

# INCLUDING CHILDREN WITH DOWN SYNDROME (PART 2): FROM THE COMMUNITY TO THE INDIVIDUAL

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This article is the second of a two-part series on successful inclusion in mainstream education. In the last issue of Down Syndrome News and Update, we focused on the importance of attitudes, the whole school culture and whole school planning.

We emphasised the effect of social opportunities on the development of all children and the role of the school in providing a social world that promotes the values we would like to see expressed in our society at large. We argued that the truly inclusive school will provide the best environment for all children to flourish, socially, emotionally and academically.

In this part we focus on the issues relevant to understanding the learning needs of the individual child and to planning the curriculum in the classroom.

**Keywords:** inclusion, reading, spelling, speech, language, memory, ability, Down syndrome

## The development of mental abilities

We would like to draw the attention of all teachers to recent psychological research which stresses the dynamic and interactive ways in which mental abilities develop in all children and in particular, the significance of speech and language, working memory and reading development to all children's intellectual progress. We will draw on our own research with children with Down syndrome to illustrate the issues but identify for you the main sources of similar research with non-disabled children. We will also identify the practical implications of this research for classroom practice.

## Background

Since 1980, we have been studying the learning difficulties of children with Down syndrome in order to develop ways of helping them to reach their full potential. It has become clear that the patterns of development and the processes involved are similar to those seen in many other children with learning difficulties within regular classrooms.

Our starting point was the study of reading skills in pre-school children with Down syndrome[1] after receiving a letter in 1979

describing the early reading progress of a child with Down syndrome and the effect that this seemed to have had on her intellectual development. This child was Sarah Duffen, hence the name of our Centre.

The letter was from Sarah's father, Leslie and in it he described her exceptional development as follows.

*Sarah began to learn to read at the age of 3 years 6 months. At 7 years she had a Griffiths DQ of 83 and a reading age of 9 years. At 11 years, she can read the following sentences with understanding: 'The soloist was not in a convenient position for seeing everyone in his audience'. 'Psychology is a science which seems to fascinate both the adult and the adolescent student'. She can also write such sentences, spelling all the words correctly. Sarah reads extensively for pleasure and has completed all but one year of her education within the normal school system.*

As Sarah was born in 1968 this account was truly remarkable. One of us (SB) has an adopted daughter with Down syndrome, Roberta. She was born in 1969 so was only one year younger than Sarah. We were therefore

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very familiar with the current literature and beliefs about the intellectual abilities of people with Down syndrome when we received Leslie's letter. It was assumed that the condition always led to severe learning difficulty (in those days still described in the UK as severe subnormality) with IQ's (Intelligence Quotient) or DQ's (Developmental Quotient) below 45 and that learning to read was certainly beyond anyone with Down syndrome.

It was actually Leslie's observations about the effect of reading on Sarah's spoken language development that interested us most. He states

*Sarah's reading ability has considerably helped the development of her speech. The critical discovery was that Sarah read, remembered and later used, in the correct context, sentences that she was quite incapable of remembering when she just heard them.*

The development of spoken language skills is considerably delayed in most young children with Down syndrome. In our view, words are the most effective vehicle for knowledge acquisition and therefore a key to mental ability, so that anything that might boost the children's rate of language acquisition was worthy of study.

Leslie's views were met with great scepticism by all the experts that he talked to when Sarah was a child, since his views contradicted conventional wisdom. It was considered that the language of children with Down syndrome was retarded because they lacked the intelligence to do any better. But what is intelligence?

We had a feeling that at least some of this argument was circular. If by intelligence we mean the ability to think, reason, remember and therefore to learn, then words and the child's comprehension and use of speech would seem to us to be a critical tool for developing intelligence. Even if genes play some part in determining a child's IQ (we prefer the term learning potential), any difficulty in mastering a first language would seem likely to hamper the expression of the child's potential.

### **Research evidence**

With a team of colleagues and research students at the University of Portsmouth, Elizabeth Woods, John MacDonald, Irene Broadley, Angela Byrne and Glynis Laws, we have conducted a variety of studies over the

past 18 years that shed some light on these issues. For the purposes of drawing out the relevance of the work for understanding some of the reasons for learning difficulties in a wide range of children, we will describe our most recent research, some of which is still in progress. Our earlier studies are described in the references listed at the end of the article for those who wish to follow the development of our understanding and evidence on these issues [1-5].

In 1990, with John MacDonald and Irene Broadley, we embarked on a study of short-term memory development in children with Down syndrome. Our attention had been drawn to the fact that many children with learning difficulties, including those having difficulty with reading and number, show delays in the development of working memory skills [6].

In 1994, with Angela Byrne and John MacDonald, we set up a longitudinal study to follow the progress of reading development in children with Down syndrome in mainstream classes and two groups of typically developing mainstream children, slow readers and average readers - all in the same mainstream classes. We have just collected the fifth set of data for this study. We are interested in the reading progress of all the children and the way in which they are developing strategies for reading and spelling. We are also interested in the links between the children's language skills, working memory skills and reading [7-8].

Research with typically developing children indicates that there are reciprocal relationships between these skills. Two large longitudinal studies, one in Wales and one in Cambridge, set up to study the factors which influence children's reading acquisition have produced the same results. (These studies are reviewed in detail in [9].)

They both show that children who come to school with more advanced language knowledge learn to read faster in their first year than those with less language knowledge. They also show that children who have better working memory skills learn to read faster in their first year in school than those with poorer working memory skills.

In the second year in school, reading progress and the child's level of reading skill begins to effect progress in language and short-term memory development. The children with the higher reading ages at the beginning of year two, show more progress in language

comprehension and in working memory skills during the year than those with lower reading ages at the beginning of the year.

Our case studies of children with Down syndrome [5] and one longitudinal group [10] study show exactly the same beneficial effects of learning to read. Using data collected in the memory training study, those who are being taught to read show significant gains in memory spans and in language comprehension over a 4 year period when compared with a comparison group. The children with Down syndrome in the comparison group were not significantly different in cognitive ability 4 years earlier, but have not been taught to read.

Reading ability and the activity of reading is, in some way, accelerating the children's development of memory skills and their acquisition of language knowledge. Why should this be so?

### Reading and language

The gains in language learning are probably the easiest to understand. Being able to read gives a child access to a whole world of new information and they will learn new vocabulary and some new grammatical constructions from print. Children's language learning usually proceeds with amazing ease. By 5 years of age, typically developing children have, on average, vocabularies of some 2,000 words. However the biggest vocabulary explosion is between the ages of 7 and 16 years when children typically learn about 3,000 words each year. By 7 years most children in the UK are becoming usefully literate. Garton and Pratt, in their book "Learning to be Literate" [11], present a very clear discussion of the interactive effects of spoken language and literacy during development in the pre-school and school years.

However, there is considerable variation in the rate of speech and language development of children. Some children are late to begin talking and while they may seem to catch up, this is not always the case. Standardised tests may show that they are at least a year or more behind on knowledge of vocabulary and grammar when they start school. These children are often the slow readers.

This turned out to be the case in our 1994 study. Though not identified as children with obvious learning difficulties at the time, the slow readers among the mainstream children were shown to be one year or more behind the average readers in their class on all the language comprehension measures that we used [7].

If their reading progress is initially being delayed by their speech and language knowledge, then this quickly becomes a vicious circle, as we know that rate of reading progress influences rate of acquisition of new vocabulary and grammar. New vocabulary equals new knowledge, so slower vocabulary learning means slower knowledge acquisition.

### Reading and working memory

Working memory is the system that you use for the immediate processing of information. It consists of a central executive, where the processing is done, and two short-term memory stores. One memory store is called the visual-spatial scratch pad and this holds visual information long enough for you to process it for meaning. The other memory store is called the phonological loop and this system holds auditory information such as speech long enough for you to process it for meaning [9].

The phonological loop underpins a child's verbal short-term memory ability (VSTM). The capacity of a child's VSTM can be measured using digit span tasks. These are found in all standardised ability tests such as the British Ability Scales. Short-term memory spans increase with age during childhood. The average digit span of a five-year-old will be 3-4 digits and that of a 16-year-old will be 6-7 digits. (The digit span is the number of digits a child can remember and repeat in the correct order when he or she hears them spoken at the rate of 1 per second.) Research shows that the main reason for this growth is increasing efficiency at speech perception and speech production. The evidence is that verbal working memory is a speech-based system and a child's span reflects his or her articulation rate. Typically, speech fluency goes up with age. This research is well reviewed in a recent article by Sue Gathercole if you wish to read it in more detail [12].

One of the reasons that a child's reading progress influences their working memory development is that learning about letter sounds and seeing words in print both sharpen a child's perception of sounds in words, so lead to faster speech perception. Children who are not progressing with their reading show delay in the development of their working memory i.e. digit span does not grow. Poor VSTM may lead to difficulty with processing spoken language in the classroom and in remembering instructions. Another factor influencing growth in VSTM is the child's explicit use of strategies such as rehearsal, silently or aloud, of material to be remembered. Children seem to become

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proficient at rehearsal at about the time they become proficient in silent reading.

A child's working memory performance has also been shown to influence spoken language development in a variety of other ways including speed of learning new vocabulary in pre-school and school age children. An excellent review of this research and its significance for teachers is to be found in a book entitled *Working Memory and Language Development* by Sue Gathercole and Alan Baddeley [9] written when they were both at the University of Cambridge. They are now at Bristol University. This book also provides an excellent review of reading development and the links between reading progress and working memory.

In a more recent review paper published this year, these authors argue that the phonological loop's main function is as a language learning device [13]. Many mainstream children with reading comprehension difficulties and with number difficulties turn out to have poor working memory performance for their age, so working memory research is an important area to keep in touch with at present.

### **Memory training for children with Down syndrome**

In our 1990 research project, we demonstrated that working memory performance could be significantly increased for children with Down syndrome by teaching the children memorising strategies [14]. Rehearsal games taught the children to use rehearsal in memory tasks. Grouping games taught children to use categorisation to improve their memory skills. However, unless the skills were consolidated and used, the memory gains were lost over the next three years [15].

Significantly, reading progress appeared to have an effect on maintaining and improving the memory span gains achieved by the memory games for this group of children. In 1995, four years after the training, the children with Down syndrome who had become readers in that time had continued to improve their memory spans, those who had not become readers, had lost the training gains [10]. This is the result that one would predict based on the studies of reading and memory in typically developing children.

### **Alphabetic versus logographic reading strategies**

Current research on the strategies that children use as they learn to read indicates that

children progress from a logographic stage, where they are remembering words by their visual patterns (sight vocabulary), to an alphabetic stage when they can sound out unfamiliar words using their knowledge of letter-sound correspondences (phonics). Writing and spelling activities helps progress to an alphabetic stage.

Children's literacy progress will be delayed if they have difficulty in moving to alphabetic strategies. The most common reason for such difficulty will be poor auditory discrimination of sounds or poor phonological awareness (ability to discriminate the sound patterns within words).

Most primary teachers will be well aware of this and be making full use of games and activities to develop their children's auditory discrimination and phonological awareness skills. They may not be aware that at the same time they will be helping working memory development.

In our 1994 research, when we compare the groups, our children with Down syndrome are having more difficulty mastering alphabetic strategies than the other two groups of mainstream children. Surprisingly after 2 years, the reading performance of the children with Down syndrome has progressed as much as that of slow readers - that is, in 1996 they were still not significantly different on a standardised reading test.

However, the children with Down syndrome were significantly worse on tests of alphabetic skills, so we conclude that they are maintaining their reading skills by relying on logographic, visual memory strategies [16]. However, as with all group data, the group comparisons conceal individual differences. Within the group, some children with Down syndrome were mastering alphabetic strategies. These children turned out to all have reading ages over 7 years. This would be the level of competence shown by typical readers when they begin to show alphabetic skills [9].

The mainstream children in the slow reader group, while significantly better at using alphabetic strategies than the children with Down syndrome, were significantly worse than the children who were average readers. While we interpret the poor alphabetic progress of the children with Down syndrome as a result of poor hearing and poor discrimination for speech sounds, we do not know the reason for the delay in the slow readers.

It may have surprised the alert reader to note that some of the children with Down syndrome are reading as well as some of the non-disabled children in their mainstream classes. In our experience, based on supporting many children with Down syndrome in mainstream classrooms, this is often the case. The other slow readers can benefit from being in small group instruction with the child with Down syndrome that can be arranged in the class by making full use of the learning support assistant.

## What are the implications of this research?

### The importance of speech and language

It highlights the way in which the development of mental abilities is a dynamic building process. Working memory function influences rate of vocabulary learning. Speech and language skills influence ongoing working memory development. Reading development is influenced by and influences growth in both areas. They have continuous reciprocal influences on each other - or in different terminology - progress in one "bootstraps" progress in another. Working memory influences speed of processing information and learning.

If a child does not learn to read, this will not only have the obvious disadvantage of denying him or her access to books and the obvious benefits of literacy, but may also slow up the development of the working memory system. It may also slow his or her vocabulary learning.

Many children with learning difficulties that become apparent in the primary classroom have subtle difficulties in auditory discrimination and speech processing. They will be less efficient than most children at learning from listening. Yet talk is the main mode of instruction.

Our children with Down syndrome have the same profile of difficulty, though will probably be more severely affected. For them and for all the other slow learners, we would recommend a two-pronged attack on the difficulty.

Firstly, to try to improve the underlying processing skills with sound games to improve auditory discrimination and phonological awareness, and memory games to improve memory spans.

Secondly, we would use teaching strategies which emphasise visual support for learning as

much as possible. For example reading schemes like "Breakthrough to Literacy", which use flashcard sets so that words are tangible and can be manipulated to build sentences that the child can then copy, can be helpful. This reduces the working memory load which will be required if the child has to write his ideas straight to paper.

### Reading as a language activity

We would ask teachers to think of reading as a language teaching activity as our children with Down syndrome need to build up their grammar. They can learn grammar when they see it in a way they cannot when they only hear it.

While the grammar learning difficulties they have may be more severe than for most other children, it is only a matter of degree. The pattern is the same for other children with speech and language delay and for those with hearing loss.

A child's mastery of grammar will be demonstrated when he or she is asked to write a story. This forces the child to try to put their ideas into grammatically correct sentences. It is a very important activity in all primary classrooms - and this is why we encourage a language approach to reading. We suggest that the child spends time in writing about the things that he or she does or is going to do, every day. The child will choose from flashcards and build sentences with them first - then write.

In this way, the child is given the opportunity to maximise his or her development of language for everyday communication. This method will also maximise success in reading comprehension, as the child will find it easy to read with comprehension about activities he or she has participated in. Diaries and project books made in this way can be taken home and shared with the family.

We would always build confidence by teaching a small sight vocabulary, including family names, when a child begins reading. (We do this at 3 years of age or even earlier with children with Down syndrome.) First we teach a sight vocabulary that can be used to build short, grammatically correct sentences so that the child can make diaries about his or her own daily experiences - and understand that we read for meaning. Once the child has a forty to fifty word sight vocabulary and can use it in this way, we then use the words the child can already read with confidence to teach

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them about letter sounds and the use of alphabetic skills.

We find many children in classrooms who have learned letter-sound correspondences - so can sound out letters and even blends correctly as a game - but can not use this knowledge to sound out a word for decoding a new word when reading or for spelling when writing. Research studies suggest that the need to spell when writing drives consolidation and use of alphabetic knowledge, so it can be counterproductive to use the flashcard words to copy for sentence building for too long. The child needs to move to trying to spell familiar words without the prompt, once confidence is building.

Old-fashioned practice is the key to learning, particularly for the slow learners - so word lists sent home for practice at reading, writing and spelling can be a great help for the child.

#### **Visual supports**

This approach to reading emphasises the importance of visual support for learning and we would extend this principle across the curriculum. Visual support such as number strips and digit cards can also be helpful for number progress.

#### **Using computers**

Technology has revolutionised the learning opportunities for the slower learning child. There is an ever-growing range of excellent software for special needs, though in our experience, not all mainstream teachers are yet fully aware of what is available and software reviews will be a regular feature of this journal.

The computer has many advantages for the less able child. It presents information visually and can offer lots of fun practice at all basic learning for reading, number etc. and for writing. It is under the child's control and therefore the learning progresses at the child's pace. The child can be an independent learner with the computer. Finally, but maybe most importantly, the computer does not get impatient or irritated!

We would take these same principles and apply them when working with older children with learning difficulties in secondary education.

#### **Conclusions**

We have drawn attention to the recent and ongoing work which demonstrates that for all children, mental abilities develop in a reciprocal and interactive way. Central to this development is the language system in the early years, and then reading progress. The efficiency of the working memory system, used for all immediate processing of information will be influenced by language and literacy skills.

Therefore a focus on language, working memory and literacy in the curriculum is essential for all slow learners in the classroom including children with Down syndrome.

In this article we have tried to provide an overview and to explain the key issues. Readers wishing to explore the research and its relevance to classroom practice in more depth will find more information in the references provided. We provide a range of one and two day workshops at the Sarah Duffen Centre for parents and for professionals at which we can go into more detail on the practical application of these findings in order to help children at home and at school.

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## References

1. Buckley, S.J. (1985). Attaining basic educational skills: Reading, writing and number. In Lane, D. and Stratford, B. (Eds.), *Current Approaches to Down's Syndrome*. London, England: Holt Saunders.
2. Buckley, S.J. and Bird, G. (1993). Teaching children with Down's syndrome to read. *Down Syndrome Research and Practice*, 1(1), 34-41. [Also Online] URL: [http://www.downsnet.org/library/dsrp/teaching\\_reading/](http://www.downsnet.org/library/dsrp/teaching_reading/) (Accessed: 1998, 31 August.)
3. Bird, G. and Buckley, S.J. (1994). *Meeting the educational needs of children with Down's syndrome: A handbook for teachers*. Portsmouth, England: University of Portsmouth. [Also Online] URL: [http://www.downsnet.org/library/books/meeting\\_needs/](http://www.downsnet.org/library/books/meeting_needs/)
4. Buckley, S.J. (1995). Teaching children with Down syndrome to read and write. In Nadel, L. and Rosenthal, D. (Eds.), *Down Syndrome: Living and Learning in the Community*. (pp. 158-169). New York, USA: Wiley.
5. Buckley, S.J., Bird, G. and Byrne, A. (1996). Reading acquisition by young children with Down's syndrome. In Stratford, B. and Gunn, P. (Eds.), *New Approaches to Down's Syndrome*. London, England: Cassell.
6. Broadley, I. and MacDonald, J. (1993). Teaching short term memory skills to children with Down's syndrome. *Down Syndrome Research and Practice*, 1(2), 56-62. [Also Online] URL: [http://www.downsnet.org/library/dsrp/teaching\\_STM/](http://www.downsnet.org/library/dsrp/teaching_STM/) (Accessed: 1998, 31 August.)
7. Byrne, A., Buckley, S.J., MacDonald, J. and Broadley, I. (1995). Investigating the literacy, language and memory skills of children with Down's syndrome and their mainstream peers. *Down Syndrome Research and Practice*, 3(2), 53-58. [Also Online] URL: [http://www.downsnet.org/library/dsrp/lit\\_lang/](http://www.downsnet.org/library/dsrp/lit_lang/)
8. Byrne, A. (1997). The development of reading skills in children with Down syndrome. Unpublished doctoral dissertation, University of Portsmouth.
9. Gathercole, S. and Baddeley, A. (1993). *Working Memory and Language*. Hove, UK: Lawrence Erlbaum Associates.
10. Laws, G., Buckley, S.J., Bird, G., MacDonald, J. and Broadley, I. (1995). The influence of reading instruction on language and memory development in children with Down's syndrome. *Down Syndrome Research and Practice*, 3(2), 59-64. [Also Online] URL: [http://www.downsnet.org/library/dsrp/read\\_mem/](http://www.downsnet.org/library/dsrp/read_mem/) (Accessed: 1998, 31 August.)
11. Garton, A. and Pratt, C. (1989). Learning to be Literate: *The Development of Spoken and Written Language*. Oxford, England: Blackwell.
12. Gathercole, S.E. (1998). The development of memory. *Journal of Child Psychology and Psychiatry*, 39(1), 3-27.
13. Baddeley, A., Gathercole, S. and Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review*, 105(1), 158-173.
14. Broadley, I., MacDonald, J. and Buckley, S.J. (1994). Are children with Down's syndrome able to maintain skills learned from a short-term memory training programme? *Down Syndrome Research and Practice*, 2(3), 116-122. [Also Online] URL: [http://www.downsnet.org/library/dsrp/STM\\_training/](http://www.downsnet.org/library/dsrp/STM_training/) (Accessed: 1998, 31 August.)
15. Laws, G., MacDonald, J. and Buckley, S.J. (1996). The effects of a short training in the use of a rehearsal strategy on memory for words and pictures in children with Down syndrome. *Down Syndrome Research and Practice*, 4(2), 70-78. [Also Online] URL: [http://www.downsnet.org/library/dsrp/rehearsal\\_memory/](http://www.downsnet.org/library/dsrp/rehearsal_memory/) (Accessed: 1998, 30 August.)
16. Byrne, A., MacDonald, J. and Buckley, S.J. (1998, March). Reading skills in children with Down's syndrome. *The British Psychological Society Annual Conference*, Brighton, UK.