Chapter 7

Developing Automaticity in Children with Learning Disabilities: A Functional Perspective Part One: Theory and Assessment

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Additional information is available at the end of the chapter

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Abstract

The current chapter is the first of two chapters in this book to describe an instructional programme based on Luria's theories, which can be used to develop basic skills and automaticity in reading, as well as basic skills and automaticity in writing and spelling. This chapter focuses on the theory behind the programme and then describes how assessment is used to develop an individual programme relating to both basic skill and fluency needs in reading, writing and spelling. The process is illustrated with one detailed case study, in which instructional needs identified in the assessment process are linked to particular areas of the programme. The results of this child and other case studies are then presented in the second chapter, *Developing Automaticity in Children with Learning Disabilities: A Functional Perspective. Part Two: Programme Methods and Materials*, in which the results of children exposed to the programme are analysed to identify key implementation variables affecting the development of reading, writing and spelling fluency.

Keywords: reading difficulties, dyslexia, reading fluency, writing and spelling fluency, automaticity, rate of work, analytical phonics, large print, repeated reading, visual tracking, sequential spelling

1. Introduction

This is the first of two linked chapters, both published in this book, which describes a framework for working to develop automaticity in reading, writing and spelling, based on the work of Luria [1–3]. In this chapter, Luria's theories are outlined in relation to the broader literature on automaticity. This is followed by a case study of a child (Child 1) with difficulties in automaticity in reading, writing and spelling, which outlines the procedures used for assessment and development of his individual programme.

In the second chapter, this child's results are then presented, together with the results of 13 other children with learning difficulties, with whom similar methods and materials have been applied. Six contrast case studies are also presented, where divergence in materials and methods has occurred. At the end of the second chapter, conclusions are drawn, and the reader is referred to a resource of low cost materials for developing automaticity in reading, writing and spelling, which is available for use by others. This is currently being used by a network of parents, therapists and teachers in Southern Africa, as well as more widely internationally.

The two chapters presented in this book are intended to be read together. The aim is to provide the reader with access to a resource, which is both theoretical and practical, based on the theory, assessment procedures, methods and materials used in implementing a fluency-based programme.

2. The development of functional systems in the brain

Based on the theories of Sechenov [4] and Pavlov [5], Luria [1] conceptualises higher mental processes as complex reflex activities, responsible for reflecting and working with the outside world. Following Vygotsky [6, 7], Luria suggests that these reflex processes are social in origin, mediate in structure and voluntary in mode of function [8].

In this dynamic view of neurological development and functioning, the natural reflexes of the child become radically organised as a result of the handling of objects. New motor patterns, for example, are formed so that the child's movements are able to match the properties of the objects with which he or she interacts. Similar principles apply in the development of human perception, which would be formed under the direct influence of the objective world of things, the majority of which have a social origin [9].

As the brain and the nervous system form the basis for human adaptation to the social and physical demands of the environment, the social and interactive conditions in human development would lead to the formation of highly complex systems of reflex connections. To be capable of reflecting, the external world requires the combined working of many receptors in the formation of new functional systems [10]. In this ongoing process of organisation and reorganisation, the development of higher mental functions would be based on the creation of new, intermediate structures of mental processes and the development of new interfunctional relationships directed towards the performance of new tasks, as well as the performance of previous tasks by new methods.

Luria suggests [1, 2] that the performance of increasingly complex tasks would require the development of increasingly complex mediate structures in the brain. A mediate structure would thus be a characteristic feature of all mental processes. Speech would also play a decisive role in the mediation of mental processes [11]. The higher mental functions would be based on mediate structures and would be neurolinguistic in character [3], as they would be both formed and mediated, with the intimate participation of speech.

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Luria's theories have had direct influence into the literature on the neurological basis of speech, language and developmental learning disabilities, both directly through his writings and through the neurological principles he advocated [12–22]. Luria's theories have formed the basis for the development of assessment procedures such as the Luria-Nebraska Neuropsychological Battery [23, 24] and NEPSY [25] and have also had a strong influence on the Cognitive Assessment System developed by Das and Naglieri [26, 27], as well as into assessment procedures more generally [28–31].

While Luria did not refer to learning disabilities directly, others have seen the relevance of Luria's theories to procedures for diagnosis and remediation [27, 32–37]. Luria's work has influenced the work of a number of theorists and practitioners who approach learning disabilities from a neuropsychological standpoint (for example, see [38–45]), and his influence can also be traced into instructional approaches based on fluency and automaticity in language, reading, writing and spelling [46–61], such as the fluency-based programme described in this chapter.

3. Automaticity as a cognitive process

Luria [1] suggests that if the higher mental functions are complex, organised functional systems which are social in origin, any attempt to localise them in circumscribed areas of the brain would not be justifiable. Rather, the system of reflexes and connections underpinning the higher mental functions would be likely to have a wide, dynamic representation throughout the cerebral cortex. Developmentally, the involvement of speech connections as necessary components of the higher mental processes would make the cerebral organisation of higher mental functioning increasingly complex.

For this reason, Luria follows Pavlov [5] in suggesting that the higher mental functions would be accommodated in the brain in functional combination centres. These functional systems would not be ready-made at birth, but would be formed in the process of social contact as well as the activities undertaken by the child in his interactions with the external world. Increasingly complex connections and interactions between these functional systems would become necessary for the development of speech and language and the language processes involved in reading and writing.

Based on the theories of Leontiev [62–64] and Vygotsky [6, 7, 65], Luria [66] suggests that the development of higher mental functions takes place in stages. In the early stages, the higher mental functions would depend on the use of external evocative signs, within a pattern of a series of unfolding operations [67]. Only when the capacity to undertake operations at a basic level is complete would these operations gradually consolidate, enabling the whole process to be converted into a concise action, based initially on external and then on internal speech. The consolidation process would involve increasing automaticity, in which a complex cycle of unconnected acts would become a highly automatised skill.

4. Automaticity in reading

In terms of Luria's conceptualisation of the development of higher mental processes, the development of automaticity in reading would be essential for its use in the hierarchical processing of information by the working brain. Following Luria [68], automaticity would be developed in reading when there has been sufficient practice to enable this complex functional act to become fluent enough to form the basis for higher mental processing.

LaBerge and Samuels [46] were the first researchers to focus on automaticity in reading, conceptualising reading fluency as a function of information processing in reading. In their model, visual information would be transformed through a series of processing stages involving visual, phonological and episodic memory systems, until it was finally comprehended in the semantic system. LaBerge and Samuels further proposed that the processing occurring at each processing stage was learned, while the degree of learning could be assessed with respect to two criteria: *accuracy* and *automaticity*. At the accuracy level of performance, attention would be necessary for processing. At the automatic level, it would not.

Samuels [69] suggested that automaticity in reading could be trained through procedures involving repeated reading, commenting that repeated reading was not a method for teaching all reading skills, but should rather be used as supplemental to a developmental reading program. Samuels further suggested that while repeated reading was particularly suitable for students with learning problems, it was also useful for all children [69]

Support for LaBerge and Samuels' work was provided by Chomsky [70] at Harvard University. Chomsky concluded that the repeated reading procedure she had used with students had been facilitating for both slow and halting readers, "increasing fluency rapidly and with apparent ease." Other researchers such as Carbo [71], Morgan and Lyon [72] and Ashby-Davis [73] also conducted studies using different repeated reading methods to model and develop automaticity through repetition. Each of these studies focused on the development of reading fluency, which Allington [74] pointed out was a characteristic of poor readers, but was seldom treated.

The notions of reading fluency and automaticity have then recurred in subsequent literature. Adams [75], for example, suggested that the most salient characteristic of skilful reading was the speed with which text was reproduced into spoken language, whereas Ehri and McCormick [76] suggested that automaticity in word reading developed in phases, with each phase being characterised by children's working knowledge of the alphabetic system.

On the applied level, repeated reading was implemented over the 1980s and 1990s in a variety of ways and was shown to be effective in developing reading fluency in a number of contexts, being successfully implemented by teachers [77–79], parents [79, 80], as well as peer tutors [81–85]. Repeated reading was successfully conducted by parents at home [80], in schools and classrooms [83, 86], as well as in sessional programmes [87, 88]. The evidence from these various types of implementation was positive, effects were often rapidly obtained and variations in implementation procedures often produced similar positive effects (for example, see [77, 78, 85, 89–94]).

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Based on review and meta-analysis of the literature, the National Reading Panel [95] concluded that there was:

"a persuasive case that repeated reading and other procedures that have students reading passages orally multiple times while receiving guidance or feedback from peers, parents or teachers are effective in improving a variety of reading skills. It is also clear that these procedures are not particularly difficult to use or do they require lots of special equipment or materials, although it is uncertain how widely used they are at this time. These procedures help improve students' reading ability, at least through Grade 5, and they help improve the reading of students with learning problems much later than this." [96].

Based on these indications, the U.S. Congress [97] supported the inclusion of fluency as an important component of reading ability, defining the essential components of reading instruction as involving explicit and systematic instruction in:[1]

- Phonemic awareness
- Phonics
- Vocabulary development
- Reading fluency, including oral reading skills
- Reading comprehension strategies.

The literature indicates that these components are stage-related and linked [99]. There is convergent evidence that phonological awareness, phonemic awareness and phonic skills are associated with learning to read [100–104]. Fluency is associated with the development of both oral reading ability and comprehension [84, 105, 106]. Fuchs et al. [107] have defined oral reading fluency as the oral translation of text with speed and accuracy. On the basis of the review of theoretical arguments and several studies substantiating this phenomenon, Fuchs et al. concluded that oral reading fluency is an indicator of overall reading competence and may also reflect overall reading competence.

Rasinski [108] has stressed that fluency needs to be an integral component of both assessment and reading instruction. Given evidence that reading fluency improves through a variety of different types of interventions involving teacher, parent or peer-tutored reading (for example, see [80, 89, 92–94]), both in children with learning disabilities [88, 109–112] and in children without learning disabilities [82, 87, 88], a major issue is whether reading fluency can be addressed solely through fluency-focused reading strategies (for example, see [79, 113]) or whether it also needs to be addressed through building connections between the processes involved in reading, writing and spelling, as well as focus on language and reading comprehension [99, 114, 115].

Wolf and Katzir-Cohen [116] have argued that there are a number of levels of subskills and components in reading fluency instruction, suggesting the need for curricular strategies for dealing with fluency-based issues. They also suggest that increased exploration of the subskills

[1]U.S. Congress. [98] (SEC. 1208. DEFINITIONS).

and components of, and issues surrounding, fluency and comprehension, will contribute to understanding of both reading development, and dyslexia subtypes. There would thus be justification on a theoretical level for incorporating assessment of oral reading fluency as one aspect of psychometric measurement of reading, together with other indicators of automaticity, (for example, see [117–120]).

At the same time, Moors and De Houwer [121] caution that there is wide usage of terms associated with automaticity as a concept, but no agreed definition as to what automaticity actually means. The author of this chapter follows Logan [50] in defining automaticity as relating to learned automatic processes, to which, following Luria [18, 19], fluency in speech and language, as well as fluency in reading, writing and spelling, would be related.

5. Automaticity in writing and spelling

Luria [67, 122] suggests that writing follows other mental processes in being a process which changes on a functional level through use and that changes on a functional level reflect greater functional integration in the brain. In the initial stages, writing depends on memorisation of the graphic form of each letter. With practice, the performance on each individual element becomes altered as writing develops into a single "kinetic melody," in which the structures underpinning the process of writing individual letters become automatised and integrated. Similar changes also take place in other higher mental processes to which the writing process is linked.

In the course of this development, it is not only the functional structure of the process which changes but also its cerebral organisation, as the activities of writing and spelling start to depend on different systems of concertedly working zones [123]. Following Vygotsky [7], this process of organisation would be based on new, intermediate structures of mental processes and new interfunctional relationships which would enable the performance of increasingly complex tasks by new methods. Automaticity would be central to the development of writing and spelling, as processes which enable their development into a single "kinetic melody" [67] capable of supporting the use of writing and spelling in higher mental activity.

Following Luria, assessment of writing and spelling would need to be linked to the assessment of reading ability. Luria [124] suggests that the investigation of writing should be conducted with a series of tests designed to analyse the state of the various elementary components and levels in writing. As writing is intimately connected with spelling, its assessment should also be linked to the investigation of phonetic analysis and synthesis of words and begin with the writing of individual letter, syllables and words. It should end with investigation of complex forms of written speech. In the course of these tests, the investigator would not only observe the quality of writing from dictation but also note the distinguishing features of the actual writing process.

On the level of instruction, Luria's theories would suggest that it would be important to develop both automaticity in reading and automaticity in writing and spelling, if these processes are not fluent. The work of the Spaldings [125–127] is based on the assumption

that both writing and reading are stage-related and linked and that the rapid recognition of phonograms forms the basis through which writing is linked to the development of reading ability. Frith [128] has also suggested that the processes relating to the development of reading and the development of writing and spelling are stage-related and linked, as the following diagram suggests.

The terms used in **Table 1** reflect Frith's contention that initially, pre-readers use logographic strategies, which involve the use of non-linguistic contextual cues, as well as the use of visual cues related to the whole shape of the word or to letter configurations within the word. This stage is primarily based on a visual route to learning, in that words are learned by rote memory through association of visual cues with the graphic representation of the word. The second alphabetic stage relies on a phonological route to learning which is more analytical. During this stage, both phonemes and graphemes become associated as children learn to sound out words [129].

Phonological processing then forms the basis for the establishment of an orthographic lexicon, in which alphabetic representations become precise enough to enable transfer from reading to spelling. The orthographic stage then develops after acquisition of phoneme-grapheme conversion knowledge, based on the application of phonological processing to spelling. At this stage, readers have learned to analyse words, and both letter groupings and word structure become important for increasingly fluid reading [129–131].

Frith suggests that there is initial dissociation between the strategies used in reading and writing in Stage 1 of each phase, whereas one and the same strategy is used in Stage 2 of each phase as children proceed from stage to stage in learning to read and spell [132]. Ehri [99] also suggests that spelling links closely with reading, but contends that beginning readers/spellers progress through phases of proficiency as opposed to stages. These phases are termed pre-alphabetic, partial alphabetic, full alphabetic and consolidated alphabetic and are related to the child's developing alphabetic and phonological knowledge. Ehri suggests that orthographic learning comes about through experience with printed language, in the process

Step	Reading	Writing
1a	Logographic	(Symbolic)
1b	Logographic	Logographic
2a	Logographic	Alphabetic
2b	Alphabetic	Alphabetic
3a	Orthographic	Alphabetic
3b	Orthographic	Orthographic

Note that Frith's model assumes interplay between the evolving processes of reading and writing, which develop through logographic, alphabetic and orthographic stages. The numbers in the table indicate different stages in reading and writing development, whereas the arrows indicate how different stages in reading and writing development are linked. The small letters a and b indicate how the processes of reading and writing evolve in the different stages, become synchronised and ultimately become fluent.

Table 1. The six-step model of skills in reading and writing acquisition [128].

of which longer and longer letter strings become stored in memory. Children in the final consolidated alphabetic phase are able to read fluently as well as spell accurately, by relying upon these stored orthographic representations.

Besides requiring integration between the processes of instruction used to develop reading, writing and spelling [133], it would also be important to conceptualise the development of fluency in writing and spelling as a long-term process. Both Frith [132, 134] and Ehri [133, 135] are in agreement that considerable practice at reading by means of an alphabetic procedure is necessary to enable the reader to establish internal representations of word forms, as the basis for developing the ability to spell accurately and fluently.

Kellogg [136] suggests that mastering the mechanics of writing forms the foundations for a 10-year process of achieving fluency in the acquisition of knowledge, as well as written and spoken production in the telling of knowledge. This would then be followed by a second decade post school to advance from knowledge-telling to knowledge-transforming. As Kellogg observes, this is similar to the process of development involved in becoming an outstanding performer in music, chess, typewriting and other domains, in which deliberate practice needs to continue for a minimum of a decade for an individual to acquire expert standing [137, 138].

6. Fluency-based materials and methods used in the author's practice

Given evidence of the importance of fluency in the development of reading, writing and spelling and the need to integrate instruction in both reading and spelling, the author has developed a set of fluency-based materials and methods for developing automaticity in reading, writing and spelling. These are based on Luria's [139] conception of the nervous system as a complex constellation of connections that in the performance of an adaptive task may be changed, whereas the task itself remains unchanged. They are also based on Schlaggar and McCandliss' [140] contention that neural networks are in a continual process of both functional and structural change during the development of fluency, Shaywitz and Shaywitz's [103] observation that neural malleability can be influenced by systematic and targeted remedial instruction and Perfetti and McCutchen's conception of reading and writing as both connected through the phonological basis of language, as well as schooled [141–145].

Following Luria [2, 3, 11], the author conceptualises the processes of reading, writing and spelling as hierarchical and linked, whereas the procedures used for developing automaticity in reading, writing and spelling are conceptualised as functional, activity-based and repetitive, based on teaching which is phonologically, visually and kinesthetically based. The materials used in the author's practice are phonically based, and the methods for using these are based on the suggestions made by Ehri [133] that the processes of teaching reading and spelling should be linked and closely articulated, using common knowledge sources and processes and that acquiring knowledge of the alphabetic system should lie within the province of teaching spelling.

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The database of materials in the author's practice has been developed and added to over a 20-year period [146]. At this stage, it includes a phonically based large-print reading series, a foundation level series of readers with linked activity books, as well as manuals developed to enable the use of these materials by parents, teachers and therapists. Being phonically based, the materials can not only be used for developing reading fluency but can also be used for analysis, learning and testing of spelling and sequential spelling, linked to indications from the literature [147–150] that spelling practice has been found to result in superior orthographic learning relative to print exposure through reading alone.

The reading fluency methods involve repetitive paired reading, involving a procedure through which paragraphs are divided into groups of three and then read by the child and a partner in varied order. This is done in 20-minute sessions which involve parents or reading partners in working the child four or five times a week. The writing and spelling fluency methods initially involve the use of the same phonically based, large-print material in activities involving copying, phonic analysis and learning words singly and in sequence. The procedures are then broadened to include more difficult graded material, which is used in activities involving handwriting, typing, analysis and revisualisation, as the basis for orthographic learning.

At the level of input, a five vowel and then a seven vowel phonic analysis procedure is introduced, which aims to make English orthography transparent to the child through activities involving colour coding.[2] The seven vowel analytical procedure is then applied repetitively in a cycle of activities involving copying, phonic analysis, use of working memory and coding of words learned into spoken, typed and written output.[3]

Target words are identified through analysis of the vowel situation within words [155], with the aim of making the alphabetic relationships between vowel sounds and letters evident. Once children have grasped and are proficient at the process involved in colour coding of vowels within phonically graded text, these phonic analysis skills are then applied in analysing more complex written material for reasons relating to the links between automaticity and semantics [156–160]. Text is used which the child has recently read and with which the child is familiar. Single words and then sequences of words are analysed, learned and tested through spelling of single words as well as dictation of sentences and paragraphs. In the process, focus is placed on developing working memory for words and sequences of words [99, 133, 152, 161–163] as well as underlying sequentialisation abilities,[4] through linking spoken to written output [166–169].

[2]Based on indications from the literature that fundamental linguistic differences in syllabic complexity and orthographic depth affect reading [151] and that orthographic learning varies in young children relative to the transparency of the particular written language involved [152].

[3]Emphasis on use of both handwriting and typing in the process of learning spelling and sequential spelling would follow indications from Ouellette and Tims [153] of different types of interactions between handwriting skills, typing skills, practice and success in learning new words. Both writing and typing are used in the learning phase, whereas writing is used in the testing phase, following indications from Ouellette and Tims [153] as well as Cunningham and Stanovich [154].

[4]Based on indications from two longitudinal case studies involving children with severe learning disabilities [164, 165]. Both children had difficulties with coding, as indicated by low scores on the coding subtest of the WISC-R. Coding abilities in both children improved after work on writing and spelling fluency using the Seven Vowel Analysis System and the Targeted Revisualisation and Sequential Spelling Programme.

As with the repetitive methods used for developing fluency in reading, the procedures used by the author for developing automaticity in writing and spelling are based on Luria's assumption [2, 3, 11] that language mediates reading, writing and spelling and that repetition and practice increases automaticity at each level of input and integration and fluency at each level of output. The methods used in the author's practice are multisensory, repetitive and integrative, following Nicolson and Fawcett's [118] and Nicolson's [170] contention that automaticity can relate to a variety of different reading, writing and spelling skills and that therapeutic techniques need to be capable of addressing a variety of areas of deficit in children with reading, writing and spelling difficulties.[5]

It is important to stress that these types of fluency-based activities are not undertaken in isolation, but as an integral part of an individual programme directed at a range of difficulties identified through assessment. How this is done will be outlined in the following sections.

7. Assessment of reading, writing and spelling difficulties in the author's practice

Country contexts differ. Much of the literature reviewed has been based on work with North American children and to lesser extent British children. This chapter focuses on the fluency processes applying to children in South Africa, and for this reason this section focuses on the format used to assess reading, writing and spelling in the author's practice, which is based in the northern suburbs of Johannesburg.[6] This reflects similar procedures used by other educational psychologists in South Africa to provide evidence which can be used not only for diagnostic purposes against what are termed the ICD DSM IV criteria by South African medical

[5]As indicated by the range of deficits found empirically in children with reading difficulties. These would not only indicate associated language-based and phonological deficits as proposed by Snowling et al. [171], Snowling [172], Stanovich [173, 174] and Vellutino [175, 176], but also a range of additional deficits as indicated by Rudel [177], Eden and Zeffiro [178], Wolf and Bowers [179], Nicolson and Fawcett [118, 119, 180–182], Nicolson et al. [183], Tallal et al. [184, 185], Stein and Walsh [186], Swan and Goswami [187], Stein [188], Nicolson et al. [189], Goswami et al. [190], Facoetti et al. [191], Bosse et al. [192] and Nicolson et al. [193].

[6]Affluence of parents may have affected the results of the sample of children referred to in this chapter. Parents in the northern suburbs of Johannesburg have traditionally been from higher socio-economic brackets 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. The majority of the children in the author's practice come from affluent households in a wide catchment area, with many parents traveling from the eastern, southern and western suburbs, and some parents travelling as much as 600 km from out of town on a weekend to bring their children for assessment or for 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 cellphones, and this has been enabled by the fact that our reading, writing and spelling fluency materials and manuals are electronic and can be delivered by email.

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aid societies,[7] but also as background for the development of programmes which can be used for working with children with deficits on a functional level.

Four screening tests are used at the outset of the assessment process in the author's practice. These are designed to yield information about reading single words and reading words in sequence and writing and spelling single words and words in sequence. The results on these tests are then reported using reading, spelling and dictation ages, for the reason that the South African ICD DSM IV criteria are based on age-related expectancies, which are then used by the medical aid societies for the management of claims and benefits.[8]

Besides following the guidelines of the DSM IV criteria in focusing on basic skills in reading and written expression and in reporting age levels for test results, the assessment procedures followed in the author's practice are also based on the procedures suggested by Luria [1] for clinical assessment of reading and writing. Qualitative analysis of an initial interview is combined with analysis of drawings, pragmatic writing-based tasks and observation in an initial ice-breaking session with the child, followed by a second initial session with the child during which the four screening tests are used to establish levels of basic skills in reading, writing and spelling. This information is then combined with additional evidence from a biographical inventory, parental interview and more formal psychometric testing.

The author also follows Luria's suggestion [201] that assessment should start with a preliminary conversation and then include a careful history, detailed observation of behaviour,

[7]The ICD-10 (International Statistical Classification of Diseases and Related Health Problems – 10th Revision) is a diagnostic coding standard owned and maintained by the World Health Organisation (WHO) [194]. 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 [195, 196].
In psychology in South Africa, due to the similarity between the DSM IV and ICD classification systems, the DSM IV criteria have been used since August 2005 for the purpose of deriving ICD-10 codes by all psychology healthcare providers except pharmacists, clinical support and allied healthcare providers. The mandatory submission of ICD-10 codes by these groups was postponed until 1 January 2006. With effect from this date, the criteria have been referred to as the ICD DSM IV criteria, and ICD-10 coding using these criteria has been mandatory for all psychology health providers (including pharmacists and clinical support and allied healthcare providers) under government regulation in South Africa.
[8]There have been differences between the ICD and the DSM criteria historically, for the reason that the ICD is produced by a global health agency (The World Health Organisation) with a constitutional public health mission, while the DSM is produced by a national professional association (The American Psychiatric Association). Since 2005, South African medical aid societies have used both sets of criteria interchangeably in providing benefits for psychological work, for the reason that while the DSM and ICD have over time become very similar, due to collaboration between the two organizations. The coding system utilized by the DSM-IV [197] is designed to correspond with codes from the International Classification of Diseases, Ninth Revision, Clinical Modification, commonly referred to as the ICD-9-CM [198]. The coding system for the later revised DSM-IV TR [199] is designed to correspond with codes from the International Classification of Diseases, Tenth Revision, commonly referred to as ICD-10 [194]. Government regulation has been based on a national task team set up in South Africa involving representatives of the medical aid societies and of the Department of Health [200]. Based on the recommendations of the national task team, what are termed the ICD DSM-IV criteria have been adopted by all medical aid societies to cover the services provided by psychologists and other allied health workers registered with the South African Board of Healthcare Providers. This board, in turn, provides practice numbers to South African psychology and allied healthcare providers registered with the Health Professions Council of South Africa.

analysis of neurological symptoms and a series of additional objective tests. Luria suggests that the examination needs to be relatively short and involves methods of experimental psychological investigation applied to clinical practice.

The methods of examination used in the initial sessions spent working with the child also include pragmatic assessment of repetitive and spontaneous speech, writing, reading, comprehension of texts and the solution of problems, in order to establish how reading, writing and spelling are used by the child as a functional system. This informal evidence is then combined with more formal testing of reading, writing and spelling skills and interpreted, as Luria suggests, against a framework of knowledge of the types of difficulties normally associated with the functional system under investigation, based on current literature (for example [104, 170]).

Assessment leads to a functional description of deficits sufficient for diagnosis of learning disability to meet medical aid requirements,[9] as opposed to an attempt to link this to possible labelling of the child as dyslexic. The standpoint adopted by the author would accord with the suggestions made by Elliott and Grigorenko [204] and Elliott [205], namely that adding a label adds little of clarity to a functional description of deficits in reading, writing and spelling for purposes of intervention. Similarly, the pattern of scores on subtests of an IQ test is used functionally to indicate areas of cognitive and language strength and weakness, as well as areas in sequencing and working memory which may need to be worked with in therapy.

8. From assessment to statement of areas of deficit

The majority of children referred into the author's practice have had developmental difficulties at school, manifesting in problems with language, reading, writing and spelling, as well as associated difficulties with focus, attention and working memory. A number of the children have had previous assessments or have been referred by either their teachers or medical professionals. These difficulties form the focus of discussion in the preliminary interview with the child's parents, as well as preliminary conversation conducted during an initial session with the child.

Following Luria [1], the aim is to move from assessment to statement of areas of deficit and from this to specific suggestions for programmatic intervention. During the initial session with the child, evidence is collected on how the child uses a pencil for drawing and copying, how the child uses language in conversation and in writing and how the child works with integrated picture-based tasks involving comprehension and interpretation. Evidence collected during the second initial session includes indicators of one word reading ability, sentence reading ability, one word spelling ability and sequential spelling ability as tapped by two short tests of dictation.

Besides assessment of basic skills in reading, writing and spelling, the evidence collected in the two initial sessions also enables assessment to be made concerning handedness, eye movements and visual tracking, as well as the potential influences of focus, attention and fatigue on rate of work. This evidence is then interpreted against a framework of additional

[9]At time of writing, the ICD DSM IV criteria are being phased out by South African medical aid societies and replaced by the ICD DSM V criteria. This may affect the codings used in the author's practice [202, 203] in the future, but has not affected the codings used with the children whose results are reported in this and the next chapter.

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evidence from a biographical questionnaire completed by the parents, analysis of the child's school books, a reading fluency rating form completed with parents and evidence from previous assessments conducted with the child.

The aim of the initial sessions is thus to develop a preliminary base of observational and test data, which can then be used as a basis for a diagnosis for medical aid purposes, recommendations concerning the need for additional more in-depth testing (e.g. cognitive testing, speech and language and/or visual assessment, more in-depth analysis of phonological and phonic skills) or for more in-depth neurological or paediatric investigation,[10] as well as to recommend specific types of programmatic activities which can be used to address the areas of deficit.

Being based on the DSM IV criteria,[11] the diagnosis then enables parents to be able to claim benefits from their medical aid societies. At the same time, the recommendations then enable work to commence on more in-depth testing in areas where there is evidence of language deficits, reading and writing skills deficits or evidence concerning lack of automaticity in reading, writing and spelling.

9. Development of a programme directed at areas of language weakness, basic skills deficits and areas of lack of automaticity

It will be evident from the above that the conceptual framework suggested by Luria [206] not only underpins the functional nature of the assessment process used in the author's practice but also guides how indications from assessment are operationalised into specific activities to address areas of language weakness, areas of basic skill deficit as well as areas in which automaticity still needs to develop. How a child's needs are related to different areas and components within a programme of intervention will be evident from the following case study.

9.1. Child 1: A Grade 3 child in a South African Government School

9.1.1. Problems highlighted in initial interview (February 2014)

Auditory processing difficulties.

Delayed milestones affecting speech and walking.

Has had occupational therapy.

Phonological weaknesses.

[10]The author has worked with children under the care of a number of paediatricians and neurologists, but particularly closely with Dr W.G. Maxwell, neurologist, of Sandton Clinic. The stabilisation of focus and attentional difficulties as well as attendant attentional lapses and symptoms of cortical irritability has been an essential feature of the fluency-based interventions provided in the author's practice. Behavioural, emotional, parental as well as chemical interventions are likely to have contributed to the gains made by the children whose results are reported in this chapter.

[11]The DSM V criteria were published in May 2013, with both ICD-9-CM and ICD-10-CM codes assigned to each of the DSM V diagnoses. South African medical aids have continued to use DSM IV criteria up to this point in time. At time of writing, the shift to use of the DSM V criteria is in process of taking place. All children referred to in this and the next chapter were assessed against the ICD DSM IV criteria [194, 199].

b/d Reversals; n/m confusion.

High anxiety levels.

Familial difficulty (dad also had learning difficulties as child).

9.1.2. Strengths highlighted in initial interview

Social abilities and friendships at school.

Good visualisation abilities.

Interest in lego and computers.

Spatially competent child.

9.1.3. Results from initial sessions of observation of performance on tests of basic skills combined with analysis of performance on pragmatic language tasks

The following tests were administered in the initial sessions with Child 1:

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, the Daniels and Diack Sentence Reading Test (as performance on the Holborn was low), the Schonell One Word Spelling Test and the Schonell Graded Dictation Tests (Tests A and B). The test-based evidence was supplemented by 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.

Child 1 presented with 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 a number of reversals in writing (b/d) as well as confusion of n/m. Observation indicated that Child 1 had attentional and focus difficulties and was very active. Emotional indicators were also present both in Child 1's drawings and in the Bender Gestalt test.

As there were a number of indicators of potential learning disability in the case history as well as in the evidence from the two initial sessions conducted with Child 1, a diagnosis of learning disability with attendant difficulties in reading, writing and spelling was made. 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, recommendations were made for more in-depth testing to establish Child 1's cognitive profile, ongoing assessment by the family's neurologist,[12] as well as testing using the phonic inventories [207–209] to establish Child 1's pattern of phonic errors.

These results are reported below.

[12]Child 1 had symptoms of focus and attentional difficulties due to immaturity in the myelinisation process, as well as accompanying attentional lapses and cortical irritability. He was treated for each of these symptoms by Dr W.G. Maxwell, neurologist, of Sandton Clinic, who assessed Child 1 on a six monthly basis throughout the period the fluency-based intervention programme was implemented.

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10. Child 1's profile on the WISC IV (UK)

Child 1's performance on the different subtests of the WISC IV (UK) [210] is summarised in **Table 2**, which presents the profile of standard scores obtained in the verbal comprehension, perceptual reasoning, working memory and processing speed areas of the test.

Child 1's performance in all areas of the test was in the normal range. However, there was evidence of scatter in level of performance both within and across different areas of the test. The verbal comprehension profile indicated that Child 1 had well developed vocabulary, a good level of general knowledge and well developed verbal reasoning abilities, but had difficulties with verbal classification and comprehension. The high scores on the perceptual reasoning side of the test indicated well developed perceptual and spatial abilities, with weakness in non-verbal reasoning, whereas the scores on both the working memory and the processing speed areas of the test indicated good sequencing abilities.

As scatter is indicative of strengths and weaknesses in particular types of cognitive and language processing, this confirmed the diagnosis of learning disability. The indications were that Child 1 was a spatially competent child with particular strengths in sequencing and working memory, which could be used as the basis for interventions to improve his functioning in writing and spelling. The conclusion was that the tests of basic reading, writing and spelling skills already conducted fell well below would be expected in terms of age level as well as overall level of cognitive performance, enabling diagnosis of a reading disorder under DSM-IV code 315.00[13] and a disorder of written expression in terms of the diagnostic criteria for DSM-IV code 315.2.[14]

There were also emotional, as well as focus and attentional indicators in the profile. Child 1's attentional difficulties were corroborated by reports from his parents and also from school,

[13]In terms of ICD DSM IV diagnosis, 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 standardized 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) [199, 211, 212].

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

A. Writing skills, as measured by individually administered standardized tests (or functional assessments of writing skills), are substantially below those expected given the person's chronological age, measured intelligence and ageappropriate 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 organized 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 on Axis III [213, 214].

Subtest	What subtest measures	Standard score	Subtest	What subtest measures	Standard score
Verbal comprehension			**Perceptual reasoning**		
Similarities	Verbal abstract reasoning and word finding ability	7	Block design	Abstract non-verbal reasoning, spatial perception and organisation	13
Vocabulary	Ability to explain the meaning of words	12	Picture concepts	Abstract ability to analyse and classify pictorial information	15
Comprehension	Social understanding and judgement	8	Matrix reasoning	Non-verbal abstract reasoning and concept formation	7
Information	Social information, general knowledge	11	Picture completion	Ability to analyse a picture to identify missing parts	16
Word reasoning	Word finding skills based on a list of verbal clues	15			
Working memory			**Processing speed**		
Digit span	Short-term auditory memory	10	Coding	Ability to work at speed in applying a simple code accurately and in sequence	10
Letter-number sequencing	Ability to manipulate letters and numbers sequentially by holding them in short-term and working memory	13	Symbol search	Ability to work at speed in establishing whether particular symbols are present or absent	13
Arithmetic	Ability to use auditory memory for numerical reasoning	6	Cancellation	Ability to work at speed in identifying relevant pictures	8

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 2. Profile of Child 1 on WISC IV (UK).

where Child 1's teacher had flagged his attentional difficulties in the classroom, and was indicating that he was likely to fail Grade 3. The emotional lability was confirmed by reports from Child 1's parents, which indicated that he was frustrated by his difficulties at school and was subject to mood swings as well as emotional outbursts at home.

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11. Child 1's profile on the phonic inventories

Two of the three levels of the phonic inventories were administered, and error analysis was conducted. Child 1's profile indicated that short vowel sounds were established, but there were high error scores on:

- Ending consonant blends.
- Medial vowel digraphs.

Overall, Child 1's pattern of errors on the phonic inventories provided evidence of both phonological and phonic difficulties. A high incidence of errors on ending consonant blends on this instrument [208, 215–218] is associated with learning disabilities. Number of medial vowel digraph errors is also an indicator of learning disability both in primary school age children [219–221] and high school children [222].

The profile of errors on the instrument was thus used as corroborating evidence of the presence of a learning disability. The profile was also analysed to identify specific phonic errors and error types which could be targeted for instruction [223, 224].

12. Statement of areas of strength and weakness

Based on the indications from the case history and the instruments used in the assessment, more in-depth diagnosis was possible. Child 1 was diagnosed as a child with developmental auditory processing difficulties affecting phonics, reading and the writing/spelling processes. Reading fluency and comprehension, spelling and writing fluency were particular areas of weakness. Scatter was evident both within and across the cognitive profile of the WISC IV, indicating that areas of strength and weakness also likely to be affecting performance at school. Focus and attentional factors and emotional indicators were present, which had been pervasive as well as occurring over time, as confirmed by Child 1's mother and the family's neurologist[15].

Child 1's high scores on verbal reasoning and on the perceptual reasoning side indicated that he was a child with a high level of spatial competence, which could be used for purposes of instruction. Based on the indications from assessment, the following areas of difficulty were identified, and the following programme implemented in therapy, with carry-over at home.

13. Development of an individual programme

As there was evidence of difficulty in a number of areas, the individual programme developed for Child 1 consisted of a number of specific interventions, which are summarised in **Table 3**.

[15]There was also erratic behaviour, temper outbursts and mood swings suggestive of cortical irritability, for which medication was prescribed.

Difficulties with Phonics	Phonic workbooks and activity books
	Instruction targeting errors made on Phonic Inventories
	Seven Vowel Analytical Phonics System
Difficulties with Reading Fluency	Reading fluency ebooks
	Repetitive paired reading using 3 x 3 oral impress method
Difficulties with Reading Comprehension	Main Ideas Programme
	Teaching of Strategies for Factual and Inferential Comprehension
Difficulties with Spelling	Analytical Phonics Programme applying seven vowel system to words and sentences
	Six to ten word a day programme for spelling errors
Difficulties with Fluency in Writing and Spelling	Development of ability to use either print or cursive in copying tasks
	Development of ability to use typing in computer-based copying tasks
	Development of sequential processing using writing and typing for phonic analysis and dictation of sentences
	Use of phonically-based reading material for phonic analysis and dictation of paragraphs
	Use of the Targeted Analysis, Revisualisation and Sequential Spelling Programme to develop working memory for words, sentences and paragraphs
	Use of sequenced mental imaging and visualisation in descriptive and creative writing

Table 3. Child 1's individual programme.

It will be evident from **Table 3** that there were a number of areas of intervention in Child 1's programme, reflecting different needs on a functional level. These included interventions aimed at establishing basic phonological and phonic skills, as well as skills in both synthetic and analytical phonics. There were also interventions designed to improve skills in word reading, as well as to establish fluency in the use of sequential reading skills and reading comprehension, as the basis for coping with the type of language and reading comprehension tasks Child 1 was being given in the classroom.

In addition, there were interventions aimed at establishing basic skills in spelling and writing and by teaching Child 1 how to analyse the structure of the words he was being asked to learn for his spelling tests at school. This was done by focusing on the vowels occurring in these words using a seven vowel analytical system, with the aim of making the vowel system used in English orthography transparent.

There were also interventions directed at establishing fluency in sequential writing and spelling. This was done through word, sentence and paragraph dictation. There was also a family-based counselling intervention. Work ethic and motivation were maintained through a reward system based on hundred squares and points.[16]

Child 1's individual programme thus provided a framework of areas of difficulty, linked on the one hand to his assessment and on the other to specific areas of intervention. This provided a basis for implementation in weekly sessions conducted with Child 1 and reinforced by Child 1's parents at home. This was done using the resources described in the next chapter.

14. Summary and evaluation

There has been increasing interest in automaticity as a necessary component in working with children with reading, writing and spelling difficulties. In this chapter, Luria's theories [1–3] of automaticity have first been outlined in relation to the broader literature. This has then been followed by a case study of a child (Child 1) presenting with difficulties in automaticity in reading, writing and spelling, and the procedures used for assessment and development of his individual programme.

In the following chapter, this child's results are presented, together with the results of 13 other children with learning difficulties with whom similar methods and materials have been applied. Six contrast case studies are also presented, where divergence in materials and methods has occurred.

At the end of the second chapter, conclusions are drawn, and the reader is referred to a resource of low cost materials for developing automaticity in reading, writing and spelling, which is available for use by others. This is currently being used by a network of parents, therapists and teachers in Southern Africa, as well as more widely internationally.

The two chapters are presented side by side in this book, so that the reader can first focus in this chapter on theory and how this translates into assessment, and then on the practical. The

[16]Influenced by comments concerning the value of points-based reward systems made by Alex Bannatyne to the author in 1978. The emphasis on teaching hundreds, tens and units through repetitive use of an ongoing reward system is the author's own.

reason for this is that procedures for assessment form the link between the areas of difficulty found in children with reading and learning disabilities and the methods and materials which can be used on a functional level for implementing fluency-based programmes in practice. The fluency-based methods used by the author are described and then evaluated in the next chapter. Key implementation variables affecting the development of reading, writing and spelling fluency are also identified, based on evidence of gains made by particular children.

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