sentences accurately. This is done working with graded paragraphs.

At Stage Four in Child H's writing and spelling fluency programme, he was placed on graded material drawn from Schonell's Graded Dictation programme. As the content of Schonell's programme was written more than 50 years ago, some of the paragraphs were clearly dated, while others expressed content which was felt to be inappropriate and possibly offensive. These paragraphs were redrafted.

For this reason, the material was checked and then revised or rewritten. The content was then supplemented by other graded material using different language registers, as well as content drawn from Child H's school books.

This was introduced using the following hierarchy of activity-based methods (**Figure 6**):

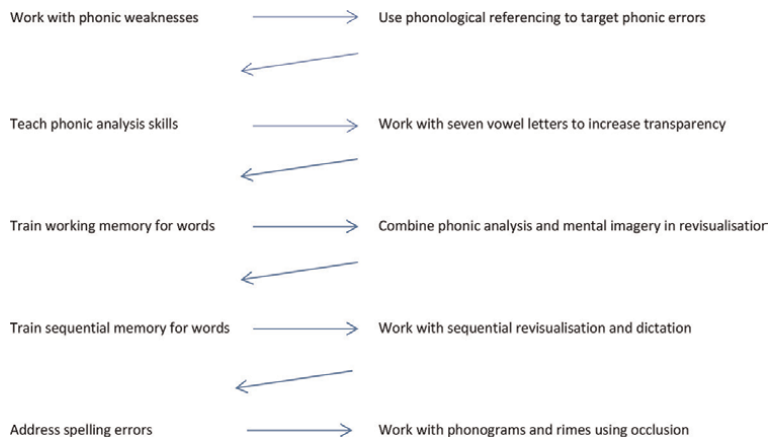

Figure 6.
Hierarchy of activity-based methods applied in the targeted analysis, revisualisation and sequential spelling Programme.

6. Hierarchy of activity-based methods applied in the targeted analysis, revisualisation and sequential spelling programme here

The aim of using this hierarchy of methods was to extend use of both Phonological Referencing and use of the Seven Vowel Phonic Analysis System in targeting a wider variety of written words in which the vowel sounds were made with more than one letter. This was done in the following way:

- Words in the paragraph which more than one letter was used to represent the vowel sound or vowel sounds were identified as target words.

- The target words were first listed by Child H in his writing book and then typed on the computer.

- The letters used to represent the vowel sounds were then phonologically referenced and colour coded.

After this, the written and typed words were syllabified, so that words based on more than one syllable could be divided spatially to reduce the number of letters into manageable chunks for purposes of revisualisation. The words were then revisualised individually and in sequence, using methods in which both phonic analysis and use of visualisation were combined in the revisualisation process.

6.1 Applying the seven vowel phonic analysis system to written language based on different language registers

In Stage Four of Child H's writing and spelling fluency programme, he was thus taught how to apply the targeted revisualisation process using graded paragraphs, with the aim of developing working memory for individual words as well as words in sequence. Span of working memory was then increased by using graded written paragraphs based on different language registers used in different contexts. This was done as follows:

a. Child H was first taught how to use both phonological referencing and the Seven Vowel Phonic Analysis System to colour code the seven letters used to represent the vowel sounds in written words drawn from paragraphs of increasing length and phonic complexity.

b. As in Stage Three of his writing and spelling fluency programme, this involved focusing on the use of the letters a, e, i, o and u to represent short and long vowel sounds in all positions in words and the use of the letters y and w to represent short and long vowel sounds in positions at or near the end of words.

c. Phonic analysis and revisualisation were then combined to develop working memory for words in which more than one letter was used to represent the vowel sounds. After being identified, listed in writing, typed and colour coded, the target words were then syllabified and revisualised in sequence.

d. The targeted revisualisation methods were then applied to develop working memory for words in sequence, working with paragraphs which increased in length and phonic complexity.

The aim of the methods used in Stage Four of Child H's writing and spelling fluency programme was thus to enable Child H to use his good visual memory and spatial competencies to address his phonological and phonic difficulties, by use of phonological referencing, phonic analysis and revisualisation in developing working memory for individual words and for words in sequence. This was done by drawing on Child H's visual and spatial strengths in teaching him how to code and then recode the sequences of letters used in writing words accurately.

The combination of phonic analysis and revisualisation methods was applied repetitively in implementing the sequence of graded paragraphs used in the programme. This was also documented in a parent implementer's manual (reference) so that the methods used in The Targeted Analysis, Revisualisation and Sequential Spelling Programme could be reinforced with work done by Child H's parents at home.

7. Use of clinical teaching in programme implementation

In implementing the activities described above, each session worked with Child H was implemented using clinical teaching on the following action research-based model (**Figure 7**). This was done to enable the focuses and sequence of instruction in the programme to be based on evidence from cognitive testing combined with pragmatic evidence indicating how Child H learned. It was also done to evidence from implementation to be used to establish how Child H learned optimally in working to address his phonological and phonic weaknesses.

7.1 Action research cycle for planning and implementation of child H's activity-based programme here

The value of using this type of action research framework in classroom work has been described by Stenhouse and his colleagues [109–113]. In working with Child H, this type of session by session progress evaluation was conducted to enable his programme to be planned and altered session by session. This was done to establish how he learned optimally, as we worked to address his phonological and phonic weaknesses.

Based on this ongoing planning and evaluation process, materials for developing reading, writing and spelling fluency in Child H's programme were sent as email

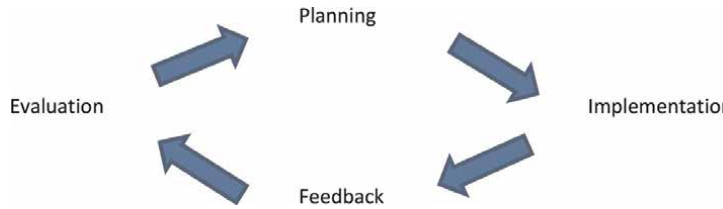

Figure 7.
Action research cycle for planning and implementation of child H's activity-based programme.

attachments on a weekly basis to Child H's parents. The methods used were also summarised in illustrated in parent implementer manuals [114–118] which could then be used to reinforce the methods used at home.

7.2 Evaluating response to intervention

Child H's progress at school was monitored through contact with his school teachers as well as regular reports on his classroom progress. These indicated that despite continuing difficulties with reading, writing and spelling, he was a well-liked member of the school community who excelled at swimming and other sports. His school reports indicated steady progress in all subjects, despite his ongoing difficulties with reading, writing and spelling.

In addition, progress evaluation was conducted through scholastic testing undertaken annually, to enable comparison of age scores, based on re-administration of the tests administered at time of Child H's initial assessment in 2016. The results are presented in the **Table 5** below.

7.3 Child H—longitudinal indicators of ongoing difficulties with one word reading, sequenced reading, one word spelling and sequential spelling here

It will be evident from the age scores in **Table 5** that Child H continued to have reading, writing and spelling fluency difficulties despite a number of different interventions conducted over a three-year period. These had involved use of a multivariate treatment approach based on implementation of phonically based reading, writing and spelling programmes, work to develop Child H's rapid naming and coding abilities, as well as work to develop working memory for words using phonological referencing techniques, as the basis for use of phonic analysis, visualisation and revisualisation methods.

Based on cumulative evidence of Child H's response to a number of different types of interventions, it was possible to motivate for additional time in tests and examinations once he reached the age of 12, as well as for a spelling concession. At the beginning of his Grade 6 year at primary school, IQ as well as achievement testing done, together with an analysis of reading difficulty based on diagnostic testing of reading comprehension, rate of reading, rapid word reading, word analysis, spelling, handwriting and working memory for words. The phonic inventories were also readministered at this point in time.

These results are reported below.

	November 2016	November 2017	November 2018
One word reading	7 yrs. 10mths	8 yrs. 3 mths	8 yrs. 10 mths
Sentence reading	8 yrs. 11 mths	8 yrs. 11 mths	9 yrs. 10 mths
One word spelling	7 yrs. 6 mths	8 yrs. 5 mths	8 yrs. 10 mths
Spelling in sequence	6 yrs. 10 mths	7 yrs. 0 mths	7 yrs. 6 mths
Chronological age	9 yrs. 6 mths	10 yrs. 6 mths	11 yrs. 6 mths

Table 5.
Child H: Longitudinal indicators of ongoing difficulties with one word Reading, sequenced Reading, one word spelling and sequential spelling.

7.3.1 Child H's profile on the WISC IV (UK)

Child H's performance on the different subtests of the WISC IV (UK) [119] is summarised in **Table 6** below, which presents the profile of standard scores obtained in the verbal comprehension, perceptual reasoning, working memory and processing speed areas of the test.

7.3.2 Child H—profile of standard scores on the WISC IV (UK) (March 2019) here

As in the IQ administered 3 years before, Child H's performance in all areas of the test was in the normal range. There was still evidence of some scatter in level of performance across different areas of the test, but within the different areas of the test there was far more homogeneous performance.

The verbal comprehension profile now indicated that Child H had well developed verbal reasoning ability, and average vocabulary, comprehension, general knowledge and verbal classification abilities relative to age level. The perceptual reasoning side of the test indicated well-developed perceptual and spatial abilities relative to age level. Child H's previous weakness in non-verbal reasoning was no longer evident, while the

Verbal Comprehension			**Perceptual Reasoning**		
Subtest	What subtest measures	Standard score	Subtest	What subtest measures	Standard score
Similarities	Verbal abstract reasoning and word finding ability.	12	Block Design	Abstract non-verbal reasoning, spatial perception and organisation.	12
Vocabulary	Ability to explain the meaning of words.	12	Picture Concepts	Abstract ability to analyse and classify pictorial information.	13
Comprehension	Social understanding and judgement.	12	Matrix Reasoning	Non-verbal abstract reasoning and concept formation.	14
Working Memory			Processing Speed		
Subtest	What subtest measures	Standard Score	Subtest	What subtest measures	Standard score
Digit Span	Short-term auditory memory.	11	Coding	Ability to work at speed in applying a simple code accurately and in sequence.	7
Letter-Number Sequencing	Ability to manipulate letters and numbers sequentially by holding them in short term and working memory.	10	Symbol Search	Ability to work at speed in establishing whether particular symbols are present or absent.	9

Note that in the above table, a standard score is a scaled score relative to a normal curve, where the average score would be a score of 10. Scores higher than 12 indicate above average performance relative to age level, indicating potential areas of cognitive strength. Scores lower than 8 indicate below average performance relative to age level, indicating potential areas of cognitive weakness. This type of profile interpretation needs to be conducted cautiously and substantiated against other information, as any scaled score is subject to measurement error.

Table 6.
Child H – profile of standard scores on the WISC IV (UK) (march 2019).

scores in the working memory side indicated good short-term auditory memory as well as good sequential memory for letters and numbers.

Relative to Child H's standard scores in other areas of the test, there were still difficulties in processing speed. There was a particular weakness in coding, but the standard score indicated improvement relative to Child H's performance on this subtest in the IQ administered 3 years previously.

Overall there was thus evidence of some scatter in the test scores, but a far less scattered profile compared to 3 years previously. This will be evident from the graph presented below, which groups the standard scores on the IQ by cognitive area (**Figure 8**).

7.3.3 Child H—profile of standard scores on WISC IV (UK) (march 2019) grouped by cognitive area here

The indications from the profile were that Child H now had well-developed cognitive processing abilities in both verbal and non-verbal areas as well as well-developed auditory and auditory sequential memory skills. There were still weaknesses affecting processing speed. Coding was still a particular area of difficulty indicating continuing needs for intervention in developing sequential working memory for words. The indications were also that Child H's strengths in all other areas of the test could now be used as the basis for interventions to improve his functioning in writing and spelling.

This was done by using the high areas in the IQ as indicators of strengths in Child H's cognitive style at this point in time, and the low areas as indicators of weakness. These cognitive processing indicators were then supplemented with clinical evidence of the working memory strategies which Child H was using in remembering individual words and words in sequence (Note 18). The conclusion was that the tests of basic reading, writing and spelling skills conducted longitudinally over the past 3 years provided evidence of continuing difficulties with reading fluency, as well as with writing and spelling fluency. The age scores also fell well below what would be expected in terms of age level as well as Child H's overall level of cognitive performance, indicating that diagnosis of a reading disorder under DSM-IV code 315.00 was still applicable (Note 19), as well as a disorder of written expression in terms of the diagnostic criteria for DSM-IV code 315.2 (Note 20).

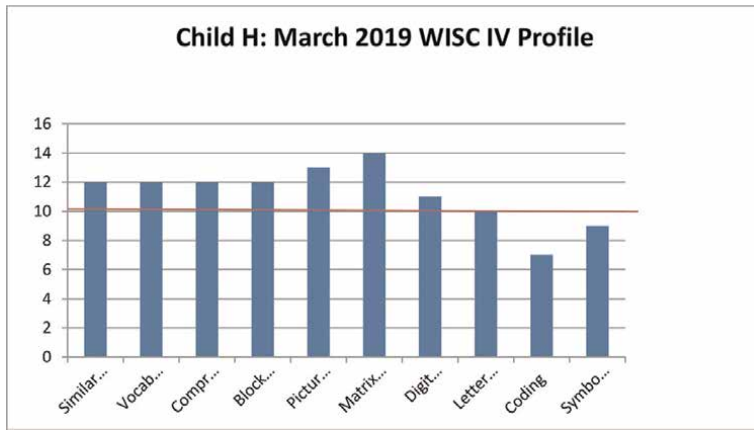

Figure 8.
Child H – profile of standard scores on WISC IV (UK) (march 2019) grouped by cognitive area.

The evidence also indicated a long-term difficulty in these areas, suggesting an ongoing learning problem likely to affect performance in school. Coding was still a particular weakness. Low scores on coding are often associated with difficulties in reading [120, 121], and for this reason Child H's continuing weakness in this area of the test indicated the need for continuing interventions to develop his coding and recoding abilities [122–126]. This required continuing focus on developing his visual memory for words, as indicated in the following section.

7.3.4 Child H's profile on the Durrell

As evidence from longitudinal testing of Child H's skills in one word reading, sequenced reading, one word spelling and sequential spelling was already available (refer **Table 5** above), the Durrell Analysis of Reading Difficulty was administered as part of his response to intervention assessment. The Durrell has a number of subtests of rate of reading as well as subtests tapping the ability to use phonic skills and visual memory, on which Child H scored as follows.

Results of reading, writing and spelling tests conducted on 2019-2109-27:
Durrell Oral Reading (rate) 8 yrs. 8 mths
Durrell Oral Reading (comprehension) 9 yrs. 6 mths
Durrell Silent Reading (rate) 8 yrs. 8 mths
Durrell Silent Reading (comprehension) 9 yrs. 9 mths
Durrell Listening Comprehension 10 yrs. 2 mths
Durrell Flash Words 11 yrs. 5 mths
Durrell Word Analysis 11 yrs. 8 mths
Durrell Test of Spelling 8 yrs. 0 mths
Durrell Test of Handwriting 11 yrs. 0 mths
Durrell Test of Visual Memory 9 yrs. 8 mths
Durrell Test of Phonic Analysis 12 yrs. 3 mths

The scatter on the various subtests will be evident from the profile of test scores presented below, which shows the discrepancy between Child H's age (line in red) and his age scores on the different subtests administered (**Figure 9**):

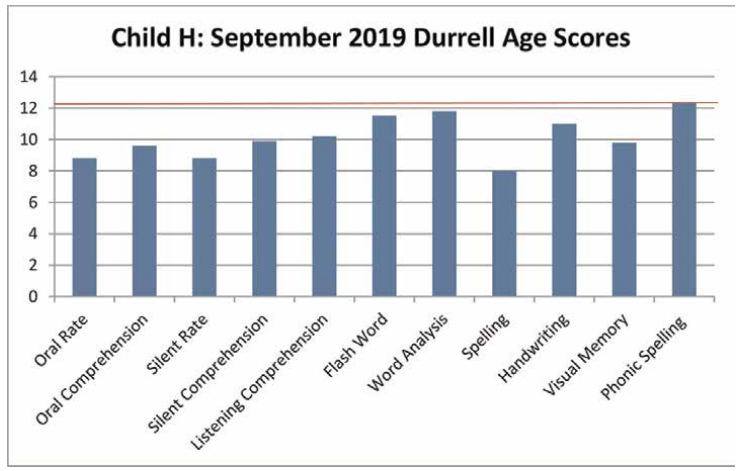

Figure 9.
Child H – profile Durrell age scores (September 2019).

7.3.5 Child H—profile of 2019 Durrell age scores (September 2019) here

Child H's continuing difficulty with rate of work in school-related activities was indicated both by his parents and his self-reports. The Durrell profile indicated that this was linked to difficulties with rate of reading and comprehension of contextual paragraphs. When compared to the scores from previously administered tests of reading, writing and spelling, the Durrell profile indicated improvement in the reading of individual words as well as in rapid recognition of letters and words, while the working memory subtests indicated progress in phonic spelling but continuing difficulties with visual memory for words. This would still need to be treated side by side with the reading and spelling sides of Child H's programme.

7.3.6 Child H's profile on the phonic inventories

As Child H was at this stage in Grade 6 at school, all three levels of the Phonic Inventories were administered (Note 21). The profile Child H's profile indicated high error scores on:

- Ending consonant blends.
- Medial vowels in words based on long vowel sounds.
- Polysyllabic and compound words based on short vowel sounds.

On the basis of previous research with the instrument which had indicated that errors on both ending consonant blends and medial vowel errors are indicators of learning disability both in primary school age children [99, 100] as well as high school children [101]. Child H's profile of errors on the instrument was used as corroborating evidence of the presence of a learning disability [90, 127, 128], while also providing evidence of specific areas of learning need. In addition, the profile was analysed to identify specific phonic errors and error types which could be targeted for instruction [129–131].

Compared to the previous profile of phonic errors made when Child H was in Grade 3 at school, his Grade 6 profile of errors on the phonic inventories provided evidence that substantial progress had been made in terms of his underlying phonological and phonic difficulties, as well as evidence that further work was necessary. This needed to target the specific errors made by Child H on ending consonant blends, continuing work on the use of letters used in combination to represent long vowel sounds, and work on base words combined with prefixes, suffixes and other morphological endings.

8. Firm classification of child H's learning difficulties based on response to intervention

Based on the evidence of Child H's response to a number of different treatment interventions which indicated continuing difficulties with reading, writing and spelling as well as continuing difficulties with phonics, Child H was classified for both medical aid and concession purposes as having dyslexia (Note 22). The classification

provided was based on the use of ICD10 indicators linked to the presence of a number of continuing areas of difficulty affecting a number of areas of scholastic functioning.

Motivation was then made for reading, spelling and rate of work concessions based on the dyslexic classification. In addition, the evidence from Child H's Grade 6 response to intervention assessment was linked to the need for ongoing intervention in a number of areas and the continuing implementation of a multivariate treatment programme.

Labelling Child H as dyslexic was at this stage based on both quantitative and qualitative data using multimethod, data and time triangulation [73, 132]. The diagnosis was firm, and based on incremental data from cross-sectional concurrent assessment as well as longitudinal evidence of Child H's response to specific types of intervention. This then formed the basis for concessions, as well as planning of the interventions necessary to support Child H's transition from primary school to high school.

9. Planning for the transition from primary to high school

After using the dyslexic diagnosis to motivate for concessions, the next step in planning for Child H's transition to high school was to work with the evidence from his Grade 6 assessment in replanning his programme. This was done using the indicators of cognitive strengths and weakness from the recent IQ, combined with scholastic test and working memory indicators.

Both the Phonic Inventories and the Durrell indicated that Child H had made substantial progress in applying phonic rules in the reading and spelling of individual words, while the working memory indicators in the Durrell indicated progress in phonic spelling but continuing difficulties with the development of higher level phonic associations, visual memory for words and rate or work. There were also continuing difficulties with reading fluency as well as writing and spelling fluency, indicating needs for interventions involving:

- activities to improve rapid naming of letters, words and numbers.
- activities to increase accuracy and speed of reading.
- activities to improve coding and recoding abilities.
- activities directed at improving visual memory for words.

Based on this, Child H's programme was replanned with continuing focus on the development of reading fluency and comprehension, accurate spelling of both individual words and sequences of words and activities designed to increase ability to process written work rapidly. This included use of a stop watch to work on reading, writing and spelling activities against pressure of time, as well as rapid reading and working memory activities based on use of an electronic tachistocope.

10. Increased emphasis on work on visual memory and rapid naming

Work was thus continued on programmes previously used for phonological referencing, phonic analysis and visual memory development, as well as work on

rapid naming using registers of words that were familiar to Child H. This was linked to activities to develop accurate and rapid memory for individual words and words in sequence. Tachistoscopic work was also introduced [118], working repetitively with words of increasing length drawn from an electronic dictionary. In addition, Child H was asked to create custom lists of words in which more than one letter was used to represent the vowel sounds. The target words were drawn from graded paragraphs previously used for targeted revisualisation, as well as from Child H's school books.

In introducing activities using the electronic tachistocope, length of words, time exposure of the presentation of each word and the time between the exposure of each word were conceptualised as treatment variables for rapid naming, as in the model presented in **Figure 10** below.

10.1 Methods for treating rapid naming difficulties here

Other variables could also be included in the model by varying the ways in which words were presented, read, revisualised and written down, by varying the exposure as well as the length of words presented electronically. The aim was to link the tachistocopic methods used for developing Child H's ability to rapidly recognise and remember words to the methods being used in other areas of the programme for training fluency in reading, writing and spelling. This was done through use of thematically based vocabulary presented tachistoscopically in activities designed to link rapid naming of words [133, 134] with written activities aimed at developing usage of the words in context. This was combined with use of computer-based speech to print technologies in which words used in context orally could be linked to words printed and read.

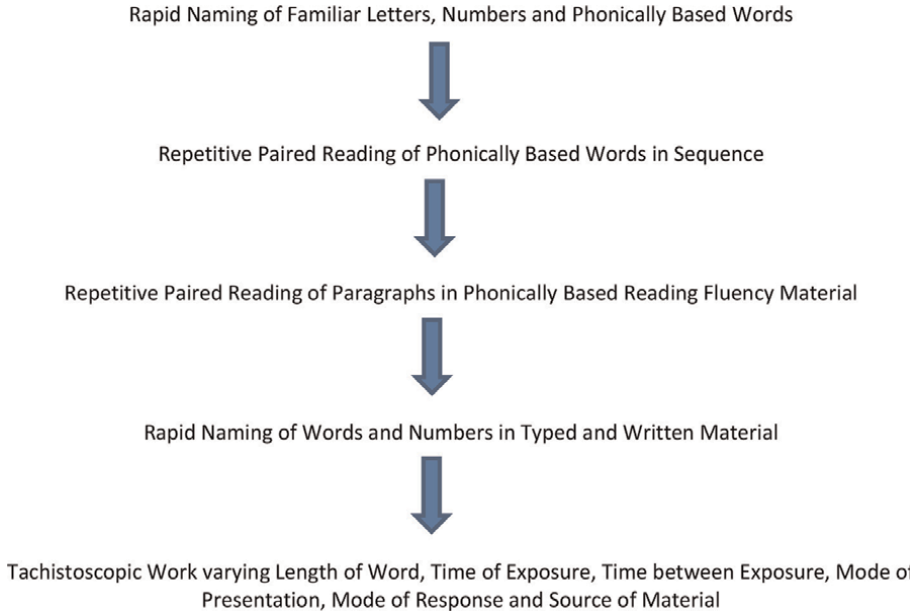

Figure 10.
Methods for treating rapid naming difficulties.

10.2 Progress evaluation (September 2020)

Over his Grade 6 year at primary school, Child H continued to work on the different areas of his programme diligently with the help of his parents. He found both the revisualisation-based activities and the tachistoscopic work particularly helpful, and reported that these were assisting his reading, writing and spelling as well as his rate of work in the classroom (Note 23).

As the aim was to achieve a level of literacy (Note 24) before the end of primary school, the Durrell Analysis of Reading Difficulty was redone in October 2020, to see whether there had been change in Child H's levels of reading, writing and spelling prior to his final Grade 7 year.

The profile of Child H's age scores on the Durrell at this point is presented in **Figure 11** below.

10.3 Child H—profile of Durrell age scores (October 2020) here

It was evident from comparing the 2019 and 2020 Durrell profiles that there had been improvements in a number of different areas of reading as well as in visual memory for words. The improvements in visual memory were particularly marked. Child H attributed these improvements both to continued focus on activities involving use of sequential memory for words and use of the tachistoscope for rapid processing and recall of individual words (Note 25).

At this point it was evident that Child H's transition to high school was likely to be accompanied by continuing difficulties with reading, spelling and rate of work. External assessment was thus conducted to confirm the classification of Child H's learning difficulties as linked to dyslexia, for which continuing concessions at high school would be necessary.

The results of this assessment are reported in the next section.

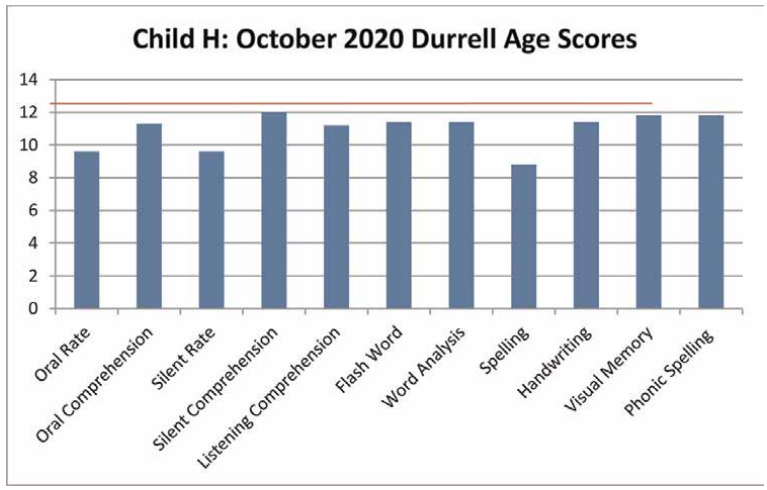

Figure 11.
Child H – profile of Durrell age scores (October 2020).

11. Application for concessions to support child H's transition to high school

In February 2021, a full psycho-educational assessment was conducted to determine Child H's levels of cognitive and scholastic functioning in his final year at primary school, so that recommendations could be made in terms of what support may be required to assist him in achieving to potential, as well as to make recommendations with regards to formal accommodations and concessions.

The assessment was done by an independent psychologist (Note 26), and was based on the following measures:

- The Wechsler Intelligence Scale for Children – WISC-V.
- Subtests from WIAT 2.
- The Test of Word Reading Efficiency (TOWRE).
- Edinburgh Reading Assessment Level 4.
- Word Chains.
- Written expression examples.
- Clinical Observations and Informal Assessment.

Child H's mother requested that previous assessment reports be utilised in order to provide all relevant background information relating to Child H's early development, medical, school and therapy history, and personal information. The results of this case study up to this point in this chapter could then be included with the application documents concessions.

12. Summary of index performance

The WISC-V is made up of various subtests that are grouped into five categories or indices, which can be used for interpretation of a child's different types of cognitive abilities. The following is a summary of Child H's performance on the indexes. Index scores lying between 85 and 115 indicate an average range of performance relative to other children of similar age, while index scores beyond this range of scores indicate above or below average performance (**Table 7**).

13. Child H—range of performance on WISC-V indices (February 2021) here

As in the IQ administered in 2016 and 2019, Child H's performance in all areas of the test was in the normal range. Comparing the test profiles, there was still evidence of some scatter in level of performance across different areas of the test, but within the different areas of the test there was far more homogeneous performance.

Index	Subtests Measure	Performance
VERBAL COMPREHENSION	Processing of verbal information	Average range
VISUAL SPATIAL REASONING	Processing and manipulation of visual and spatial information	Superior range
FLUID REASONING	Problem-solving ability	Average range
WORKING MEMORY	Short-term memory	Average range
PROCESSING SPEED	Rate and accuracy of mental processing	Low Average range
FULL SCALE	General cognitive functioning	Average range

Table 7.
Child H – range of performance on WISC-V indices (February 2021).

The verbal comprehension profile in 2021 indicated that Child H had well-developed verbal reasoning ability, and average vocabulary, comprehension, general knowledge and verbal classification abilities relative to age level. The perceptual reasoning side of the test indicated adequately developed perceptual and spatial abilities relative to age level, but the previous weakness in non-verbal reasoning was no longer evident, while the scores in the working memory side indicated good short-term auditory memory as well as good sequential memory for letters and numbers.

Relative to Child H's standard scores in other areas of the test, there were still difficulties in processing speed. There was still a particular weakness in coding, but the standard scores indicated improvement relative to Child H's performance on this subtest in the IQ administered 3 years previously.

Overall there was thus evidence of some scatter in the test scores, but a far less scattered profile compared to those from both the previously administered IQ tests. This was evident from the graph presented below, which groups the standard scores on the IQ by cognitive area (**Figure 12**).

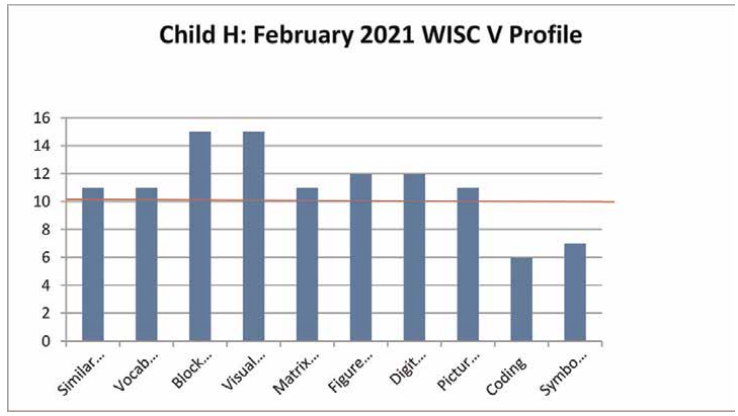

Figure 12.
Child H – profile of standard scores on WISC V (UK) (February 2021) grouped by cognitive area.

14. Child H—profile of standard scores on WISC V (UK) (February 2021) grouped by cognitive area

The profile provided evidence of spatial competence, as well as evidence of ongoing difficulties with processing speed linked to difficulties with coding. As the coding subtest has been retained unchanged in each restandardisation of the WISC (Note 27), Child H's raw coding scores were compared over time. This analysis indicated that steady gains had been made over a four-year period in raw scores, but that Child H still had continuing weakness in coding relative to other children of his age.

There were also continuing difficulties with both reading and spelling difficulties, as well as problems with rate of written work. This was evident in Child H's profile of achievement test scores which is presented in **Table 8** below.

15. Child H—achievement test scores (February 2021)

Overall, while Child H's school reports indicated that he had made steady progress at school, response to intervention assessment provided evidence that difficulties with reading, spelling and rate of work were still evident, as well as classification of Child H's difficulties as linked to dyslexia. Firm classification could be made on the evidence that Child H had made good progress with reading comprehension but was still scoring well below age level on word reading, with continuing weakness in phonological and phonemic skills, as well as spelling. Rapid word recognition was also still below average.

As these areas of weakness were associated with difficulties with reading, spelling and rate of work which were ongoing as well as resistant to treatment, concessions at high school for reading, spelling and rate of work would be necessary. Ongoing

Subtest	Test measures	Standard Score	Age Equivalence
WIAT III Word Reading	Letter identification; phonological awareness; letter-sound awareness; accuracy of word recognition; automaticity of word recognition.	75	9 yrs. 8 mths
WIAT III Pseudo Word Decoding	Phonemic Decoding Efficiency	82	9 yrs. 7 mths
Edinburgh Reading Comprehension	Reading comprehension	93	12 yrs. 4 mths
WIAT III Spelling	One Word Spelling	82	9y8m
TOWRE	Sight Word Efficiency Phonemic Decoding Efficiency	85 83	9y6m 9y3m
Letter Chains	Rapid Letter Recognition	109	n/a
Word Chains	Rapid Word Recognition	89	10 yrs. 0mths

Table 8.
Child H: Achievement test scores (February 2021).

treatment of the areas of weakness in the profile would also be necessary, using methods which used Child H's high levels of spatial ability to address the continuing areas of phonological and phonemic weakness, as well as the continuing difficulties with rapid naming and coding.

16. Main trends in this case study

In the case study presented in this chapter, firm classification of type of learning disability was made at the end of Child H's primary school years, based on triangulation of evidence collected by use of different methods over time [84, 85], within a model of inference based on a process of incremental validity [17, 83]. Diagnosis was then linked to concessions to compensate for those areas of difficulty which have been demonstrated to be resistant to particular forms of treatment, as well as to ongoing treatment and learning support in particular areas of the high school curriculum.

Firm diagnosis was made possible by both longitudinal assessments using psychometric testing, as well as analysis of Child H's response to particular types of treatment intervention. These focused on a number of areas of difficulty identified by Child H's parents, including the following:

- Reading fluency difficulties.
- Guessing rather than analysing words, affecting both reading and rate of work.
- Spelling and phonic difficulties.
- Difficulties with phonetic spelling.
- Issues with writing and completing work.
- Difficulties with completing creative writing tasks.
- Lowered confidence due to awareness of difficulties.

These areas indicated the need for multivariate assessment as well as multivariate treatment, which was provided by the following:

- Use of Methods to Develop Reading Fluency.
- Use of Methods to Develop Phonological and Phonic Skills.
- Use of Methods Designed to Increase the Transparency of Written English.
- Use of Methods Designed to Improve Working Memory for Individual Words and Sequences of Words.
- Use of Methods to Develop Rapid Naming and Rate of Work.
- Use of Methods to Compensate for Spelling Difficulties through Computer-based Speech to Print Technologies.

Child H's difficulties were initially described functionally, as the basis for developing his treatment programme. This was implemented using formats which enabled focus on a number of treatment areas side by side using graded electronic materials which included.

- Phonically-based large print reading fluency books.
- Graded phonic and phonological referencing materials.
- Graded reading comprehension materials.
- Graded test-based written language materials.
- Graded working memory and sequential working memory materials.
- Graded test-based arithmetic and maths problem-solving materials.

Child H's treatment was thus multivariate and was implemented through weekly sessions with support from Child H's parents, who received illustrated electronic parent implementer manuals as well as weekly emails with supporting electronic materials for implementation at home. This enabled focus on the skills required to support Child H's work at school, as well as the classroom and homework tasks provided as part of his programme at school. It also enabled firm diagnosis of dyslexia, dysgraphia or dyscalculia to be made at the end of Child H's primary schooling career, based on evidence of his response to the classroom work included in his school programme, evidence of his scholastic attainments, as well as evidence of the development of his abilities in cognitive processing which took place side by side with the treatment interventions described in this chapter.

Detail in the case study has been provided with the aim of providing the reader with an idea of the different types of fluency-based methods and materials used in working with Child H over a number of years, as well as the way in which longitudinal progress evaluation has been combined with psychometric testing conducted at different points over Child H's primary schooling. This has enabled skill development to the stage where Child H has successfully made the transition to high school. It has also enabled firm diagnosis of dyslexia with the aim of motivating for a number of concessions.

The application for concessions has been successful at this point in Child H's schooling. He is confident in his abilities, coping well with his high school programme and excelling at sport. He also has a talent for maths, a talent for transactional writing in English and a love of poetry.

17. Summary and evaluation: can this case study be replicated?

Despite the limitations implicit in the analysis of single cases, a number of aspects of this single case (N = 1) design can be generalised, and are replicable by others.

17.1 Model of assessment

The model for response to intervention classification of learning disabilities described in this case study is multimethod, based on summative assessment linked to

progress evaluation of longitudinal interventions conducted across a number of areas of functional difficulty. While the assessments conducted with Child H have utilised the types of psychometric instruments commonly used in our country to provide indicators of underlying learning disabilities [6], the methods used and the types of evidence used for classification can be replicated.

For readers interested in assessment, there would also be good reason to do so. One reason is that use of repeated measurement linked to qualitative evidence collected at different data points over time would be likely to increase the likelihood of valid classification. The detail provided in this chapter would also indicate that a response to intervention approach to classification provides firm evidence that dyslexia is a type of learning disability which is likely to affect children throughout their schooling, for which concessions are not only advisable, but necessary.

This argument has been advanced by a number of other researchers and clinicians working internationally [20–22].

18. Methods of treatment

For readers interested in methods of treatment, this chapter has presented a longitudinal timeline documenting an approach to treatment which is essentially multivariate and eclectic, based on the combination of a number of treatment methods. The central focus of treatment has lain on the development of fluency in reading, writing and spelling based on the neuropsychological theories of automaticity proposed by Luria [1, 2] as well as the work on oral impress methods and paired reading first described by Heckelman [135–137] and then successfully implemented by others in the field [138–147].

A number of the treatment methods reflect the types of phonically based described by the body of researchers and clinicians who work from the standpoint that dyslexia is a severe difficulty with phonological processing [121, 148–153]. Other treatment methods are based on my previous work in the development of spatial perception using Piaget's theories [154–159] and focus on developing working memory for individual words and words in sequence using eidetic imagery [160, 161]. These methods use phonic analysis combined with VAKT and revisualisation-based techniques similar to those described by Fernald [27], as well as by others who have found it necessary to adapt other techniques in working with children [162–165].

The methods used are thus eclectic and based on use of combinations of graded reading, writing and spelling fluency activities, as well as use of methods targeting rapid naming and rapid reading and recall of words. They would accord with the types of multivariate curricular strategies suggested by Wolf and her colleagues [133–134]. They would also accord with the recommendations made by those researchers and clinicians who have suggested the value of linking the development of both skills and automaticity in reading, writing and spelling [107, 166–171].

At the same time, the methods used with Child H for developing writing and spelling fluency would appear to be unique in the literature. These are based on use of phonological referencing [106] as well modifications of the analytical techniques for teaching how words work based on seven vowels pioneered by Caroline [172]. As used in my practice, the seven vowel system applied in analysing and mapping the letter combinations used to represent vowels in English orthography is based on metacognitive strategies that have been logical to a number of children with severe learning difficulties [5]. What has been effective in enabling these children to code

from what you write to what you say, and to recode from what you say to what you write have also been logical in terms of research indicating evidence of a universal phonological principle, which would apply to learning to read the orthographies used in all languages, including pictographic written languages [173–176].

These methods may be of interest to others as use of a seven vowel as opposed to five vowel system enables direct coding and mapping of the letters used in written English to the sounds made in spoken English, with few exceptions. It also provides a basis for combining phonic analysis and revisualisation in developing working memory for individual words as well as words in sequence, as described in previous publications [6], and in this case study.

Overall, however, those readers who know the field well are likely to see the methods described in this case study as multivariate, eclectic and derivative of the pioneering work of Gates [25, 177], Monroe [178, 179], Orton and Gillingham [180, 181], Durrell [26] and Fernald [27] in stressing the importance of assessing and linking treatment of both phonological and visual aspects of reading disability to the development of working memory. In addition, they are derivative of the many other researchers and clinicians who have stressed the importance of linking the teaching of reading, writing and spelling with the development of working memory, whose contributions are acknowledged in the reference list.

As the practice materials are phonically based and made available for use electronically, the methods described in this case study can be and have been successfully worked with and adapted by parents, teachers and therapists through use of the types of activities described in our detailed manuals [8, 105]. They can also be replicated as the methods and materials described in this case study are available for implementation at low cost by others.

19. Aggregation with the results of other case studies

Children's problems vary, and no one size fits all. While this N = 1 case study would support this standpoint, there is also the potential of aggregation of N = 1 case studies with others. For readers with an interest in aggregative case survey research, one way to implement this type of clinically based aggregation is to use classificatory variables for purposes of grouping, comparison and contrast. This is being done in the author's practice on an ongoing basis as follows.

There is sufficient breadth of graded, phonically based material in the practice's data base to develop fluency-based programmes for children of different ages and with different pre-test levels of reading, writing, spelling and sequential spelling skill. Besides Child H, these materials have been used by the parents of a number of other children diagnosed as having learning disabilities manifesting in difficulties with reading, writing and spelling, as well as fluency-based difficulties.

As a number of additional children have used the same data base of materials as well as similar methods for developing reading, writing and spelling fluency, the case aggregative techniques described in a previous publication provide a basis for ongoing aggregation [6]. This used categorical variables to contrast the results of an opportunity sample of 20 children selected from the files of children with whom similar fluency-based programmes had been implemented over a three-year period with the results of other children exposed to differing types of fluency-based programme implementation.

Criteria for inclusion were that each of the 20 children had been diagnosed with a learning disability affecting reading, writing, and spelling, and also had fluency-based difficulties. Each child was also exposed to work in all three areas of intervention (reading, writing and spelling) of the fluency-based programmes described in this current chapter. Based on case contrast analysis with the results of 6 children on whom systematic variation in one or more area of programme implementation had occurred over the three-year period, a number of implementation variables were found to be likely to affect the successful implementation of our fluency-based work.

These variables were as follows:

- Consistent and regular exposure to phonological and phonic instruction to provide a foundation of basic skills on which the fluency interventions in our programme could be built;

- Consistent implementation of methods designed to improve both reading fluency, and writing and spelling fluency to produce the greatest likelihood of positive effects; and.

- Consistent support from parents in programme implementation to produce the greatest likelihood of positive effects.

Despite the many limitations and threats to validity implicit in aggregative case survey analysis, these results indicate the potential of using categorical variables for purposes of classification and contrast, as a basis for identifying central trends in multimethod data drawn from clinical work with children, and relating these to outcomes. The central trends reported above are of interest as each of the treatment variables applied in the types of fluency-based programmes used in working with Child H, in the case study presented in this chapter. Consistent implementation has also taken place. Consistent support from Child H's parents has been present over the entire period of programme implementation. The evidence of outcomes has also been positive.

20. Notes

Note 1. This has been described in a previous chapter which can be accessed *via* the following link:

http://mts.intechopen.com/articles/show/title/dyslexia-dysgraphia-and-dyscalculia-a-response-to-intervention-approach-to-classification

Note 2. The ICD-10 (International Statistical Classification of Diseases and Related Health Problems – Tenth Revision) is a diagnostic coding standard owned and maintained by the World Health Organisation (WHO) [182]. The coding standard has been adopted by the National Health Information System of South Africa (NHISSA), and forms part of the health information strategy of the South African National Department of Health (NDOH). The standard serves as the diagnostic coding standard of choice in both the public and private healthcare sectors in South Africa for morbidity coding under Regulation 5(f) of the Medical Schemes Act 131 of 1998 [183].

Note 3. Rob Stark, of the Centre for Therapeutic Excellence https://www.centrefortherapy.co.za

Note 4. The multivariate approach to assessment and treatment used in the practice has been described in a previous two part publication which can be accessed via the following links.

https://www.intechopen.com/books/learning-disabilities-an-international-perspective/developing-automaticity-in-children-with-learning-disabilities-a-functional-perspective-part-one-the

http://www.intechopen.com/articles/show/title/developing-automaticity-in-children-with-learning-disabilities-a-functional-perspective-part-two-pro

Note 5. Child H was educated in a government-funded primary school in the northern suburbs of Johannesburg, which are areas where parents usually lie in higher socio-economic bracket than parents in other residential areas, or the reason that as the city evolved, the eastern, western and southern suburbs were closer to the dust, pollution as well as the physical danger of underground blasting in the gold mines. As commercial gold mining has been phased out as the underlying gold-bearing reef has been exhausted, wealth distinctions affecting residential areas have become more blurred. As a result, the children in the author's practice come from a wide catchment area, with many parents travelling from the eastern, southern and western suburbs, and some parents travelling as much as 600 kilometres from out of town on a weekend to bring their children for assessment or to educational therapy sessions. Similarly, the referral and schooling network in the practice covers a wide geographical area. This is possible with the advent of email and cell phones, and this has been enabled by the fact that our reading, writing and spelling fluency materials and manuals are electronic.

Note 6. These were developed in the classroom in 1978 and 1979, while the author was working at Crossroads Remedial Centre and then at Norwood Remedial School. The initial research results were analysed in early 1979 and reported in mid-1979 [87], prior to the author joining the University of the Witwatersrand, Johannesburg. The Phonic Inventories were then implemented as one of the instruments used in research conducted at Japari Remedial Centre, Parktown, Johannesburg. The results were reported between 2005 and 2011 [89, 90, 98, 184, 185].

Note 7. In working with Child H and other children in the practice, my aim has been to link instructional activities to the child's cognitive style, which is defined as the ways in which each child thinks, perceives and remembers information. Child H's cognitive style was determined by listing areas of strength and areas of weakness from a number of indicators of how he processed information (e.g. areas of strength and areas of weakness in his cognitive and achievement test profiles) [186, 187]. Following Piaget [188], these indicators were then combined with observation of the successful strategies employed by Child H as well as errors made in working on activities involving use of perception, language, thinking and working memory. Areas of weakness and errors made then formed the targets for instruction, using methods based on Child H's strengths and the learning strategies he found to be effective in writing and spelling individual words and words in sequence. These were determined through action research based on observation, followed by evaluation and replanning.

Note 8. In terms of ICD DSM IV diagnosis [189], assessment of reading difficulties would normally be conducted on Axis IV, which would aim to identify psychosocial stressors, as well as psychosocial and environmental problems affecting reading ability on a functional level. Reading difficulties would then be classified under reading disorders, corresponding to ICD-10 code F81.0 and DSM-IV code 315.00, as follows:

A. Reading achievement, as measured by individually administered standardised tests of reading accuracy or comprehension, is substantially below that expected given the person's chronological age, measured intelligence and age-appropriate education.

B. The disturbance in Criterion A significantly interferes with academic achievement or activities of daily living that require reading skills.

C. If a sensory deficit is present, the reading difficulties are in excess of those usually associated with it.

If a general medical (e.g. neurological) condition or sensory deficit is present, Axis III on the ICD DSM IV would also be used for classification purposes. This axis aims to identify underlying medical or neurological conditions which may influence reading ability (e.g. attentional or concentration difficulties, especially those associated with cortical immaturity, or slow myelinisation associated with poor connectivity).

Note 9. The diagnostic criteria corresponding to ICD-10 code F81.2 and DSM-IV code 315.2 for 315.2 a disorder of written expression are as follows:

A. Writing skills, as measured by individually administered standardised tests (or functional assessments of writing skills), are substantially below those expected given the person's chronological age, measured intelligence and age-appropriate education.

B. The disturbance in Criterion A significantly interferes with academic achievement or activities of daily living that require the composition of written texts (e.g. writing grammatically correct sentences and organised paragraphs).

C. If a sensory deficit is present, the difficulties in writing skills are in excess of those usually associated with it.

As with Code 315.00, if a general medical (e.g. neurological) condition or sensory deficit is present, the condition would then be coded.

Note 10: This was done through use of standard scores linked to age equivalents.

Note 11: At time of writing this chapter there are between eight and nine thousand items in the practice's data base. These are graded, and test-based. As all of the materials are electronic, they can be sent out by email. This enables implementation of multivariate programmes based on use of our methods and materials both locally and internationally.

Note 12: Based on a points reward system suggested to me by Alex Bannatyne in 1977.

Note 13. Based on the author's work with Errol van der Merwe in developing three dimensional spatial perception working with engineering students at the University of the Witwatersrand over a 20-year period [155, 156, 158, 159, 188, 190–195], as well as work done over a 10-year period with children at Japari Remedial School, Johannesburg. This involved implementation of instructional procedures based on use of eidetic imagery in visualising and revisualising words [161, 196–198].

Note 14. The possibilities of using eidetic imagery in developing working memory for words are indicated by the author's clinical work using the Targeted Revisualisation and Sequential Spelling Programme with a number of children with reading, writing and spelling difficulties [5, 6], as well as by research done by Ravenscroft [161]. Ravenscroft used a mental imagery questionnaire based on procedures for visualising and revisualising words with a sample of 92 children at Japari Remedial Centre, each of whom had been diagnosed as having a learning disability. About 76% of children in the sample (70 out of the 92 children tested) were able to use eidetic imagery to visualise and revisualise words. Ravenscroft's research thus indicated the potential value of using revisualisation techniques in working with children with learning disabilities, as well as the high incidence of spatial competence in children with reading, writing and spelling difficulties. This provided support to my

own clinical work which has focused on combining phonological referencing, phonic analysis and revisualisation techniques in developing working memory for words, and sequential working memory for words [8, 105].

Note 15: It is important to note that my work has involved adaptation use of Fernald's techniques. Ravenscroft's research indicated that three out of four children in a sample of 92 children at Japari were able to use eidetic imagery for purposes of recalling words. At the same time, one out of four children in the sample was not high visualisers. For this reason, both visual imagery and other forms of mental imagery (e.g. reauditorisation or use of kinetic or tactile imagery) would need to be used in developing working memory for words.

At the same time, there were also indications from Ravenscroft's data that eidetic imagery was trainable. As Kasdon has pointed out, this is also implicit in the stages involved in Fernald's procedures. As Fernald has suggested [27], what is important is to develop the ability to look at the word and say it, to close one's eyes and use mental imagery to recall the word, then to say the word while holding the word in the mind with one's eyes shut (thus linking spoken language and mental image) and then to spell the word with one's eyes shut. It would also be important to test working memory through writing the word.

Following Fernald's suggestions, working memory for words as well as writing and spelling fluency would need to be developed in stages. It is also clear from Fernald's account (e.g. page 147), that visual imagery was not present with all the children she worked with at the start, but in a number of children developed through training. Individual children also adapted to the techniques in their own ways.

This has been the principle followed in my own work. As Kasdon has observed [162], the stages involved in using Fernald's techniques are not purely based on use of a kinesthetic method, but involve the development of a process of recall based on the child's particular use of mental imagery. The processes involved would be likely to vary from child to child. This is clear from the cases described by Fernald, and was the principle adopted in Kasdon's work at the Ferkauf clinic at Yeshiva University, as well as the principle adopted in working with Child H. This involved use of Fernald's techniques as a framework, which was then adapted to fit Child H's cognitive style and his individual ways of learning.

Note 16. Use of a format system enabled work to be conducted with Child H in a number of areas, and supported by work done at home. The format system was also used as the basis for the work done with other children online during COVID [8].

Note 17. Learning the spelling of words using occlusion involved a technique in which a word was written on the left hand side of the page, looked at and then covered with the hand while being written in the middle of the page. Both hands would then be lifted, and the words checked for consistency and accuracy. Both words would then be covered with the hand while the child tested him or herself by writing the word for the their time on the right hand of the page. Both hands would then be lifted, and the word marked by the child as correct or incorrect.

Note 18. As in the clinical work described by both Fernald and Kasdon, test information was combined with use of observation of the strategies used by Child H in remembering words. In working with Child H, grade and age scores from the Durrell tests of visual memory for words and phonic spelling of words were used as indicators of competence in using visual and auditory memory for recalling words. These were interpreted in conjunction with observation of the processes Child H used for revisualising words, and then writing these words from memory. Once the revisualisation process was well established, this was then extended into rapid reading

of words combined with work on recall of words read rapidly using an electronic tachistoscope.

Note 19. In terms of ICD DSM IV diagnosis, there was evidence that Child H had reading difficulties which has continued over a number of years. This implied diagnosis on Axis IV, which would aim to identify psychosocial stressors, as well as psychosocial and environmental problems affecting reading ability on a functional level. This could then be classified as either ICD 10 Code F 81.3 relating to a continuing and long-term reading disorder, or ICD 10 Code Z 73.3 (stress not elsewhere classified).

Note 20. The diagnostic criteria corresponding to ICD-10 code F81.2 and DSM-IV code 315.2 for 315.2 a disorder of written expression also still applied, based on assessment of Child H's writing and spelling skills, as measured by individually administered standardised tests (or functional assessments of writing skills) are substantially below those expected given Child H's chronological age, measured intelligence, and age-appropriate educational reports from his school.

Note 21. The three levels of the Phonic Inventories focus on use of consonant blends in words based on short vowel sounds, use of vowel digraphs and use of morphological endings in polysyllabic and compound words based on short vowel sounds.

Note 22. The diagnosis of dyslexia linked to the ICD 10 diagnostic criteria was made by Robert Stark, of the Centre for Therapeutic Excellence. This was based on analysis of psychometric test data, combined with longitudinal analysis of school reports. In addition, Child H's response to intervention over the same period provided clear evidence of the need for concessions in reading, spelling and rate of work.

Note 23. A number of children in the practice have been using tachistoscopic methods for development of rapid reading as well as working memory for words. The response to use of these methods has been very positive. Child H, for example, reports that work on the tachistoscope has contributed to better processing of written material as well as more rapid cognitive processing more generally. Similar comments have been made by other adolescent boys and girls in the practice, indicating the potential of tachistoscopic work to address rapid reading of words as well as working memory for words read quickly.

Note 24. A level of literacy is defined as attainment of reading, writing and spelling age scores of between 12 and 13 years on achievement tests.

Note 25. Based on Child H's verbal and written evaluation comments.

Note 26. Robert Stark, of the Centre for Therapeutic Excellence., https://www.centrefortherapy.co.za

Note 27. The WISC, WISC-R, WISC IV and WISC V all use identical symbols and presentation formats in the coding subtest. The implementation procedures and timing of the test have also remained unchanged through all the different restandardisations of the WISC.

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Chapter 4

Teacher Perspectives on Effectiveness of Assistive Technology in Supporting Children with Dyslexia Learning Disabilities in Ogun State, Nigeria

Obafemi Ayodeji Olayemi and Ishola Ayodele Oluwaseun

Abstract

Assistive Technology for Children with Learning Disabilities (ATCLD) was developed in response to language and math challenges faced by dyslexic students at Adeola Odutola College. This development follows a needs assessment and focuses on upper secondary schools 1–3. As explained above, assistive technologies (ATs) are commercially available, adapted, or modified to improve, maintain, or enhance the functional abilities of children with disabilities. Unlike many schools in Nigeria, Adeola Odutola College enrolls students diagnosed with learning disabilities and trains them in a mainstream teaching and learning environment. Similarly, the Ministry of Education notes that the Nigerian classroom has diverse students with different abilities and students with special educational needs are often enrolled in mainstream schools. In response to the described dilemma, this study developed a tagged ATCLD with text-to-speech skills that enable compensatory learning that emphasizes repetition. The ATCLD effort followed the following methodology. This means that younger children can create new schemas of information. In addition, text-to-speech and text-to-speech assistive technologies widely used for input and output in this research will be expanded in the future.

Keywords: assistive technology, dyslexia, dyscalculia, text – to speech, english language, mathematics, secondary schools

1. Introduction

Dyslexia is a commonly transmitted disorder in nursing [1]. Moreover, it is a defect related to the process of visual input [2]. Students with this condition struggle with language and mathematics because of the way they organize pictures, text and sound [3]. Difficulties related to dyslexia are recognized by the UN All Learners, among others. This is often achieved through an inclusive lens that emphasizes the use of ICT and versatile learning strategies [4]. Comprehensive Education by Ministry of Education, Federal Republic of Nigeria [5] could be a method to address and respond

to the diverse needs of all children, youth and adults by increasing participation, culture and community and reducing exclusion within and even outside the education system. This recognition is supported by the National Institute for Academic Development's Handbook for Academics in Support of Learning (NIED, 2014), which focuses on serving students who are moving through the essential core competencies in a cross-curricular style and skills [6].

Dyslexia is often an inherited neurological disorder; it leads to problems with reading, writing and spelling [1]. ATCLD will also be implemented for children affected by the above problems; the etymology of the word dyslexia comes from the Greek DYS-disorder and the language LEXIA. A diagnosis of dyslexia does not mean an intellectual disability, people with dyslexia are fully capable, but this can only be improved through proper identification and appropriate training [7]. Instead, dyscalculia is a math-specific learning disability that can cause difficulty understanding number concepts or using symbols or functions necessary to succeed in math [8]. In recent years, researchers have become increasingly interested in studying the use of technological devices to improve the performance of children with specific learning disabilities in inclusive classrooms [9–11]. These studies have shown that assistive technology is a potential help in improving the educational needs of children with SLD and that the integration of technology is important to increase the learning effectiveness of children with learning disabilities [9, 11]. However, little information was gathered from teachers about how technology devices would benefit children with specific learning disabilities [10–12]. The successful implementation of technology in the classroom depends to a large extent on teachers' knowledge and attitudes towards the use of technology in the teaching and learning process [13]. Therefore, it is important to focus on how teachers perceive the effectiveness of assistive technologies for children with specific learning disabilities.

Learning is the acquisition of new knowledge and skills. In the early developmental years, children begin to learn to read, write, and count according to their age and intellectual abilities. However, despite normal intellectual abilities and normal visual, auditory or physical abilities, some children appear to be particularly unable to acquire mathematical and language skills, even when provided with adequate learning opportunities [14]. Children with learning disabilities lag behind in cognitive acquisition but have average or above average IQs, meaning they do not have low intelligence issues [15]. The term learning disability covers a very wide range of characteristics. Due to the impact on cognitive processes, students with learning disabilities may experience difficulties in various academic areas as well as social and emotional development; however, the main problems most often lie in specific areas such as reading, writing and arithmetic, which are the basic foundations of education.

Inclusive education is the process of responding to the diversity of children by improving participation in the classroom and reducing exclusion from education [16]. Inclusive education ensures a quality education for all students by effectively meeting their diverse needs in a sensitive, respectful and supportive manner in mainstream schools. Mainstream schools accept children with special needs in the classroom with their typical peers and strive to meet the needs of all children with a quality education. The United Nations Convention on the Rights of the Child [17] states that every child has the right to education regardless of disability and without any form of discrimination. Children with special needs are therefore effectively educated in special or mainstream schools to promote their independence and sense of well-being through maximum inclusion and active participation in the communities in which they live [18].

According to the Individuals with Disabilities Education Act [19], any device that is used to improve the performance of individuals with disabilities is considered assistive technology. This could include any program or product system used to increase, maintain, or improve the useful abilities of individuals with disabilities [15]. In addition to aids as part of the curriculum, teachers can facilitate children with special needs in solving known learning problems and can encourage independent study. However, the selection, acquisition and use of useful technology depend on an assessment of the child's needs as well as the suitability of professionals working with students with learning disabilities [20].

Assistive technology allows students with disabilities to improve their access to courses and the quality of their professional knowledge [21]. Several useful technological devices are available to help teachers improve their students' useful abilities by increasing their participation in learning opportunities and engagement in activities [9]. Computer powered directions include numerous code applications to help children improve their learning activities and reach their potential. These technologies vary from simple spell checks to more advanced speech recognition (systems, teaching and learning software). Among them, software such as voice recognition, word prediction, spell checking and scientific software have been found to be effective in meeting the requirements of children with specific learning disabilities [12]. When students with learning disabilities are unable to meet academic and behavioral goals in school, teachers should recognize the need to create usable technology tools and supports that can modify them to successfully complete assigned tasks. AIDS is therefore an integral part of education and a necessary half in the design and development of teaching programs for university students with disabilities [22].

As stated by the Ministry of Education (2009), children at Adeola Odutola College (AOC) receive teaching that is applicable to graduates in mainstream settings. In response to the above, Assistive Technology for Children with Learning Disabilities (ATCLD) was developed for SS.1 to SS3. It deals with English and math programs by allowing text input, displaying colored text and images, and outputting sound to the user.

Adeola Odutola College (AOC) is a mixed school (boys and girls) that prepares students with special business needs as it offers WASSCE levels including structured modules and business subjects. ATCLD is designed for beginners and can prepare students at this level. Qualitative methods; In the initial phase of the study, case studies of dyslexic students from Adeola Odutola College (AOC) were used followed by quantitative methods; An experiment was conducted during the ATCLD test. The combination of these techniques is known as a hybrid approach. The waterfall model guides the development of a search engine, as requirements gathering is the initial stage. Research focuses on improving maths and English, as people with dyslexia have problems understanding language and arithmetic. A pilot study on the adoption and use of iPads for active reading demonstrated improved academic performance [23]. The work in this study focuses on earlier technologies, so ATCLD is based on the same improvements in academic achievement as earlier technologies.

The main objective of this study was to develop an assistive technology, namely ATCLD, for better understanding of Mathematical and English concepts for students with dyslexia at Adeola Odutola College, Ijebu Ode, Ogun State. The main objective of this study was achieved by implementing the following secondary objectives:

1. Identify system requirements for assistive technologies

2. Development and implementation of assistive technology

3. Evaluate the effectiveness of assistive technologies in improving understanding of mathematics and English concepts

2. Facilitating student achievement with assistive technology (world perspective)

The compensatory nature of assistive technology creates opportunities for students with disabilities [24]. Coincidentally, Currie and Drewry [25] added that assistive technologies are often promoted to schools, parents, and educators as tools to support students with special needs. Create a balance to address learning disabilities and promote individual independence. The use of assistive technology can provide a compensatory alternative and, when incorporated into quality writing instruction, can lead to improved performance, as in the case of MacArthur (cited in [26]). ATCD is a compensating AT, so it can provide these parameters.

In improving the realm of unique education, it has turned into an unusual place to view assistive technology as a resource provided to people with physical, sensory (auditory and visual), and communication impairments [24]. The response from education specialists has usually been to offer assistive technology that offers physical right of entry to academic and network packages and services. A key function of assistive technology in facilitating the right to enter academic experience is as a means to achieve core curriculum outcomes [24]. Most children with special knowledge disabilities have reading problems known as dyslexia. It commonly affects a child's ability to understand and manipulate the sounds of spoken speech, in addition to having problems interpreting and recognizing new words. Children who are affected by this problem have difficulty acquiring knowledge that they can explore properly and fluently [6]. Writing disability (dysgraphia) is another educational bottleneck for college students with learning about disabilities. Children with dyslexia have trouble organizing and writing down their thoughts and ideas. It affects the primary writing skills of handwriting, typewriting and spelling. Another learning disability is an inherent difficulty remembering and effectively using the steps of a math problem (dyscalculia). Specific problems consist of length and spatial relationships, orientation, region values, decimals, fractions, problems understanding time-related concepts, and problems remembering math facts [14].

3. Teacher perspectives

To facilitate educational opportunities for children with SLD, teachers should use appropriate teaching strategies and materials to reduce or eliminate children's deficits in specific learning areas. The primary responsibility of teachers is to provide children with and without disabilities a successful learning experience that will help them achieve their goals for a bright future [15]. Therefore, educators need to identify the right technologies for these students to use their resources and how those resources can be used most effectively, with whom, where, and when. They may have knowledge of how to teach and how to design curriculum to meet students' needs,

which is an important part of children's academic success [27]. However, inadequate information and educational strategies for integrating assistive technologies into the mainstream curriculum continue to plague educators. To illustrate this, a research study [28] revealed concerns among teachers that their education programs did not provide enough courses and field experiences to enable them to become teachers and support students with special educational needs.

Despite the knowledge and training of teachers, the use of technology in school varies according to children's preferences and their interest and disposition towards it Use of technology [29]. The Individualized Education Plan (IEP) can identify the child's strengths and weaknesses, likes and dislikes, and what strategies help deal with the child [20]. In addition, through learning, the teacher can improve students' motivation and engagement by increasing their autonomy and self-direction. Bronfenbrenner's bioecological model [30] is useful in its application to personalized learning as it explains the interactions borne by the children. That supports their development and learning. The bioecological model consists of major environments inhabited by children and teachers and is organized and conceptualized in separate systems including microsystem, mesosystem, exosystem, macrosystem, and chronosystem [31]. The microsystem, the deepest layer, includes a child's relationships and interactions in their immediate environment (family, peers, school, or neighborhood). The Mesco system establishes the connection between the structures of the child's microsystem "family - school, partner - family, neighborhood - partner". The exosystem consists of connections and processes between environments that the child does not directly execute. However, the structure of this layer can influence the child's development by interacting with some structures of the microsystem. The macro system is the outer shell of the child's environment and is linked to cultural values. It consists of customs and laws. Finally, the chronosystem is also relevant to the child's environment. This can be internal or external [31]. Urie Bronfenbrenner's theory of child development describes how important social situations in a child's life interact and influence important outcomes, including social and emotional adjustment, academic achievement, and engagement. Provides a comprehensive conceptual foundation [30]. A teacher's perception of assistive technology can determine the extent to which technology is used in the teaching and learning process [32]. To improve the use of assistive technology as an intervention, teachers should ask what techniques and strategies are useful in different types of learning situations and how children become more strategic and effective lifelong learners. We need to know how to use the technique as an effective intervention that allows [33]. However, what teachers do and what they know about assistive technology depends on their level of skill, experience, knowledge, and competence in inclusive practice [13]. For example, teachers who think of learning as the accumulation of information tend to think of teaching as the transmission of information. In contrast, teachers who view learning as a conceptual shift are more likely to be facilitators, always encouraging children to learn independently. Their perceptions and attitudes greatly influence the acceptance, implementation, and outcome of using assistive technology to teach children with learning disabilities.

4. Specific learning disability

Learning is acquiring new knowledge and skills. Depending on their age and intellectual ability, children in early development learn to read, write and do arithmetic. However, despite normal intellectual ability and normal visual, auditory, or physical

abilities, some children fail to master language and mathematics, especially when appropriate learning opportunities are available. Yes [14]. Children with learning disabilities lag behind in acquiring cognitive skills but have average or above average IQs. However, the bigger problems are more common in specific areas such as reading, writing and mathematics, which are central to education. Most children with certain reading disabilities have reading and writing problems known as dyslexia. In general, it affects a child's ability to recognize and manipulate sounds in spoken language, as well as problems deciphering and recognizing new words. Children who suffer from this problem have difficulty learning to read directly and easily [19]. Writing disability (dysgraphia) is another academic area of concern for academics with learning disabilities. Dyslexic children find it difficult to study, organize their thoughts, and write. Affects rudimentary writing skills of handwriting, typewriting and spelling. Another reading disability is the intrinsic problem of remembering and correctly using exact math problems (dyscalculia). Specific issues include size and spatial connectivity, exposure, location values, numbers, fragments, difficulty understanding time-related generalities, and difficulty flashing fine-grained data [14].

5. Inclusive education

Inclusive Education Inclusive education is the process of addressing the diversity of children by enhancing their participation in the classroom and reducing educational rejection [16]. Inclusive education ensures quality education for all students by meeting diverse needs in a responsive, caring and evidence-based manner in mainstream schools. Mainstream schools aim to enroll children with special needs alongside common peers in the classroom and to meet the needs of all children with quality education. United Nations Convention on the Rights of the Child [17] states that every child, regardless of disability, has the right to an education without any form of discrimination. Children with special needs can therefore be effectively educated in special or general schools, and through maximum complement and active participation in the communities in which they live. It can build dependencies and foster happiness [18]. The Salamanca protest calls for general education institutions to be regarded as places of child development open to all children, regardless of their physical, emotional or intellectual disabilities [16]. Inclusive seminars are expected to focus on the differences between different orders and to have unique characteristics that distinguish individuals from each other.

The United States Individuals with Disabilities Act (IDEA) states that an Individualized Education Program (IEP) should be developed if a child is associated with participation in a special education setting [34]. Each child's IEP is created by a team comprised of the child's teacher, parent, child, and outstanding special education. IEP trains are required to create an Individualized Education Plan (IEP) to meet the specific needs of children with special needs in mainstream schools. The United Nations Convention on the Rights of Persons with Disabilities [20] emphasizes the right of persons with disabilities to lifelong literacy education without discrimination and on an equal basis with others, without exclusion from general education on the basis of disability. The main task of educating children with disabilities is to provide all children with disabilities the most stylish education possible in the most suitable environment, with the aim of obtaining the highest possible educational status in mainstream schools [23]. However, the literacy development of children with learning disabilities in general education classrooms depends on the successful

implementation of educational methods and facilities to support the literacy of these children [28]. Teachers must be responsible for organizing, implementing and evaluating classroom adjustments according to the needs of children. Interventions such as tutoring, supportive and educational methods, peer training, collaborative literacy and metacognitive strategies have been developed to optimize classroom effectiveness for children with specific literacy disorders [32].

6. Factors impacting teacher perspectives

Several factors can influence teachers' perspectives on the effectiveness of technology. The papers used for this methodological review slightly reflect factors stated for different perspectives on assistive technology for children with specific literacy disabilities.

6.1 Training/experiences

A teacher's perception and understanding of assistive technology depends on the effective instruction they receive during the preparation program and professional development. Most articles point to a lack of training programs and teacher experience [31, 35, 36]. As an example, the researchers reported that a teacher's prior experience and knowledge determined how effectively her AT was used in teaching literacy and how well it supported the child's learning development. [31]. Teachers with more experience and more AT-related training activities (coursework, workshops, in-service programs) reported more positively about the effectiveness of the technology [31]. However, 30% of teachers who participated in the study said they were not ready or confident to use technology and did not know how to effectively implement, integrate and evaluate assistive technology. Similarly, another research study found that teachers currently using computer-based instruction claimed it was an effective tool for improving student learning, while teachers are new to technology, we found that users reported using something they were not familiar with [35]. Additionally, 60% of teachers reported lack of training or experience in assistive technology, and were reluctant to integrate different activities for children with learning disabilities of different ages [36].

6.2 Level of confidence and knowledge

Of the six articles, three revealed teachers' perceptions of confidence and knowledge when using technology in the classroom [31, 35, 37]. Teachers have shown that certain assistive technology skills influence self-confidence., know how to set up assistive technologies and how to adapt them into effective tools. A particular child developmental impact is instruction [31]. Similarly, teachers who reported low confidence indicated a need for additional training and knowledge of TA, including its educational objectives and functions [35]. Teacher confidence is related to their perception of their ability to use and integrate AT into the educational process. To illustrate this, most knowledgeable teachers show confidence in their ability to support children, saying that assistive technology can promote children's independence and encourage active learning. However, less confident and less knowledgeable teachers view TA as a complementary rather than an integral aspect of the curriculum [37].

6.3 Unavailability of devices and technical support

To integrate technology for children with learning disabilities, the availability of appropriate learning programs and software is essential in classrooms. Of the six studies, three explored teachers' concerns about the absence of equipment, lack of technical support, and the high cost of different software [31, 35, 36]. Teachers report that low-tech ATs are used more often than high-tech ATs, possibly because they are cheaper and easier to use without technical support [31]. In this study, 75% of teachers reported being uncomfortable using high-tech devices, such as the high cost and lack of availability of technical services [31]. In addition, teachers are concerned about the low availability of appropriate technology devices in the classroom to support children with special needs [36]. Similarly, they point to a lack of access to technology, such as insufficient computers, software costs, and lack of IT technicians [35].

6.4 Time constraints and unique needs of children

The availability of appropriate learning programs and software in the classroom is critical to the integration of technology into children with learning disabilities. Of the six studies, three investigated teachers' concerns about lack of equipment, lack of technical support, and high costs of various software [31, 35, 36]. Teachers report that low-tech ATs are used more often than high-tech ATs, probably because they are cheaper and easier to use without technical support [31]. In this study, 75% of his teachers reported being uncomfortable using high-tech equipment, including its high cost and lack of access to technical services [31]. Additionally, teachers are concerned about the lack of appropriate technical equipment available in the classroom to support children with special needs [36]. They also point to a lack of access to technology, including a shortage of computers, software costs, and a shortage of IT personnel [35].

6.5 Time constraints and Children's special needs

Research papers show that time constraints are a major barrier to promoting the use of educational technology [35–37]. To use computer-based teaching as a teaching tool, teachers need more time to prepare computer programming programs [35, 36]. The introduction of ATs in the classroom and the time it takes to teach children how to use them [37]. Additionally, two articles point to individual differences in children, autonomy, learning motivations, and preferences for using learning apps [31]. Effective use of assistive technologies depends on supportive policies from teachers and children's willingness and interest in using them as effective tools.

7. Assessing the effectiveness of assistive technologies

Adebisi et al. [38] explored the effects, benefits, and reasons why the use of assistive technologies for children with learning disabilities can close achievement gaps. Did. This article describes different types of assistive technologies that have been developed and used to help children with learning disabilities solve written, literate, listening, and math problems. He emphasizes the need to select appropriate

technical aids for children with learning disabilities and to ensure that children with learning disabilities get the maximum benefit from the use of assistive technology in the classroom [22]. We've highlighted educational guidelines for teachers to do or at home with technology to make the teaching and learning process fun and effective. The study design of Adebisi et al. [38] is consistent with ATCLD's considerations in solving literacy and numeracy problems.

8. Methodology

The study population consisted of 20 teachers and 44 students from SS 1 to SS 3 out of 2 teachers and 73 students of Adeola Odutola College, Ijebu-Ode. The cost-effectiveness and feasibility of the study was ensured by purposive population sampling of 5 teachers and 10 students, as warranted; this was done for the desired sample size. In addition, the credibility of the questionnaires used during the study was achieved through careful scrutiny by the researchers' supervisors, for which a sample of the participating teachers was provided. During the two weeks of the course, the participating teachers returned the questionnaires; instead, students were asked about their difficulties in reading and understanding the language. The interview questions come from the survey questionnaire. Content analysis, including the classification, synthesis, and tabulation of linguistic and behavioral data, was the qualitative data analysis used in this study. Quantitative data were statistically evaluated using Microsoft Excel, in which numerical data were plotted. Visual impairments, neurological disorders, and physical disabilities are among the barriers to effective computer use [39]. In the study, participants were asked to assess their own needs by a school counselor affiliated with Adeola Odutola College in Ijebu-Ode. Test results show that students with dyslexia at Adeola Odutola College, Ijebu-Ode need assistive devices, such as when students have vision or hearing problems, and these recommendations are part of the system requirements.

9. Results

Each learner took four tests, namely; the language proficiency pre-test (a), post-test (b), arithmetic proficiency pre-test (c), and post-test (d) denoted by (a), (b), (c), and (d) respectively. Besides, distinction in post and pre-test/s are symbolized by (b) Sub (a) and (d) Sub (c) while proportion (%) increase or decrease is expressed by ((b-a) /a) x 100). Additionally, the letters E, F, G, and H represent the test taker. The subsequent is an example of information manipulation for learner G. 10 students took half within the interview; however, the testing was scaled down to six candidates because it may be deduced from the analysis (**Table 1**).

Test trial out of 16 Marks for learner E, F, G and H Grade 5 learners brought to book low marks in comparison to their grade 6 counterparts. This is evidential as illustrated on the above **Figure 1**.

Series 1 and 2 represent language and mathematics correspondingly. Though grade 5 learners demonstrate a lower performance in **Figure 1**, they hold a record of most improved marks in **Figure 2**. Most improved marks associated with pupils of fifth grade signify the concept of younger children being better learners. This means the teaching of basics should not be done at any later stage to avoid complications as older children may be prepared for other activities in life (**Table 2**).

Learner name	Language proficiency pre – test (a) 16 marks	Language proficiency post – test (b) 16 marks	Mathematics proficiency pre –test (c) 16 marks	Mathematics proficiency post –test (d) 16 marks	(b) Sub (a)	(d) Sub (c)	% (Language) increase/decrease	% (Math) increase/ decrease
E	5	8	6	9	3	3	60	50
F	3	5	4	7	2	3	67	75

Table 1.
Test marks for SS1 students in based on proficiency.

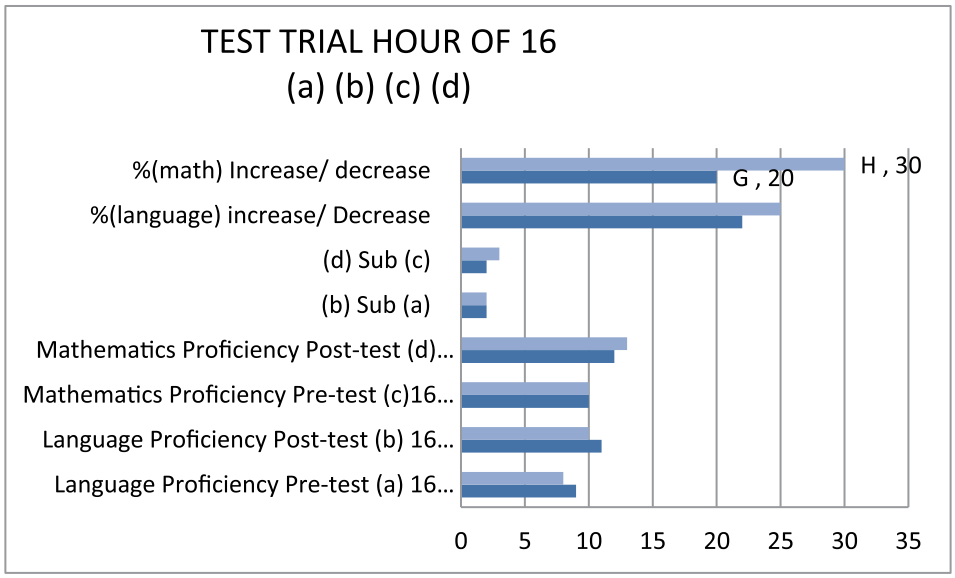

Figure 1.
Test trials for learners.

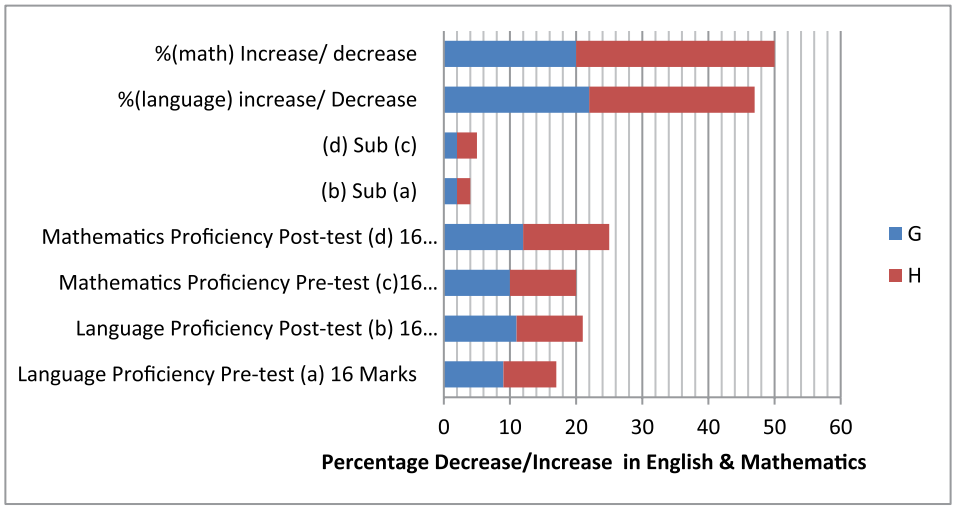

Figure 2.
Percentage increase/decrease in language and mathematics.

Rumelhart's (quoted in [10]) Schema idea is a proof of the way readers use earlier information to apprehend and research from text. Improving fifth-grade scholar success means; Young youngsters can broaden new diagrams that summarize units of information. This look at simulated and carried out Graham and Richardson's [34] idea of know-how the connection among the function of AT and consumer desires. Thus, within the improvement of the ATCLD, the necessities took place. In contrast, Culèn and Gasparini [23] performed a case look at, that's much like the technique used on this look at. Coincidentally, each research confirmed improvement. Goal; Improving the studying and writing of youngsters with studying disabilities is the

Learner name	Language proficiency pre-test (a) 16 marks	Language proficiency post-test (b) 16 marks	Mathematics proficiency pre-test (c) 16 marks	Mathematics proficiency post-test (d) 16 marks	(b) Sub (a)	(d) Sub (c)	% (Language) increase/decrease	% (Math) increase/ decrease
G	9	11	10	12	2	2	22	20
H	8	10	10	13	2	3	25	30

Table 2.
Test trials for SS2 learners.

intention of Culèn and Gasparini [23], further to the experimental technique of Rello et al. [39] concerning the usage of publish and pre-check accompanied with the aid of using this look at..

10. Teachers' knowledge of assistive technology

Technology Regarding instructors' focus of the advantages of the use of assistive technology, 89% of respondents agree with that instructors aren't completely aware about the advantages however they agree with that instructors understand the significance of assistive technology. The biggest percent of members agreed that colleges must offer assistive generation for college students with disabilities because academic companies are answerable for instructing college students and investment is your responsibility. However, they 10 agree with that colleges do not have any responsibility to offer assistive generation and no reason for this perception has been stated.

10.1 Availability

In reaction to the subsequent declaration: "The availability of assistive technology within the lecture room offer possibilities for college students with disabilities to get right of entry to the mainstream curriculum", 92% agreed and emphasized that scholars with disabilities want to be taught to apply ATs, even as 7% disagreed with the preceding declaration due to the fact college students with such issues can also additionally have problems within the trendy curriculum. Participants diagnosed many advantages of the use of assistive generation within the lecture room. For example, numerous humans stated that assistive generation can assist have inclusive lecture rooms for all college students, no matter their disabilities. Participants stated that AT may want to by hook or by crook assist college students to satisfy their instructional responsibilities and that AT enabled college students with disabilities to be unbiased and take part within the curriculum. However, respondents additionally suggest that AT would possibly have a few disadvantages, such as: For example, the bad labeling of college students with disabilities, which also can purpose emotional damage.

11. Recommendations

The consequences of this suggest the want for reinforcing ATCLD or a relative application, consequently, Adeola Odutola College and different colleges in Nigeria must reply to this name with the aid of using availing human and capital assets to amend consumer necessities and supply of facts for populating the assistive generation. The implementation of ATCLD must amplify to trainer and learner schooling so as to make certain green use of Assistive Technology. Moreover, the Ministry of Education and the National Institute for Educational Development must make certain the enforcement of ICT because that is in accord with the Inclusive Education policy.

12. Conclusion

Every Nigerian baby has the proper way to a simply and nice education (Human Rights Constitution, Nigeria, 1990). However, a few instances exclude positive people

from diagnosed countrywide education, such as: According to assistive technology, ATCLD desires to move similarly to serve a good broader institution of students at Adeola Odutola College, Ijebu-Ode, and elsewhere. In addition, teacher schooling guides associated with helping youngsters with studying problems and in trendy must be introduced. It could be extra beneficial if the Ministry of Education inculcate the problems associated with studying disabilities and collaborate with other countries. Assistive generation may be a beneficial and supportive device for college students with disabilities; it facilitates each instructors and college students to create an unforgettable studying experience. The researcher strongly believes that everybody can research and enhance academically, however humans want to study the surroundings to attain those desires of spans instructors, parents, families, and the network can paintings collectively to offer a success studying surroundings. In present day societies, generation has end up an essential a part of existence and social progress. Part of the function of educators is to make assistive generation to be used by humans with disabilities and permit them to gain from it and enhance their essence of existence through the use of the pleasant assistive generation to be used.

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Chapter 5

Perspective Chapter: Learning to Work Smarter with Teaching Assistants to Develop a Dyslexia-Friendly School

Dominic Griffiths

Abstract

Schools now widely rely on the deployment of teaching assistants (TAs) to support the inclusion of students with learning differences, including students with dyslexia. However, research findings forthe effectiveness of their deployment has been mixed. This chapter therefore seeks to draw upon research evidence of best practice to aid teachers in maximising the quality of their collaborative work with TAs, where TAs are working in-class or in teaching structured programmes of literacy support with individual or small groups of students. This chapter take a critical stance, framed by the social model of disability, advocating a whole-school approach to managing TAs' deployment and recommending a rethinking of joint working practices with teachers, so that they are both fully involved with supporting students with dyslexia and other learning challenges in the classroom. It also warns of the double-edged nature of the 'paradox of the expert', where classroom teachers maybe working alongside dyslexia specialist-qualified TAs

Keywords: teaching assistants, inclusive education, Dyslexia, Dyslexia-friendly schools, social model of disability, whole-school approaches, collaborative practice, joint working

1. Introduction

Since the 1990s Teaching Assistants (TAs*) have played an increasingly important role in both mainstream and special education in England. However, there was originally some confusion over their roles in schools. This confusion was highlighted by Balshaw [1], who identified early perceptions of TAs as: 'piggies in the middle ….left in no-man's land' …dogsbodies …[or worse still] a spy in the classroom [or] an overgrown pupil' (1999:12). Since those early days, the number of TAs in the English workforce has grown steadily, from 24,000 full time equivalent (FTE) posts in 1997 Balshaw [1] to 221, 481 in 2010 and 271, 370 in 2020 [2]. The chances are, therefore, that newly-qualified teachers (NQT) will find themselves working in a classroom alongside one or more of these paraprofessionals, so it is vital that the working collaborations

between teachers and TAs are positive, productive, and mutually respectful experiences for both parties and ultimately help foster inclusive classrooms for all learners, especially those with learning differences such as dyslexia. This chapter explains the development of the various dimensions of the TA role, explores some of the challenges that TA/teacher collaborations might encounter and draws upon the latest research evidence about maximising the potential benefits of joint working in the classroom, with the aim of better supporting dyslexic students. In doing so, I will also draw upon my own research and professional experiences as a classroom teacher, dyslexia-specialist teacher, Special Educational Needs and Disabilities Coordinator (SENDCo), and teacher-educator. This chapter also draws upon models of disability and neurodiversity in framing how schools need to consider dyslexia support and TAs' roles within those processes in the dyslexia-friendly school.

2. The development of the TA role

As Balshaw's quotation above suggests, there was not only confusion in schools over the TA role but also their status. Balshaw [1] noted that the early deployment of TAs in schools was largely to fill ancillary roles, but their brief soon widened to include much more of a learning support role, both within the classroom and withdrawing individual and small groups of students to tackle programmes of extra help for those who had slipped behind in their learning: in particular, extra literacy support; and this included many of those identified with dyslexic-type difficulties. Much of this was driven by the then government's drive to remodel the teaching workforce [3].

Initially, there was suspicion from some mainstream teachers, about the presence of TAs in their lessons. Teachers were traditionally used to their classroom being their own private domain. Nor, as Sebba and Sachdev [4] noted, had they routinely had training in *how* to work with TAs. There were also fears that TAs were not just present in their classrooms but perhaps judging their performance. Many mainstream teachers, faced with the demands of developing more inclusive teaching for the diversity of learners in their classes, in response to a series of government-led Special Educational Needs Codes of Practice in England [5–7], have often felt that they were potentially facing demands for which they felt ill-equipped and that they might be under scrutiny where this lack of confidence was exposed [8]. For their own part, many TAs felt that they were being thrown into teaching and learning situations for which they has little or no training, including, supporting students with dyslexia [9] and that they, in turn, would be judged as inadequate by the classroom teachers.

In response to the confusion and misgivings reported above, the English government established a set of national professional standards for TAs [10] linked to the workforce remodelling drive, and a generic package of induction training for TAs was rolled out to schools [e.g. 11]. In addition to this, a range of other training courses at Levels 2 and 3 have been developed over the last 15 years by various professional development providers, sometimes leading to the Level 4 Higher Level Teaching Assistant (HLTA) qualification, and Level 5 Foundation Degrees in Learning Support, which many TAs have taken advantage of and value [12]. However, access to such training opportunities has been, according to Hussart and Croucher [13], somewhat unsystematic and many TAs have reported that, after initial induction training packages, access to further training has sometimes been hard to get [14]. In terms of

specific dyslexia training for TAs, the British Dyslexia Association (BDA) has developed the Accredited Learning Support Assistant (ALSA) qualification, offered as a Level 4, 5 or 6 course [15].

3. Challenges in the deployment of support staff

A major research project on the use of TAs in schools the *Deployment and Impact of Support Staff* (DISS) was reported in 2009 [16]. The report identified many shortcomings in the ways that TAs were being deployed in schools and the ways in which they were interacting with students in their support roles.

The DISS research team's main areas of focus were around staff preparedness, deployment both in and outside the classroom, the practice of support staff and the impact of support staff.

3.1 Preparedness

- Relative lack of training opportunities for the majority of TAs
- (Echoing Sebba and Sachdev's 1997 findings) The majority of teaching staff still did not receive training on how best to work with support staff.
- Lack of teacher/TA joint feedback and planning time for the majority of staff.

3.2 Deployment of support staff both in and outside the classroom

- The majority of TAs' time was spent in pedagogical roles rather than in assisting the teacher or the school.
- The vast majority of TA time, both in and outside the classroom was spent in supporting those individuals or groups of students identified as low attaining or as having special educational needs (SEN).
- At the secondary level, there was evidence that the more time these pupils spent with TAs, the less individual attention they received from the class teacher.

3.3 The practice of support staff

- TAs' interactions with students seemed to be more focussed on task completion rather than actual teaching and learning activities for learning.
- TA guidance for students tended to 'close down' rather than to 'open up' talk to develop learning
- This support was often 'reactive rather than proactive' (probably reflecting the lack of pre-lesson preparation time identified above).

3.4 The impact of support staff

- One positive effect of the involvement of support staff was the effect on teaching staff workloads and their concomitant stress levels and job satisfaction.

Another positive impact of TA involvement in the classroom with the overall level of classroom control and the amount of individual attention available to individual students (though *which* students were receiving individual attention from *which* staff has already been raised as a potential concern).

At the primary school level, access to support from TAs seemed to have little effect on students' positive attitudes to learning; however, at the secondary level, having TA support seemed to help students to be less distractable or disruptive, to help their interactions with peers and to help them work more independently.

Nevertheless, in terms of student progress in English, Maths and Science, there seemed to be a *negative* relationship between the amount of in-class and small group support that students were receiving from TAs and their overall achievement, even controlling for variables such as prior attainment and 'SEN' status.

The DISS report concluded:

> *"The picture concerning impact is therefore a mixed one. Though some of the results presented here have identified problems in current deployment and practice we would not want to give the impression that support staff do not have an important role to play. Our general view is that problems may have arisen from assuming that extra support will lead to positive outcomes for pupils without first establishing a clear understanding and view of the role of support staff and how it affects pupils. Classroom based support staff have huge potential in helping teachers and pupils but there are questions raised in this report concerning the way they are currently deployed in schools and this may be one reason why supported pupils may not make as much progress as expected. The findings have wide significance in the context of concern with the lack of progress made by some pupils in school. Given that lower attaining pupils are more likely to be given extra support in schools it is vital that this support is well organised, prepared and effective." [16: 140, my italics]*

The DISS team not only reaffirmed the potential of TAs to be deployed more effectively, but they also made it clear that their conclusions should form the basis for education leaders at all levels to consider support staff in schools in terms of their 'wider pedagogical role' (WPR). That involved taking together TAs' characteristics, conditions of employment, preparedness, deployment, and practice and thinking about these in their wider contexts. The DISS research team's summary report [17] stressed that

"The WPR model can help identify the possible factors and levels that need to be considered when seeking to account for effects of support on academic progress

> *It helps show that the effectiveness of support should not be personalised or individualised just to properties of individual pupils or TAs because this would seriously underplay the situational and structural factors within which TAs have to work and which will affect their impact. The practice of support staff therefore needs to be seen in the context of decisions made about their deployment by teachers and headteachers, which are largely outside their [TAs] control, and also in the context of their preparedness and conditions of employment. In reality it is likely that individual characteristics and situational and structural factors will all be important and that there will be a complex interplay of relationships between the various components." [17:9, my italics]*

In fact, in terms of the focus of the rest of this chapter, the importance of context must frame any meaningful and effective consideration of working smarter with teaching assistants to support the inclusion of students with dyslexia. With that

framework in mind, before exploring practical ways forward that support a dyslexia-friendly school, we need to consider how we think about those students who have attracted the label 'dyslexic' in terms of differing models of disability and wider discourses of neurodiversity.

4. Considering the student with dyslexia within differing models of disability

In order to develop effective working practices between teachers and teaching assistants, I would argue that they both need to share a critical understanding of how students with dyslexia have been traditionally conceived of in educational discourses and to draw from what has been useful but to challenge where they see limiting and inadequate ideas, some of which are quite deeply ingrained into many teachers', TAs' and schools' belief systems. This section outlines how dyslexia (and other SENDs) are conceived through the lenses of the Medical, Social and Biopsychosocial Models of disability, as well as differing models of neurodiversity. The aim is to develop shared critical reflective approaches to practice, grounded in deeper shared understandings of dyslexia and the need to respond to individual differences within a disability rights-informed dyslexia-friendly school.

4.1 The medical model of disability

From the earliest studies of dyslexia as a 'phenomenon' from the late nineteenth and into the first half of the twentieth centuries, dyslexia had been the subject of a medical gaze [e.g., 18, 19]. Over the course of the twentieth century and into the twenty-first, this framing of dyslexia as essentially a neurobiological issue has persisted and has driven vast amounts of research into the subject with parallel strands of research based in the field of cognitive psychology (see Elliott and Nicolson [20] for a useful summary of both). These medical-neurobiological and cognitive-psychological conceptions, which have dominated the field of dyslexia research can also be tracked in many other fields of research into Special Educational Needs and Disabilities (SEND). The focus has been firmly on the individual subject and their deficits in learning, language, motor skills or attentional skills, depending upon the field of behavioural interest. The subject is de-contextualised and scrutinised for clues, with the aim of treatment and possible cure of these 'pathologies'.

As Cotterill [21] has noted, in the field of education this framework has led to the employment of a wide range of professionals whose roles have been:

> *'..to judge the limitations of a child with special needs or a disability against functional and developmental norms. The child's performance is compared to the functions carried out by others of the same age to determine the severity of the child's SEN. The child's limitations are labelled through screening and assessment and are described using clinical terminology including 'the pathology of impairment' or 'aetiology of the syndrome'. In attempt to cure the condition, the symptoms displayed by the child are treated using therapeutic or educational interventions and drug therapy.' [21; 84]*

This psycho-medical approach, based on the deficits-based medical model, has traditionally dominated, and arguably continues to dominate, responses to dyslexia in the field of education [21].

Useful though much of this research and practice has been and can be, in socio-cultural and educational terms this approach to understanding dyslexia (and other SENDs) has traditionally underplayed or ignored environmental factors in people's lives. In cultural terms, in particular, the dominant discourses have been of tragedy and pity, sickness and cure, protection and rescue, 'handicap' and charity [22].

4.2 The social model of disability

This traditional framing of SEND remained largely unchallenged until the 1970s, when, in the wider societal context, disabled people themselves began to question these dominant discourses and demand a refocus upon the restrictions being placed upon them in a world geared towards people without impairments, failing to accommodate a greater diversity of people and leading to their social, educational and economic marginalisation [22].

This movement grew through the 1980s, both in the UK and internationally, and was crystalised in the work of disabled academic, Michael Oliver, whose key 1990 work, *The Politics of Disablement* [23], set out and contrasted medical and social models of disability. These models contrasted the (psycho)medical approach to disability, largely led by non-disabled professionals: the Medical Model, with a Social Model, which considered a disability in its full socio-political context, in which disabled people, actually being disabled by lack of representation and societal opportunities should challenge and fight for their civil rights through demanding changes to the societal arrangements in the worlds of education, employment and daily living, to *maximise their opportunities to live independently*, accessing support, where needed, on their own terms. The key methods of the Social Model approach are to identify the barriers to these opportunities and to eliminate, or at least minimise them. The social model seeks to clearly differentiate *'impairment'*, which is an individual's differences or set of challenges, be they physical, cognitive or sensory, from their 'disability', which represents the ways in which narrow societal arrangements and facilities fail to accommodate people's diversity of needs, which Goodley [22] describes as 'ableist'.

Oliver's work has influenced the development of Disability Studies as a field of teaching and research in the late twentieth and early twenty-first centuries, which has been able to provide counter-narratives to the traditional psycho-medical discourses of deficit in the field of disability. Social Model narratives also led to changes in legislation in the UK'; importantly in the 1995 and 2005 Disability Discrimination Acts [24, 25], which acknowledged the legal rights of disabled people, and the 2010 Equality Act [26], which includes disability as a characteristic which must be protected from direct or indirect discrimination under the law.

These challenges and reforms have found their way into the world of education, through the SEND Codes of Practice for schools [5–7], as well as a movement to develop more generally inclusive schools, reflecting more the diversity already 'out there' in society, and whose disabled students' rights to presence and participation are legally backed.

The 2015 SEND Code of Practice (SENDCoP) [7] emphasises that students with SEND are the responsibility of *all* teaching staff; not just the SENDCo and specialist teachers or TAs. It calls for the voice of the student to be heard, for the recognition views of their parent or guardian as 'expert', as well as for joint working between them and the professionals and between the professionals themselves as the key drivers for successful inclusion in education.

The Social Model has come in for some criticism, which Hodkinson [27] summarises as:

- a lack of acknowledgement of the lived experience of pain and illness, with a heavy emphasis on social contexts.

- a homogenisation of disabled people a single group, thus failing to acknowledge the individual differences in their lived experiences linked to gender, class, ethnicity and so on.

In response to these criticisms, other models of disability have been invoked as alternative frameworks, such as Engel's Biopsychosocial Model [cited in 27] or Shakespeare's Interactionist Model [28]. These sought to focus on the complex interplay between biological, psychological and social factors in individual people's lives. However, whilst these models do offer nuance, Oliver himself, in a 2013 response to his critics, pointed out that he did not seek to eliminate individual biology and impairment entirely in his social model and that his model has been thus misconstrued [29]. He acknowledges individual differences in circumstance but maintained the need for disabled people to continue to unite and struggle for real emancipation. After all, it did take the politicisation of the disability to drive through the legislation noted above, and as Hodkinson [27] has noted, the Biopsychosocial Model, for example, 'has not had a great impact upon health or education.'

So, how can we link this discussion back to the context of effective joint working with TAs in the context of inclusive dyslexia-friendly schools? Riddick's research identified the limitations of psychometrically-based approaches to the inclusion of students with dyslexia in education, including dyslexic trainee teachers in higher education, and was one of the first to invoke the Social Model to identify discriminatory learning environments and attitudes as the issues that need addressing [30]. These findings were echoed in MacDonald's use of the Social Model in reporting interviews with dyslexic adults reflecting upon their experiences at school [31]. He also noted how socio-economic factors might mitigate or aggravate the effects of the barriers that they encountered.

More recently, Giangreco [32], has recognised most of the DISS project's findings in the USA education context and uses a Social Model-influenced framing of the issues to show how many shortcomings and challenges identified in DISS reflect continuing ableist attitudes underpinning school organisational and curricular arrangements (all be they within well-meaning school governance regimes). In considering the deployment of TAs in schools, he insists that the struggle for disabled students' still-constricted civil rights needs to be maintained. This echoes the Social Model's insistence upon challenging ableist attitudes (even when unconscious) and, like MacDonald [31], upon opening up spaces for student voices to really be heard.

The next section of this chapter, which considers developing smarter ways of working with TAs in promoting a dyslexia-friendly school is therefore informed by a Social Model framework, which focusses on reforming school environments, not just 'fixing' students. Firstly, however, we will also consider how using the concept of 'neurodiversity' can inform more nuanced approaches to embracing student diversity in the classroom.

5. Neurodiversity and dyslexia

As well as using the Social Model of Disability to underpin this discussion, at this point, it may also be useful to consider the concept of 'neurodiversity' and its relation to current thinking about dyslexia. This might help us reframe some of the issues of pedagogy and joint working to develop more inclusive practice

The term 'neurodiverse' was originally coined by the sociologist Judy Singer [33] as a way of reframing what she considered her negative label of 'autistic'. The term subsequently became applied to the wider range of learning differences often bracketed under the term 'special educational needs' (SEN) [34]. However, this SEN-based conception of neurodiversity has been criticised as being firstly, merely deficit-focussed [35]; secondly, subscribing to a false dichotomy between notionally 'neurotypical' and 'neurodivergent' populations, where in fact these 'boundaries' and cut-off points are merely arbitrary social constructs [36] and thirdly, that human neurodiversity is much more nuanced and universal [36]. Masataka has suggested that neurodiversity, therefore, be considered in the same ways as biodiversity [37].

Recent studies from the field of neuroscience are starting to offer evidence in support of these critiques of the siloes of discrete 'SEN syndromes'. A recent major research project undertaken at the Cambridge University Cognition and Brain Science Unit [38] has revealed that there seems to be no consistency in the neural network patterns of people categorised under the same SEN labels.

This problematisation of traditional SEN categories with clear diagnostic cut-off points has come under increasing scrutiny in the case of dyslexia. In a recent review of the state of the definitions and understandings of dyslexia, Snowling et al. [39] echo this developing conception of dyslexia as 'dimensional' rather that neatly 'categorical' in nature, where diagnostic boundaries are leaky and where dimensions of dyslexic-type difficulties (e.g. poor phonological awareness, weaker working memory capacities and decoding problems in reading and/or spelling, etc) are by no means universal in dyslexia, nor are they unique to dyslexia. Furthermore, many people who have attracted the diagnostic label of 'dyslexic' have other co-occurring difficulties, sometimes in motor skills, numeracy or attentional issues (though these themselves would not be considered as diagnostic criteria for dyslexia). These complexities within the spectrum of profiles of people usually singly labelled as 'dyslexic' have important implications for the ways in which teachers and TAs need to collaborate to support these learners. The somewhat leaky boundaries of the threshold for dyslexia diagnoses, often inconsistently applied in assessments can also mean that some learners who may have dyslexic-type difficulties fail to 'make the cut' in 'official' identification of their needs. Kirby [40] also noted a social class dimension confounding some diagnostic practices, with some families having the economic means to pay for private assessments not automatically available to students from poorer backgrounds. The implications of inconsistent diagnoses mean that teachers and TAs supporting learning in the classroom may need to be aware of some students' needs for support for these types of challenges, despite having no formal identifying dyslexia label.

Further implications of these findings for supporting the diversity of students in the classroom will be discussed in the next subsections of this chapter.

6. Developing policy and practice for working smarter with TAs in a dyslexia-friendly school

6.1 Introduction

The Social Model of Disability clearly suggests that the development of more inclusive educational provision for students with dyslexia needs to be based on an equal rights-based approach, where student's voice is heard and where learning environments, rather than just individual student 'remediation', are the focus.

This final section of the chapter does not just aim at a list of 'tips for teachers' (though issues of strategies and resources will be touched upon.). There needs to be a deeper under the understanding of the key underlying principles of joint working and the deployment of TAs that can promote a more dyslexia-friendly school. In outlining these principles and practices, I will be drawing upon some key research, much of which has been developed in response to the DISS report findings. Two, in particular, will help us consider priorities for action in working smarter with TAs: firstly, *Challenging the role and deployment of teaching assistants in mainstream schools: The impact on schools. Final Report on the Effective Deployment of Teaching Assistants (EDTA) Project* [41], summarised in guidance for schools by Russell et al [42], and secondly, the Education Endowment Foundation (EEF) report *Making the Best Use of Teaching Assistants* [43].

The 2012 EDTA project was undertaken by the same London team that researched the DISS project and drawing upon the lessons learned, reported action research in schools aimed at maximising the effectiveness of TAs, using the framework of the TAs' Wider Professional Roles (WPR, see above) under the headings of: the preparedness of TAs, the deployment of TAs and the practice of TAs[41]. The 2018 EEF report, partly by members of the same team, offered an updated review of good practice and the report's seven key recommendations will be referred to in the following discussion [43].

As well as drawing from the two key research reports noted above, I will also refer to other recent research on working collaboratively with TAs in the context of developing a dyslexia-friendly school. The chapter section will draw upon two reports based on the finding of the 2016-2018 *Dyslexia Support Project (DSP):* firstly, *What works in dyslexia/SpLD friendly practice in the secondary school and further education college sectors: Four case studies of effective practice* [44] and secondly *Teaching for neurodiversity: training teachers to see beyond labels* [45].

Using the WPR structure seems a useful way of exploring these principles of smarter collaborative working, but I also add an extra subsection, based upon further research by Griffiths and Kelly [46], to discuss the particular issues around collaborative working with TAs delivering structured interventions to support literacy skills, including those delivered by dyslexia specialist-trained TAs.

The chapter section also reflects how effective joint working between teachers and TAs needs to incorporate the voices of the TAs and the students themselves in developing inclusive practice within the wider framework of a whole-school approach, underpinned by the Senior Leadership Team.

6.2 Auditing the preparedness, deployment and practice of TAs in collaborative working

Whole-school audits can be very powerful in the process of developing more inclusive practice in schools, as the *Index for Inclusion* [47] has demonstrated internationally [48]. Following the Social Model of Disability, the prime focus, as mentioned earlier, is on facilitating *all* students' rights to a more enabling learning environment, rather than just trying to 'remediate' individuals in an unchanged school context. The *Index* invites stakeholders to consider the Cultures, Policies and Practices of their school with a view to doing more of what works and reconsidering where challenges still remain in the processes of developing inclusion.

In the case of maximising the effectiveness of TAs through joint working, Russell et al. [42], emphasise the importance of auditing as being driven by the school's senior

leadership team (SLT). The effectiveness of this whole-school level, audit-to-action plan model is echoed in Griffiths and Kelly's research on dyslexia-friendly schools [44].

Russell et al [42] have suggested that, in auditing the TA deployment and preparation in school, the TA WPR framework is used to form section headings of the audit document. A whole-school TA audit needs to have a clear-eyed and critical approach, making an honest appraisal of the current 'state of play' in a school and using the data to establish a baseline for a school improvement action plan. The process is not a one-off activity: the TA action plan, having been put into practice, will need a thorough review as part of a cycle of action and reflection, ideally carried out annually. Russell et al [42] also note that this audit of TA preparedness, deployment and practice might also consider the effects on pupil progress of the various TA-delivered structured intervention programmes, including those to support the literacy skills of students with dyslexic-type difficulties.

It is important that there is 'buy in' to this auditing process and so it is suggested that the school's TAs are thoroughly briefed on the rationale for the audit and that this is not in any way an assessment of individual staff member's *competency*, it is all about maximising their effective deployment as part of whole-school improvement. Given the central importance of joint working practices here, it is also important that all the school's teachers are also thoroughly briefed on this process, with the same key messages emphasised.

To encourage 'buy-in' and to gain a more democratic feel to the audit process, it might be a good idea for a TA deployment working party to be convened to carry out the audit and to conduct an initial analysis of the data drawn from it. It would be logical to have the school's SENDCo as a SLT member of this working party, but in order to move away from the idea that TA deployment is not just a SEND issue, it would be important to have another senior teacher as a member. For transparency and equity, it would good practice to then put out a call for expressions of interest for teaching staff and TAs who might also wish to volunteer to join. It would also be useful to get a cross-section of staff, representing different age-phases in the school (particularly for primary schools) and/or different subject/curricular areas (particularly for secondary schools).

The Audit Team is then formed and the job of gathering the data can get underway. It may well be useful to pair up teachers and TAs to carry out various strands of this work, in order to foster the culture of collaboration that lies at the heart of the aims of the process.

So what data might be gathered for this audit? Russell et al [42] suggest a two-level approach to this process: TA deployment and activity at whole-school and at classroom levels.

At the whole school level, TAs should be asked about the extent to which they:

- 'Work in and away from the classroom
- Lead whole classes.
- Provide pastoral support to pupils.
- Perform non-teaching [administrative] tasks...
- Prepare for/deliver and/or assess work for intervention or booster sessions
- Meet with teachers to plan and prepare

- Meet/liaise with outside agencies'. [In the case of supporting students with dyslexia, this might include consultation with specialist dyslexia advisory teachers or education psychologists]. [42:21]

At the classroom level, TAs should explain the extent to which they:

- 'worked with pupils on a one-to-one basis or with groups of pupils
- worked with higher-, average- and lower-attaining pupils and those with SEN
- roved (walked around) the classroom, perhaps in a monitoring role
- led or addressed the [whole] class
- did other... [administrative]... tasks
- listened to the teacher teach (e.g. were part of the class audience)' [42:25]

The EDTA [41] team found it useful to get TAs to keep 'work diaries' to monitor the time they spent on these various tasks and this would form useful 'hard data' for any audit as a basis for action. In parallel to this, questionnaires could be sent out to teachers to examine the nature of their collaborative work with TAs.

In addition to gathering this data, Russell et al [42] suggest that focus groups of teachers or TAs be established to reflect upon their working practices together and to 'compare notes'. It is suggested that these are convened without SLT presence to help allow for open discussion and to minimise feelings of being appraised/judged.

Complimentary to these sources of data, the DISS and EDTA [41] projects made use of extensive observations of TAs both in and out of the classroom, noticing the ranges of duties that they were carrying out and how and with whom they were working, including with which individuals and/or groups of students they were spending the bulk of their time. Blatchford and Webster [49] nearly 10 years after the DISS project, found that students with SEND in mainstream schools were *still* spending more time interacting with TAs than either with their teachers or their peers.

These sources of data can then be triangulated together to gain a fuller picture of the deployment and practices of TAs within the school. In addition to these voices being heard in the audit, I would add that the voices of the students themselves should be heard. Even quite young children can be consulted on their feelings about TA support if the right elicitation methods are used. For example, Pinkard [50] used the Mosiac method of combining verbal interviews and visual stimuli to explore 10-11-year-olds with a variety of SENs' views of their TA support (discussed further below).

Finally, the audit should gather data on TA and teacher *preparedness* in working together. The data should include the extent of training that teachers and TAs have had in SEND and in inclusive pedagogy, TAs subject area knowledge and confidence in supporting those subjects whether teachers and TAs have had any training in how best to work together. With regard to working with teachers to support students with dyslexia, Preen [9] and Griffiths and Kelly [46] gained insights on TAs' views on their preparedness and the challenges of collaborative practice (discussed in more detail later in this chapter), which have important implications for whole-school staff development.

It is clear, then, that developing smarter joint working practices with TAs to support the diversity of students, including those with dyslexia, needs to be based upon a full picture of what is currently happening and what the stakeholders all feel about this state of affairs. The TA audit is a vital tool in this process. Recently the National Association for Special Educational Needs (NASEN) has developed a useful simple guide to developing and conducting a whole-school review of TA deployment, including a series of review templates auditing all aspects of practice [51].

6.3 Smarter deployment of TAs and teachers for a dyslexia-friendly school

Having conducted the TA audit, and action plan for school improvement needs to be drawn up. As the EDTA, EEF and DSP findings have indicated, the smarter deployment of TAs to promote inclusive joint working in a dyslexia-friendly environment needs to be action-planned *at the whole school level* [41, 43, 44]. As Russell et al [42] point out, a clear vision of what the effective deployment of TAs should look like is the necessary precursor to decisions around their preparation for their roles and the practices that they need to develop.

We will look at the deployment of TAs to support dyslexic students out of class in structured literacy interventions a little later, but the key overriding principle in considering the deployment of TAs in the dyslexia-friendly mainstream classroom is that the DISS research has taught us that just attaching a TA to the students with SEND, including dyslexia is not the most effective or fair way to proceed [16]. As Giangreco [32] reminds us, using the lens of the Social Model of Disability, the student with SEND has as much right to teacher time as any other student. The EDTA research [41] and EEF review [43] further show, where teachers can work more directly with students with SEND including those with dyslexia, they gain more understanding of those students' strengths and challenges and gain confidence in developing their inclusive pedagogy. This issue has been explored by Pinkard [50], whose interviews with students with SEND reflected their keen awareness of their reduced contact time with the class teacher where a TA was being deployed. Furthermore, in my own experience of working with dyslexic students in secondary school classes, many older students feel acutely uncomfortable and self-conscious with a TA 'velcroed' to their elbow.

The more effective deployment of TAs in the classroom should follow a 'team teaching' model, where teacher and TA work closely together and the time where the TA merely sits listening to the teacher is minimised. The EEF research suggests that where the teacher is introducing a topic, the TA might be taking some notes onto the class whiteboard. They might be developing a list of key words and terms for the lesson, for example, or they might be noting student suggestions and answers to the teacher's questions.

The teacher and TA might identify different groups within the class and could take turns, on different days to work with different groups. Blatchford and Webster [49] further suggest that these groups should, where possible, be mixed- ability, which seems to offer better opportunities for students to interact with a wider range of peers and also for students to be able to get help from peers where needed, for example for a dyslexia student, remembering new key words, discriminating similar sounding key words (e.g. implode/explode) or just checking the spelling of a word. The mixing of groups also means that teachers and TAs are more likely to share out a 'roving' role around the whole class.

The policy for the deployment of TAs, moving them away from just supporting students with SEND needs to be, noted earlier, a whole-school policy and applied consistently, directed at SLT level.

Russell et al [42] suggest that strategic models for deployment can be based upon linking TAs to a particular class or year group (often favoured at primary school, or early in secondary school, in my experience) or linked to subject departments (often favoured in secondary schools). Auditing the TAs' skills, interests and experience can often offer useful guidance as to where they might be most effective, for example, a TA with good Mathematics skills or a TA skilled in working with younger pupils. One additional role for the deployment of TAs in a dyslexia-friendly school might also be in a non-teaching, but pastoral role. The challenges of mainstream schooling for students with dyslexia can have social and emotional consequences for some students who struggle [52]. As part of dyslexia-friendly school provision, therefore, access for the students to counselling support and a staff member to advocate for them can be crucial. Whilst clinical counselling support may better be left to professionals, TAs can play a key role as a listener and offer to advocate for the students about their learning needs and to teach them self-advocacy skills [53]. They can also act as a point of liaison between the school and home [42]. Gaining dyslexic students' and their parents' viewpoints on their education is a key element in the processes of dyslexia-friendly schooling and the pastoral TA can play a vital role here [44].

This change of philosophy in the deployment of TAs involves a change in schools', teachers' and TAs' mindsets, and cultural change can be hard to achieve. These changes will need time to really bed in. In the case of teachers working with those TAs that have had some SEND training, this can often be rooted in what Giangreco [54] has called 'the training trap', where teachers just assume that the specialist TA has got to be the automatic first choice to work with 'those sorts of students'. This training trap was noted as a particularly strong phenomenon in my own research interviewing dyslexia-specialist TAs about their roles [46], which we termed 'the paradox of the expert'. The aim should be the sharing of skills and knowledge, between teachers and TAs, which is a two-way process. These changes may well have also to be explained clearly to the parents/guardians of students with SEND, including dyslexia, who have an Education, Health and Care Plan (EHCP) which might indicate a certain level of hours of in-class support. The message is that that level of support is still there but delivered in a slightly different way and that involves more direct contact time with the teacher, who will therefore get to know their child's strengths and challenges much better so that they can teach them better.

6.4 The Preparedness for TAs and teachers to work together for a dyslexia-friendly school

It is clear from the foregoing discussion that staff will need training for more effective teacher/TA joint working to develop more dyslexia-friendly practices. Once again, the Social Model reminds us that the potentially disabling environment for dyslexic students is what needs to be changed for their rights to access the curriculum. This is echoed in the 2015 SENDCoP [7], which insists that 'reasonable adjustments' to teaching need to be made to facilitate this access. This, in turn, means a whole school-approach to training and preparation for staff. Griffiths and Kelly [44] found that for a dyslexia-friendly school to be achieved, this meant that dyslexia-friendly cultures policies and practices were backed by SLT as 'non-negotiables' with staff. For this to be realised in the classroom, both teachers and TAs need dyslexia awareness training, which includes input on the nature of dyslexia, the challenges that this can present for dyslexic learners, as well as classroom resources and strategies that help support them. They also need to understand that, with neurodiversity, these needs will not always

be identical. TAs interviewed by Preen [9] noted that such knowledge, skills and understanding were lacking for them but that there was a real appetite for this kind of professional development. Therefore, all staff should be given mandatory training and support in their development, which also means identifying targets for improving their practice and monitoring and mentoring to achieve these aims (perhaps with more of this for less confident staff members). This might involve a senior teacher or perhaps a local authority dyslexia specialist teacher/advisor. They might also have opportunities to shadow and observe skilled practitioners at work in the classroom. This training should also prepare teachers and TAs in identifying where access arrangements may be needed in tests and examinations for dyslexic students, for example, student access to a reader and or scribe or use of a word processor, plus extra time and how to provide this support competently and fairly. This should also involve hearing students' own opinions and preferences about their access to support [55].

Teachers and their TAs need to have joint planning time built into their timetables. This may come at a small financial cost for extra TA timetable hours, but the EDTA researchers [41] found this to be one of the lynchpins of effective practice. Teachers and TAs may also benefit from specific training on joint working practices. TAs need to know the lesson learning objectives and how they will be deployed during the different activities. This could be indicated on the written plan for the lesson.

6.5 Developing dyslexia-friendly joint practice for teachers and TAs

As well as changing the ways that teachers and TAs are deployed in the classroom, both the DISS and EDTA projects noted the dangers of fostering student dependency on TA support in class [16, 41]. Russell et al have argued that many TAs feel under pressure to show their effectiveness by focussing on task completion rather than fostering understanding and this often leads to them spoon-feeding answers to pupils and, in my experience, even completing tasks for them! The EDTA [41] and EEF findings reflect the need for staff to be focussing on developing students as independent learners and this is often a challenge for dyslexic students.

In a review of teaching and learning in dyslexia, Reid [56] noted key among challenges for dyslexic students are issues of accessing text, working memory in retention of learning (particularly information only presented via the auditory channel), organising and completing extended writing tasks and, linked to that, sequencing skills.

In order to facilitate a more independent dyslexic learner, therefore, teachers and TAs need to be designing and teaching lessons that can help students minimise or circumvent these issues. There is much professional literature that goes into some depth about developing a dyslexia-friendly leaning environment [e.g. 56, 57]. Whilst the scope of this chapter limits what can be covered in this regard, findings from four case studies of dyslexia-friendly schools and colleges found the following strategies and resources to lie at the heart of dyslexia-friendly teaching [44]:

- access to training about the nature of dyslexia and how to support students with dyslexia in the classroom;
- access to training about the nature of dyslexia and how to support students with dyslexia in the classroom;
- access to ongoing advice and support from a mentor with specialist knowledge, including team teaching opportunities;

- access to peer support through peer observation and through sharing examples of dyslexia-friendly strategies and resources;

- a commitment to using multisensory techniques and resources in teaching and learning across the curriculum;

- use of ICT, including iPads and apps, to enhance teaching and learning across the curriculum; opportunities for students to use alternative recording strategies to demonstrate their knowledge, skills, and understanding (e.g. using mind maps, audio recording, role play, etc.); a consistent school /college-wide approach to developing study skills;

- linked to this, a fostering of students' metacognition about their own learning habits;

- supporting weaker working memory in dyslexic students (e.g. in the use of pictures to support verbal instructions)

- fostering student feedback on their learning tasks;

- supporting dyslexic students' sequencing and organisational skills (e.g. breaking down tasks into smaller sequences of steps);

- consideration of the use of text in teaching: minimising overload, considering text layout, supporting text with pictures;

- support with extended writing tasks (e.g. use of writing frames, sentence starters, etc);

- use of the classroom's physical environment as a teaching and learning tool (e.g. the development of 'learning walls');

- extensive use of group work to foster cooperative learning (e.g. use of Kagan sets activities);

- maintaining an awareness of the emotional climate in the classroom and support for students to recognise and manage their emotional states. [44:6-7]

Now, this might seem like a huge challenge for teachers and TAs in differentiating lessons for dyslexic students, but in fact, those schools and colleges found that nearly all students in their classes benefitted from the listed approaches and that individual students might use different elements of this support as they felt they needed them. This echoes the findings of the *Teaching for Neurodiversity* project [45], where teachers were experimenting with 'teaching beyond labels' and finding that students with dyslexia felt less singled out and thus self-conscious. It also offers support to the notions of individual neurodiverse variation across the dyslexic population.

These approaches also fit well with the philosophy of Universal Design for Learning (UDL), which is based upon the idea that all learners are unique and that they can benefit from choosing from a wide range of available ways to present

learning material, ways to engage with learning tasks and ways of recording and demonstrating their new learning [58].

In summary, dyslexia-friendly teaching is generally inclusive teaching for all learners. Teachers and TAs both need to get familiar with these approaches and gradually to build them into their lesson planning, whilst helping students to make choices that will help them access learning independently.

6.6 Teacher-TA joint support for individual dyslexia structured intervention programmes

Some dyslexic students may be withdrawn from lessons to follow the small group or individual structured intervention programmes to develop literacy skills. These programmes are usually based around a structured, cumulative strand of phonics, supplemented by working memory training, punctuation work and sight vocabulary work [59]. Griffiths and Kelly [46], interviewing specialist-trained TAs delivering these programmes, found that students were usually engaged with these programmes but that the teachers and TAs in the mainstream classroom were often ignorant of the contents of the out-of-class sessions and were, therefore, not well-placed to help reinforce this new learning in the mainstream lesson. The solutions to this problem could lie in teachers and TAs observing these lessons in action, having a copy of the students' schemes of work, with regular updates as to which elements students were currently tackling to build reinforcement opportunities into their lesson-planning. For this, liaison with the specialist TA should be organised regularly. In secondary school this would be with the student's English teacher which, the research indicated, seemed to work well. These intervention programmes also need regular monitoring in terms of whether the TA is teaching all the required elements appropriately (programme fidelity) and whether the student is actually achieving measurably better as a result.

7. Conclusions

In conclusion, the key message is that teachers are responsible for the learning of *all* students in their class. The Social Model of Disability frames this as a *rights* question: it is neither fair nor effective to simply leave certain students identified with 'special needs' to be supported by TAs with limited access to their teachers [32]. New teacher/TA joint working and team-teaching approaches need to be adopted, not only to enhance all students' right to access to their teacher, which is key to enhancing their progress but also for teachers and TAs to develop their range of knowledge, understanding of and skills in dyslexia-friendly practice, which also recognises how these relate to the neurodiversity of *all* the students in their classes. A whole-school approach, which sets out the non-negotiables, needs also to support teachers and TAs in undertaking this journey.

Nomenclature

TA	Teaching Assistant
LSAs	Learning Support Assistants
LSS	Learning Support Staff
LSW	Learning Support Workers
CAs	Classroom Assistants

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Chapter 6

"One Day, Will This be also My Land Where I Belong?": A Narrative Participative Study with a Young Woman's Experiences of Reading and Writing Development, Having Severe Speech and Physical Impairment

Andrea Atterström and Louisa Atterström

Abstract

The backdrop to this project is earlier studies showing a plateau in children's, with severe speech and physical impairment (SSPI), literacy learning at beginner's phases. The study has a transformative, participatory, and inclusive research approach. Research questions focus on what contributed the most to continued lifelong literacy development, according to existing research, and a young woman's narrative. Her chosen significant experiences and processes were investigated through a narrative inquiry in an e-mail dialog. A contextual case-based analysis was made by the first author with member checking with the participant/co-author. Findings are the importance of lifelong identity building, functional assistive technology at school and home, communicative relationships, creative expressions and long-term hopes, goals, and dreams. Conclusions for literacy learning struggles and possibilities of inclusive educational adaptations are discussed and at last, there are recommendations for future research.

Keywords: severe speech and physical impairment (SSPI), augmentative and alternative communication (AAC), literacy, reading, writing, participative, inclusive, transformative, capability approach

1. Introduction

Having severe speech and physical impairment (henceforth SSPI) involves you need reading and writing skills more than so-called able-bodied because by means of an alphabetic code communication and learning possibilities open. Furthermore, at present, the digital world offers any literate person new possibilities [1], especially

with augmentative and alternative communication (AAC henceforth) via high-tech devices [2]. Through personal empowerment and self-advocacy, you can become an active member of society, and via inter- and intrapersonal communication, intellectual, emotional, social, and vocational development becomes reality [3]. "Providing effective instruction in literacy skills is truly the single most important step in empowering individuals with AAC needs to meet their personal goals and attain their full potential" according to a source in [4]. This quotation stands for nowadays even more than when it was written 30 years ago.

Nevertheless, few students challenged with SSPI learn to read at all; even fewer progress beyond beginner skills according to a longitudinal study with children 6, 9, and 12 years old [5]. Children's positive literacy development stopped after the first 3 years, and a decrease in IQ points was also found at 12.

1.1 Preschool

The child's first learning community outside the family is the preschool learning environment. Children's emergent and early phases of literacy learning need to be well-supported from the very start. Research shows nevertheless that already preschoolers (with SSPI) have fallen behind [6]. Struggling literacy learners (with SSPI) confront different environmental and intrinsic obstacles in the process of learning to read and write [5, 7–9].

1.2 Low expectations

Several studies show educators', augmentative and alternative communication-AAC experts' and parents' lack of confidence in literacy success for these students, which can lead to a small proportion of classroom time dedicated to literacy activities [5, 9–14]. How do teachers support children to build expectations of literacy learning in environments that do not believe in nor value their achievements in reading and writing? The negative spiral, which is initiated by ability factors and sustained by avoiding tasks [15], can eventually lead to a self-fulfilling prophecy [16]. No struggling reader makes progress while waiting for readiness factors to appear [15].

1.3 Intersecting ability

About intersectionality and student outcomes Grant and Zwier [17] found that the intersection of ability is understudied. Students intertwining identity axes are basic features for the increase of equity in learning environments. Few studies including children with disabilities are presented in two developmental journals since 1996 [18]. One found reason is that children having a disability seldom are included in studies concerning other issues than the disability, for example literacy. If the argument of the researchers was a 'normal' population, were children scoring IQ over 130 then consequently also excluded? In the USA 15% have a disability, why studies with a realistic population view include everyone [ibid].

Norton and De Costa [19] emphasize the learner's experiences in an unequal social world. Therefore, they ask us, researchers to take into account the following interrelated three decisive questions:

- Which are under-researched social categories?

- To enhance the understanding of the mutual relations learner-teacher-social context, what research is adequate?

- Which research populations need deeper analysis?

This current project aims at taking on those three challenges, with a marginalized group in the field of both disability and learning, namely young people having severe speech and physical impairment, who are engaged in a narrative dialogical inquiry about own experiences of continuing development of their reading and writing. Romero [20] guides us in creating these decentering interactions and practices in pedagogical spaces. In her study with focus groups, she used self-reflexivity in dialogic and multiperspectival ways, in search of potentially productive spaces in the forgotten, overlooked, and absent forms of expression. She also emphasizes using intersectionality-like thinking [21] to open these complex interrelated meanings of multiple forms of diversified expression. The last advice in relation to this, is to continue interrogating identity and language relationships in the classroom, as students tend to avoid decentering and looking at the margins.

2. Aim and methods

A literature review, focused on the findings on children's (with SSPI) struggling development of reading and writing, was combined with a narrative participative inquiry via an e-mail dialog. A contextual case-based analysis was made by the first author with a member checking the narrative's interpretation with the participant/co-author.

Another aim was moving subjects from the margins to the center, listening to the learners' own experiences of learning to read and write, in this case listening to "voices of the students with SSPI" ([13], p. 41). Grounded in this citation from an earlier case study's participant Emil: "I think it's a very good idea of yours to want to know more about how I read and write." ([14], p. 25).

A decisive point of concern since earlier experiences [14] was that the participant's investment of time and energy was counted to be more rewarding than exhausting. Therefore, the method of writing via e-mail was seen to best meet the individual accommodations and continuous readjustments. An important analytical bias to have in mind is 'the privileging of orality' in communication studies ([22], p. 54).

3. Findings in the literature and narrative

3.1 Time on task

A study shows only 10% of the students challenged with SSPI chose a literacy activity during the school day [23]. In two other groups of children (those with intellectual disabilities and those without any disability), 50 and 72% of children respectively chose literacy activities daily. Concerning reading on your own every day the figures for the groups were 3, 40, and 39% respectively (ibid). The need for larger quantity of instruction and learning possibilities is evident. "At a minimum, students who use AAC may benefit from the same proportion of activities in each of the literacy categories" ([24], p. 32).

Attitudes towards the learner are significant for both the quantity and quality of the literacy team's instruction. A survey of special education teachers' opinions related to literacy instruction for children with severe disabilities using AAC, concluded the need for preservice and in-service training to develop teachers' attitudes towards seeing potential capabilities and raise expectations [12]. Another study addressed the speech and language therapist's perceived preparedness and attitudes and presented generally negative opinions about teaching literacy skills to augmented speakers [10].

3.2 Content-curricula

Studies indicate that all efficient literacy education needs an integrated balanced approach with combinations of more authentic and skills-based literacy activities, for our challenged group as for everyone else [24–27]. As for nondisabled children, important predictors of literacy development are shown to be phonological skills and working memory [9, 28].

A 6-weeks intervention study with an integrated approach of word identification and AAC instruction selected three participants out of the eight who met the criteria for the study [29]. When communicating with his/her speech generating device - SGD henceforth, the person is at the same time practicing reading frequent words. This makes the print processing speed increase. The participants worked with 75 digital lessons of the program "Literacy through Unity Study". All made progress with the identification and generation of words and developmental spelling, as well as expressive communication.

3.3 Transparent orthographies

Our context of Swedish-"speaking" learners using AAC, leads us to explore possible similarities and differences to learn from the studies with predominantly English-speaking literacy learners. To support the transference of knowledge, Erickson and Sachse [30] describe the literacy learning process of Seymour [31] as a base for comparisons, and its implications for German and English learners. This theoretical framework consists of four phases:

0: letter-sound knowledge.

1: foundation literacy.

2: orthographic literacy.

3: morphographic literacy.

Phases 0 and 1 can be easier for literacy learners in more transparent languages. Phase 2 could be more natural to deep orthography languages (like English) because you already employ a lexical-logographic reading strategy instead of alphabetic coding. English studies focusing on the last two phases were however not identified in this project. There were German studies on writing alone that show morpheme-based instructional approaches had a positive impact [Walter, Schliebe and Barzen, 2007 source in 30], and combined with reading [Kargl, Purgstaller, Weiss and Fink, 2008 source in 30].

3.4 Internal speech

To process phonologically when reading, nonvocal people use internal/silent speech. On the way to learn to use your internal speech, the first step is to make the students aware of their inner voice through encouraging them to "say it in your head", and, for example, singing songs with subvocal letter naming [32]. The second step when awareness is present, is reading meaningful texts to practice using inner speech. Here practicing "subvocalizing" with the three steps of the nonverbal reading approach – NRA – could be another way [33]. In an intervention study teaching students to use their internal speech, four students learned to use a three-step decoding strategy [34]. Any possible vocalization was encouraged for checking active participation. If vocalization was impossible personally chosen motor indicators could substitute the voice. These also had the role of reminding the student of the different steps in the decoding process. Six months after intervention all four participants had been observed using the strategy independently when encountering unfamiliar words in texts. Another study that shows the importance of developing internal speech, showed different results on a visual rhyming task for children with CCN and children with typical development [35]. Results on the other eight tasks (which included verbal support on phonological awareness) did not differ between groups though.

3.5 Computer-assisted literacy learning

With the accessibility to computers, assistive technology, and the digital revolution of the last decades, the possibilities for literacy learning are expanding. Synthetic speech is a support in literacy learning for the students with SSPI [6, 35]. The study as described above [29], successfully used computer-assisted instruction – CAI. In another study, the nonverbal reading approach – NRA was combined with CAI [36]. All three participants made progress in word identification. Working with individually designed PowerPoint (PPT) slides, students were able to repeat word exercises independently and teachers could use their instructional time more effectively. NRA can be used both for shorter individual words and dividing longer words into parts and decoding them, and PPT is available and easy to handle. The study showed that the reliability of technology is an important issue though. Another visual issue, in combination with computers, is the result of a case study on spelling [37]: Their participant preferred visual print feedback, which might indicate a stronger visual learning focus in general.

With the last decade's growth of internet's social media and speech generating devices-SGDs, through the implementation of high-technology AAC systems literacy and communication have become a focus. Myers suggests that literacy and "technology skills" ([26], p. 274) should be integrated. Her four participating students could all work independently on the computer with more targets after intervention. For example, the students wrote a newsletter to their parents about the topic of the week. "By using the capabilities of AAC devices, the literacy skills of both the user and the people with whom he or she communicates can be effectively and functionally developed." ([38], p. 171).

3.6 Formative assessment

Every student needs to receive instruction in relation to his or her current abilities [39]. Teachers need to know their students' individual proximal zone of development in their literacy learning, to be able to help them. Unless the surrounding classroom

environment also is assessed and changed, the education and students´ formative assessments cannot be successful. Malmqvist puts it in these words:" The pupils' results must obviously be related to given educational conditions as well as their individual prerequisites." ([40], p. 47). The study found difficulties in getting students to participate in tests. The teachers argued that the test situation could be a negative experience for the students or that the student "was not able to participate" [ibid, p. 15]. We are here reminded of the documented low expectations (see above Section 1.2). It is important to offer" repeated authentic literacy learning opportunities for all students, "as learning takes a different amount of time for everyone ([24], p. 33). Maximizing time dedicated to learning and intensive individualized instructions in areas of critical skills are necessary, the same authors continue.

Altogether, a profile of the student's educational literacy capabilities, emerges. The teacher can then balance instruction and direct quantity and quality of the teaching. Ferreira [7] seeks the area of greatest instructional need. This area receives the instructional emphasis and is addressed by the most highly qualified personnel available at the school. The educational implications for learning, show instruction with others is important [40], as in all three studies pupils were educated by their school assistant (para-professional aid) outside the classroom. Finally, also Erickson and Sachse emphasize the need to address the complexity of literacy learning as for example relationships in the classroom and the trust in children's skills [30].

3.7 Learners' own voices

Most of the existing studies lack the learners' own voices. Only Myers [26] and Swinehart-Jones & Heller [34] asked for the participating children's own reflections: Myers' participants in an intervention study with an integrated approach to literacy, communication, and language, changed opinions after 4 weeks when re-answering the same questions. After intervention they said that: they did not like their parents to answer in their place, they liked reading books on their own and they liked creating stories and seeing them in print. Changes in the students' own perceptions of themselves as readers and writers were shown after only 4 weeks. The peers' role modeling was also reported as an important factor.

In a study about Nonverbal Reading Approach-NRA both students and teachers agreed on the following evaluation ([34], p. 141):

> *"Students with severe speech and physical disabilities can learn to read."*
>
> *"The NRA is easy to use."*
>
> *"Internal speech helps decoding."*
>
> *One participant wrote: "Finally, someone knows a way to teach me to read."*

3.8 Narrative about my literacy learning, by Louisa, 20, with SSPI

Here are the findings about what Louisa experienced as the most important contributing aspects to her reading and writing development. These are intertwined in the narrative and therefore, presented in chronological order. The narrative's found themes were lifelong identity building, functional assistive technology at school and home, communicative relations, creative expressions and long-term hopes, goals, and dreams.

"During my entire childhood, I always attended the closest local preschool in my living area, and later the nearest elementary school, as my playmates and neighbours of the same age attended. My parents chose this, opposite the advice from health service providers at the hospital. I started preschool at 10 months in an integrated class with children up to 5 years of age. After one term I got my own (pre)school aid who supported my needs, and the older children also took good care of us younger ones. My parents have told me that when they came in the afternoon, they often found me on the sofa reading a book with the 5-year-olds. At this preschool the teachers also used signing as a child with Down's syndrome was in the class before I started. During my childhood, I did not look upon myself as disabled. I always played with my peers, using walkers both inside and outside. My school aid also supported me in the play. There and then my self-identity started to be created. An identity that was not disabled.

My first augmentative and alternative communication (AAC) tool was home-made pictures organized in thematic topics. Soon I got a picture communication symbols- PCS-board from my speech and language therapist (SLP). This picture and symbol based AAC tool was very limiting and frustrating for me. I eye pointed or used a head laser pointer. The communication board was 5 paged with around 200 PCS-pictures, with the alphabet and numbers on the first, then pronouns, verbs, adjectives, and nouns. My mother tongue or first language was also "Louisian" which meant lots of nonverbal expressions, such as movements of eyebrows, mouth and lips, eye gazing, over all face mimic and muscle tone and voluntary movements in all my body. I started to learn to read and write, but I did not realize then that it would be the key to my whole life. In the rear mirror, I now understand that some important persons in my life predicted or at least hoped for this early on. When I started learning initial sounds of words, it helped a lot to avoid misunderstandings and speed up communication.

At 5 years of age, my therapists wanted me to start learning Bliss. My parents then asked who would teach me, and the answer was them. Due to their being unqualified at that language and as I was already gripping many sounds and letters, they chose to wait and start Bliss later if the alphabetic reading and writing would fail. Bliss is picture based and not like Swedish phonological. I also got a head mouse as steering assistive technology (AT), which still is my best friend, and a special sounding qwerty. Now I could explore the letters and sounds better on my own. Before I used a large single button to push "enter" at the computer, and someone else steered the mouse to where I eye gazed. I played lots of learning games this way but now I could play by myself! When I started to learn to write on the computer and eye gaze at the alphabet board, communication became so much smoother. Especially, easier for the communication partner, and less frustrating for me.

During my six preschool years, I had many different school aids. Some were good and some were less professional. Even then it was important for me that they kept in the background and only interpreted whenever I said something. Some aids did not understand this interpretive role, and instead took too much attention and space. I remember one incident at a school assembly in the hall. We met once a month the whole school and I loved to sing together. I was seated with help on the floor with my class, the aid supporting me from behind. That day I got so irritated when my aid also sang along, because I felt the assistant was not there "in person." I did not want an extra person behind me. Therefore, I told the aid to stop singing. She got angry with me and said that everyone could sing along at the assembly. All the teachers agreed too. When my grandmother came to pick me up that afternoon the aid told her about what happened and my behaviour. My grandmother agreed as well and confirmed

their point of view. Nobody asked me about my perspective or my feelings and experiences. Nobody bothered to understand why I said as I said. Looking back, I see this was an important experience for my development with assistance. Still, until this day, it hurts to think that nobody confirmed or was able to see it from my perspective. I will probably never forget this experience. It felt like abuse. Today, I lecture at teacher programs in inclusive education, to contribute to better comprehension and self-critical reflection. Teachers need to learn to listen better, even to children without oral speech. My goal is to contribute to developing tools to reinforce and empower young children's identity development during the pre- and elementary school years.

When I was a child, I never saw my limits. I felt just like any ordinary kid! My personal assistant (PA) or school aid, and different supporting equipment were all just parts of myself and my body. Now in retrospect, I understand how important it was for me to think like that, for my future self-image and identity building. I believe it was my mother who gave me that view of myself and always kept supporting me keeping that confidence. Accepting me made me a whole Louisa, a whole human being. My person is whole and includes all equipment and assistants. A person with strong identity and integrity, might be the most important of all.

Starting elementary school at seven was a smooth transition as I was in an integrated pre-and elementary school with kids aged 4–10 in the same group. We all knew each other and the teachers very well already in the past 2 years. Every day I chose a book (easy to read for beginners) from the classroom library to take home and read. On the computer, I used a program called Clicker to write and listen to my texts. I loved to create stories and make pictures in the program Paint. The impossibility to draw and paint was the reason I did not change to eye tracking when it was introduced to me later.

One of the most important things was, when I received my first speech computer at eight. A couple of years before we had found it at a national disability fair. When I finally got hold of it, to my huge disappointment it could just whisper… Many months passed until it was fixed, so we did not get a good start. Even when it came back mended, I did not use it very much, as I had the best assistance team of my life. I spoke with the alphabet board we both knew by heart, so it was faster than using the computer. My PA always used "I" when interpreting me, so they were my voice. A functioning personal assistant being my voice, my hands, and my feet.

Transition to another nearby school was inevitable at ten. We were fighting a lot for my rights, but the reception and inclusivity were not working. Finally, I ended up restudying year four instead of moving to a special unit for motor disabled in the nearest town. The new teacher and class were great, and we had 3 years together. Here, I finally learnt to read more fluently and could watch tv with subtexts. Words with consonant combinations were and still are a struggle. I also learnt to write in my other first language Spanish (because my father is Spanish speaking) and English. It was still more difficult because I could not receive the same word prediction programs as in Swedish, due to economical restrictions in the health habilitation services. Finally, my school bought them to me. So, when going abroad or just talking with people in these languages I had to bring my school computer instead of or combined with the smaller speech generating device-SGD for only Swedish.

Later junior high school proved to be a challenge, nevertheless, they made some adaptions for example with a home classroom. Additionally, for the first time I did not have a paraprofessional aid, but a qualified resource teacher. She helped me a lot in preparing new vocabulary word banks on my school computer for each subject, in collaboration with the different teachers. I started using text-to-speech synthesis- TTS for reading longer texts. I also got personal assistance during schooldays for the first

time. The last year though, I was harassed and exposed to many evil stares every day. I felt like their eyes wanted to kill me. The school principal talked to them, and they explained it was a misunderstanding, so nothing changed. I was crying myself to sleep every night, had difficulties sleeping at all, and even was offered sleeping meds by my doctor. I thought about never going to school again, not even continuing the next year at a senior high school. My mother tried to comfort me and pepped me to go back every morning, saying "each day you show up at school you win, and you show them they cannot break you." Two other things which helped me through these worst months were my favourite artist Pernilla Andersson inviting me to her Christmas concert, and then also talking to Allan Linnér – the radio psychologist on Swedish national public broadcasting. We used to listen every week to his conversations, so it felt natural to turn to him. I wrote to the program and got the chance to speak with him about my situation for 2 hours. He told me it was the first time he talked to someone using TTS, so he felt very nervous! The program itself was 30 minutes [41]. He helped me a lot and I got more than 700 empowering commentaries and mails afterward. We also had a follow-up program when I had changed to a new senior high school [42].

Senior high school was like heaven. My teacher from junior high school continued to work with me, and the PA too. I chose to study esthetical program with gaming graphics. I wanted to create more inclusive computer games with disability issues. I still love creating pictures on my computer. Three things helped me with regaining my self-confidence these years. Firstly, I got a new PA who was very professional and made me trust myself again and hold my ground. So, I started to form and make the PA exactly my own way. Thanks to my writing ability I lead my personal assistance all by myself. Secondly, I got my first job during summer preparing a material for developing the competence of PAs at my cooperative. I had already started to question, how my PAs were treating me and how the environment treated us. Thirdly, as it is difficult for me to study abroad, we have had exchange students in our home from different countries. I was skeptical at first but changed my mind. It was one of the best things ever! My host sister was completely natural towards me and did never turn to my PA. When we sat together on the bus to school and chatted the entire bus stared and wondered how on earth she could sit there next to me day after day... It was fun to shock everyone! Can you talk to that girl in the wheelchair? Now we keep in contact and have been visiting each other's families several times. Due to being at high risk for Covid-19, not lately though. These three things helped me develop my identity as human being and personal assistance user. If the PA follows my instructions and keeps quiet in the background, he/she is often seen as rude by the surrounding people. But according to me the PA only is doing the job correctly and professionally. I do not want a commentator in my life. The PA knows not to be personal at work. This is seldom understood and even more difficult to develop nowadays as fewer are interested in working as a PA.

Writing poems have been a way for me to handle life and get the power to continue living, even when life is not treating me humanly. Like when a PA quits and I must find a new, and I get again dependent on my family for some weeks. It is hard to be over 20 and still need your family totally to survive. At the same time, we must accept facts and reality. This poem was written to manage frustration:

As an active volcano

Everything can happen in a minute.

Everything can change in a second.

It is like living on top of an active volcano.

Having an outburst.

Whenever.

No safety.

No trust.

No calm.

I rewrite many times, reading and listening to the written through TTS. I also use spelling correction and before I publish let someone read and correct the text. Another of my poems is published in a Spanish writer's book [43].

Creative expressions such as lyrics and music play important roles in my life. When I was a child, I sang in the church children's choir with my best friends. I have always sung in my own way. I find lyrics fitting into my life. Just like "Let it go" by Pernilla Andersson [44]. It came truly as a gift the day my employer's office had told me I was unrealistic in my searches for a job and some private smaller problems: "Let them go, let them fall. You don't have to save them all." Even if it is difficult, you must accept this, to survive as a human being, I think. I have also played the drums since I was 12. I had always been making rhythms with my feet on different chairs on wheels. Practicing conductive education for all my life included singing and rhythmical intention. It helps my brain to coordinate and automatize movements easier. That is why rhythms are so natural to me, I guess. Now, 2022 when performing, I still find stages not adapted to wheelchairs, so I also find it important to fight for future generations rights to perform and play music.

Some years ago, I took part in an art project about 'challenging the urban norm.' I made photos with my pony, rabbits, and cats in the forest to show it is possible to have relations with animals and nature even using wheelchairs and personal assistance. The photos were in exhibitions around my region Västra Götaland and I also produced a photo book for children as my final high school work [45]. My intention was to show children photos of a person and her pets, and later discover the wheelchairs hidden under a patch you can fold up. When I was a child there were no picture books representing children with mobility devices. I think it is important both to children having a similar impairment and for more typically developed to get used to seeing different disabilities early in life. Picture books and tv-programs are good ways to contribute to a more open and inclusive world in equity. The UR, Swedish education public service, made a tv-film about my life using text when I was 15. It is called "The word is mine – Louisa [46]." In the future I would like to write more books. Taking part in this literacy project was an important step. I have been involved before in a Swedish anthology about "positive special education" where parts of my life story can be found [47]. Few have expectations of me, but I have my own high expectations. We need to be a counter force to the dehumanization of persons with severe disabilities needing support from personal assistance all their lives. I wish to show children they are not alone and that their value and needs are equal all others.

Recently, I got a new speech generating device – SGD, a "Grid pad" with all three languages in one. The only thing to improve now is that the voices change, so when I speak, I have different voices depending on the language. In Swedish I chose the voice called Anna, in Spanish Inés and in English Kate. Over a decade ago there were only

two options – one female and one male, so things do improve. I am not sure if there are several voices of children to choose between though. In the future, I hope to sound the same regardless language, and to be able to express feelings with sounding for example happy, caring, sad, angry, firm, or insecure. Another thing is that I want my SGD to save words I use, now my PA must help to prepare new words in word banks, and it is not easy for them. Many has learnt Swedish as a new language.

I also hope there will be more recognition in society for us using other forms than oral speech as communication. When I speak it takes longer as I write what to say. Meanwhile many get unsecure at best, or just walk away not waiting for my answer at worst, depending on their silence tolerance. They might also turn to my PA, who then direct them back to me. Then they can get scared and walk away. Many suppose I cannot think, and then I want to show off and feel tense, and it takes even more time to write. Consequently, I love keeping conversations and relations on internet, where Facebook and messenger are the most accessible for me. I feel like anybody else; it is easier to chat there than face to face. I can relax and the friend does not have to wait for my answer. No PA risks interfering in our conversation either and it feels wonderful. Nobody else knows, it is only between me and my friend. There I can have my true private life. Thanks to my two other languages Spanish and English I can follow disability activists and organizations worldwide. I really feel like a part of a huge community where everyone understands each other!

My younger sister has always understood me best and fastest. We do not have to use the alphabet to understand each other. She is my everyday salvation and gives me strength to continue living in a world that does not see you as a human being. When she hugs me fare well in the morning, my day begins with a warmth and calm in my whole body. She reminds me of the fact that I also am a person, an ordinary person. I am allowed to be just her human sister! Therefore, my biggest dream is to become a mother one day. To be seen only as someone's loved mum, without focusing on a PA or equipment. Just being the person I am.

Participating in different projects about personal assistance, communication, literacy [47], and sexuality, have given me new experiences. Therefore, I also counsel teams with PA working with children. The question I pose to myself is to which extent we should let the child keep his/her dreams and confidence, even if I now know how society will look upon him/her and crush the individual. Is it better to let the child know his/her place in society right away? Do you tell a child with more typical development his/her dreams are unrealistic?

At last, for some years I participate in peer support meetings with my assistant cooperative STIL, a cornerstone in the independent living (IL) movement. In peer support meetings our PA wait outside the door, and we can discuss themes together exclusively for users of personal assistance. We have a leader among us who also have a PA, and we can ventilate our struggles and discriminating experiences on a regular basis. We live in a similar world and can understand each other better. We need to get together in our own world regularly to be able to continue listening to ourselves and stand our grounds, in a society who does the opposite. Then, inspired by singer/songwriter Sofia Jannok's lyrics 'This is my land' [48] I ask: One day, will this be also my land where I belong?"

4. Conclusions

There is consistent evidence for the need for environments throughout childhood and beyond that inspire the learner's further practice his or her literacy skills, on the

complex journey towards becoming a member in a greater (reading and writing) community. This evidence was found both in Louisa's narrative about her years of literacy development in preschool, elementary school, senior high school, and beyond, and in the literature (see further 'local understanding' and 'literate citizenship' [3]). The learning communities of preschool and school have these potential possibilities with long-term relationships between the child and his/her peers, teachers, and aids [49]. In summarizing, the importance of lifelong identity building, functional assistive technology at school and home, communicative relationships, creative expressions and long-term hopes, goals, and dreams, stand out in Louisa's narrative, as well as in the more participative studies [26, 34].

As preschool, at least in Sweden, is attended by most children, the emergent and early phases of literacy learning can be seen as general interventions. The flexibility of meeting the learners' individual needs might be more natural in age-integrated groups, which is emphasized by Louisa. She also describes the possibility of attending an extra year in the beginning of schooling. The Swedish Compulsory School legislation [50] gives students the right to two additional years of schooling, recognizing different learning trajectories within the compulsory school. Families of children with SSPI should be informed of this right, to achieve basic learning to read and write on an independent basis with the elementary school teachers' profound knowledge.

The learner's motivation for individual interventions can rise with perceived needs of, for example, spelling consonant clusters and achieving better reading fluency. An area of concern in both writing and reading Swedish, showed to be frequent multiple consonant combinations and clusters according to Louisa. Experiences from other participants suggest that in Swedish it is also critical to learn to analyze and divide long words into their prefix, suffix, and the root of the word [49]. These needs can be discovered through using whatever literacy skills the learner has reached in meaningful communication. The balancing act between acquiring skills and their improvement is a delicate question. The teachers' sensitivity towards and trust in their learners are important tools as Erickson and Sachse emphasize [30].

Providing digital equity and reliability of technology are two important issues easier met at school than at home. Important is to balance between individual computer-assisted instruction and more community-oriented instruction. Digital social media can break isolation and alienation, as Louisa gives examples of. Combining literacy and general curricula, learning and communication with high-tech SGDs (speech generating devices) and the internet is highlighted by many references. This might lead to taking responsibility in advocacy issues for yourself or/and in the disability movement as Louisa emphasizes.

To what extent are the results from the dominant research with English-augmented speakers transferable to literacy learning in more transparent languages? The assumptions are that using several strategies for decoding is more demanding for persons using English. Encoding and decoding develop in reciprocity in more transparent languages. Writing and reading are consequently inseparable. The first phases of literacy learning could be easier for students with more transparent languages, as discussed in [30]. Learning to "read" logographically is not a successful tool in a transparent language, sight word reading is seen as a tool of an emergent literacy phase. To impede the plateau in the literacy development at 9 years of age, their perseverance needs to be supported in different ways for example practicing internal speech, where NRA might be helpful as the learners evaluated [34] and could be used in other languages in adapted ways. If a transparent language is easier to read and write in the beginning, the corollary may be that the transition to morphological and orthographic phases gets more complicated.

Finally, documentation of success, even when seemingly very small and slow, gives the learners motivation and self-confidence, and fosters success [39]. There is no need to fear assessments, especially formative ones. With the mentioned results of speech and language pathologists-SLPs' and teachers' attitudes towards literacy learning, they might be the only ones fearing a documentation of assessment of literacy development (or lack of the same). In inclusive education, the literacy learning community strives for equity and affiliation with each other. Through celebrating differences as valuable, the community can develop a unity in diversity.

5. Future recommendations

At last future needs are discerned for investigating children with SSPI's literacy learning struggles, and possibilities of inclusive educational adaptations. Research from an educational view was scarce, why documenting the classroom's intertwined teaching, learning and interaction for and by these students and evaluating the results are urgent. A future study could be about the role of peers in reciprocal cooperative literacy learning in inclusive communities of learners with and without disabilities. For example, silence in the classroom is probably one important prerequisite for developing inner speech and silence tolerance. These questions need to be further explored together with reading and writing students with SSPI, their peers and teachers. The need for educational research was concluded by Malmqvist [40] two decades ago. Neither these nor other struggling readers learn through waiting for readiness factors to appear [15]. Research in the field of literacy learning after the beginning phases was even harder to find. Studies of inclusive literacy learning are few also in the transitional and emergent phases. Case and intervention studies of English-speaking students show an optimistic future. Comparative studies with even more transparent languages such as Finnish and Spanish are also important.

There is a need for more participatory and transformative studies in this area. Very few studies included perceived environment and personal experiences of literacy learners with SSPI. Encouraging the expression of and listening carefully to participants' (with severe disabilities) own experiences in the areas of learning to use internal speech in reading and synthetic speech in writing, would be helpful. In the future their voices need to be at the center of the research process using current information, communication, and assistive technology, and focusing on the third of Sen's human diversity areas – the ability to convert resources into valued functionings [51].

bell hooks [52] emphasizes the healing power of theory in addressing pain and ground a resistance struggle. She also points at the children's important ability to theorize without cultural biases, as "they do not see why we might not do things differently" [Eagleton in 52, p. 28]. In this case, a mass-based disability resistance struggle [52], includes for example researchers listening to children with severe disabilities even when very young and using AAC, integrating alphabetical print with digital equality [1, 53]. This is important because "Disabled people do have both knowledge and ways of knowing that are not available to the able-bodied" ([54], p. 348). To facilitate participation and give each participant optimal prerequisites, digital means can be explored such as on-line focus groups, writing "easy-to-read," adapted questionnaires, handling personal secretarial support, and combining verbal answers and pictures/photos.

Obviously, the informational base for evaluative judgments is important [55]. Depending on which approach is chosen, different information and evaluations are given. Sen deliberately refrains from setting out a list of core capabilities, as the

capabilities a person values are context-bound and changeable over time. Dignity and self-reliance, however, are personal characteristics of great importance in converting capabilities into valuable functionings, according to Sen [51]. Let us remember to emphasize the emphasis on literacy functionings because they are also instrumental in expanding other capabilities [55], especially when you do not use oral speech. Do multilingual augmented young speakers in different countries, contrary to Louisa, get support from the start nowadays [56]? Where are the conscious, intersectional, and more collaborative inclusive approaches towards in our case literacy learning, related to ability, gender, age, and language issues?

New questions have also risen about how and why power is clustered around some disability categories and not others, a question to study further and analyze both intersectionally and intrasectionally [19]. In a geopolitical space as Sweden with few millions of Swedish language speakers, which are the possibilities for organizations to support their populations in literacy learning? The heterogeneity within the small group of students with SSPI can further complicate research, and this in combination with the small population might make studies far from number one in funding. However, the increased quality of life once you acquire functional literacy skills is considerably higher. Students with SSPI will not learn to read and write unless thorough early interventions and ongoing continuous modifications of instruction are made. Is it reasonable to expect a student to succeed in something he or she does not even work on daily? Should a so-called developed country in year 2022 have analphabets with what we call "typical" average intelligence? The results could also be of interest for persons with traumatic brain injuries, stroke, and aphasia. Nevertheless, a recent review about research with disabled young people transitioning from child to adult, revealed that studies with persons having physical disabilities were rare. Neither participatory longitudinal studies with young having disabilities of any kind nor intersectional approaches were many [57]. If students with SSPI are to reach the goal of whatever literacy skills they can, further participative and transformative studies of their lives and education are necessary.

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Dyslexia is biological in origin, but environmental factors also play a role. It affects people differently, but typical difficulties include reading, writing, and spelling, limited working memory capacity, and difficulties with organization, sequencing, and concentration. Early identification is crucial so that learners can receive the support that they need. This book explores contemporary perspectives on dyslexia. It starts by outlining approaches to support dyslexic students drawn from the application of cognitive science. It moves on to consider treatments, the role of technology, and approaches for working with teaching assistants.

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