

IMPROVING THE SPEECH AND LANGUAGE SKILLS OF CHILDREN AND TEENAGERS WITH DOWN SYNDROME

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This article reviews the research on speech and language in children and adolescents with Down syndrome from a practical point of view. It identifies the typical profile of speech and language development, emphasising the variability in development for different individuals, and describes the main reasons for this profile as far as they are understood at the present time. Drawing on this information and what is known about the processes of speech and language development in typically developing children, the paper sets out principles to guide parents, teachers and speech and language therapists as they interact with the children in their care.

The main difficulties experienced by children with Down syndrome can be grouped under several headings; difficulties in hearing, auditory perception and processing, difficulties with clear speech production and greater difficulty in learning grammar than vocabulary. These, in turn, are likely to effect the quality and quantity of the language learning opportunities available to the children. Babies and children with Down syndrome need more, high quality learning opportunities in order for them to learn and remember the meanings of words and sentences, yet they get less opportunities because of their slower progress.

The author argues that most children and young people with Down syndrome could be helped to improve their speech and language skills if we simply applied the knowledge that we now have more effectively.

Introduction

The aim of this article is to provide those in daily contact with children and adolescents with Down syndrome, including parents, teachers, classroom assistants and pre-school staff, with information that will enable them to help the children to talk more and to talk more effectively. It will also explain the need to take account of the children's speech and language difficulties when involving them in classroom and school activities, and when teaching them to read. The article should also be useful to speech and language therapists, as it provides a guide to recent research and sets out the principles that should inform speech and language therapy programmes for children and adolescents with Down syndrome, drawn from that research.

Since I last reviewed the information available on this topic in 1993^[1], there have been many

important papers^[2-8] and book chapters^[9-22] published on speech and language development, and several books^[23-25]. These publications have all contributed in some way to an increased understanding of the language learning needs of children with Down syndrome and there is now considerable agreement among the experts on the principles which might guide effective interventions^[2/5/10-13/25-27].

The title of my 1993 article was '*Language development in children with Down syndrome: reason's for optimism*'. I am even more optimistic as a result of the new information available now. The evidence suggests that most children and adults with Down syndrome could be talking more, talking more clearly and talking in longer sentences if we could provide those in daily contact with them with relevant practical guidance.

This does not mean that everyone should be working all day, everyday, on intensive language teaching activities, though in our experience, some structured teaching each day is important and I will return to this later in the article. It means that we can probably all improve the effectiveness of most of the normal everyday interactions that we have with children with Down syndrome, as parents, teachers and carers. If we have some insight into how children learn to talk and into the specific difficulties that may be slowing up this process for children with Down syndrome, we can create a more effective language learning environment.

At The Sarah Duffen Centre, we provide speech and language intervention through early development group sessions for children from birth to five years. We have also been engaged in research in this field for almost twenty years, so in writing this article, I am drawing on our own practical and research experience ^[28-34] as well as the published literature.

The article will address the following questions:-

- 1.How do children learn to talk?
- 2.What is the typical profile of speech and language development for children with Down syndrome?
- 3.How much do children with Down syndrome vary in their progress?
- 4.What does recent research tell us about the possible reasons for the delays and difficulties with talking experienced by most children with Down syndrome?
- 5.Does the research provide any guiding principles that should inform intervention activities?
- 6.What are the practical implications of this research for those caring for or teaching babies, toddlers, preschoolers, or children in primary school, junior school, secondary school or college?

1. How do children learn to talk?

Children learn to talk as they take part in all the ordinary, everyday communication that they experience during their waking hours. The quality and quantity of their language experience influences the rate at which children progress and the range of their language knowledge and skills^[35-37]. In order to talk, children have to master a range of knowledge and skills and these can be

considered under four headings, communication, vocabulary, grammar, and speech.

Learning to be a communicator

The typical infant is laying the foundations for learning to talk in the first year of life. In the first few months, babies learn that communicating is fun and that when communicating they have the full attention of another person, child or adult. They learn this from their earliest smiling at about six weeks of age. When someone looks at and talks to a baby, he or she usually looks and smiles. Later, when we are talking to each other, we usually look at the person talking to us, that is, we make eye-contact - we look and we listen.

We also take turns in the conversation, listening and then talking. Babies are usually showing turn-taking skills by 7 or 8 months of age, when engaged in babble games. The baby is quiet and looks while their communication partner coos or talks to them and then he or she takes a turn and babbles, gurgles or coos in reply. We communicate in a variety of ways, using facial expressions, tones of voice and gestures for example. Babies have to learn to interpret and to use all of these if they are to be good communicators.

Most babies use gestures to communicate before they use words. They point in order to say 'Look' or 'What's that?' They wave 'bye-bye' and hold up their hands to say 'pick me up please'. This is a natural stage, when gestures are used before the baby can say the word. Using gestures, babies learn that they can influence the behaviour of those around them in their world.

These non-verbal skills - smiling, eye-contact, turn-taking, facial expressions, tones of voice, gestures - are all important aspects of communication to be mastered as the baby moves towards talking. They continue to be part of the communication exchange whenever we talk to another person and so remain important throughout life.

Building a vocabulary

The next step towards being a competent talker is learning to understand and then say words, to build up a vocabulary of words. Babies begin to understand the words that they hear spoken to them and around them because the words are referring to things that they are seeing, hearing or doing. Each day, parents talk to babies as they pick them up, feed, bathe, change nappies, go for a walk, or take a ride in the car. As babies hear the same words used

day after day, in the same contexts, they begin to learn the meanings. The first 50 to 100 words that babies say are similar in meaning in all cultures, because they are all engaged in similar daily living activities. Between 12 to 18 months, young children begin to talk. They begin to say some of the words that they are beginning to understand, to use them to communicate.

To get this far, babies have to be able to

- Hear well enough to discriminate between the sound patterns of words, so that they can hear the difference between 'hat' and 'cat' or 'cheese' and 'trees'.
- Attend to the situation so that they can link the sound of the word with its meaning.
- Copy the sound pattern of the word so that others can recognise it when they talk.

To progress with talking at a typical rate then, a baby must have good hearing, be able to link words with their meanings during everyday experiences of talk, and have normal speech production abilities.

Joint attention

Babies are very active in setting up their own language learning situations. Around one year of age, they can initiate 'joint attention' sessions. These are situations when the baby and his or her carer are attending to the same object or activity, for example, both looking at a toy or at a car passing. The carer, whose attention to the toy or the car has been established by the baby holding it up or pointing, talks about the toy or the car. The more of these 'joint attention' sessions the baby experiences, the faster he or she will pick up the meanings of words^[38-43].

Adults can also set up these joint attention sessions by drawing the baby's attention to an object or activity. Research indicates that the more children are talked to in these situations, where they can 'see what you mean', the faster they learn to talk. The more children are talked to in this way, the more opportunities they have for learning a wide range of vocabulary. Some adults do this naturally, that is they tend to talk to the baby in this way while going about ordinary activities together during the day. Others are rather quieter and do not talk to the children in their care to the same extent. These differences affect the rate at which children learn early vocabulary^[44-46].

More vocabulary - new words through life

Vocabulary learning starts in infancy and continues throughout life. Each new word that

the baby learns to understand and then to use represents a piece of knowledge about the world. We have words for just about everything that we know something about and the size of our vocabularies reflects the extent of our world knowledge. If a baby is learning words more slowly, then he or she will be learning about their world, and the things and people in it, more slowly than the child who picks up words at a faster rate. There is a link between the rate at which a child is mastering the language of the community and the rate at which he or she can develop knowledge and mental abilities such as reasoning and remembering. In my view, significant speech and language delay is bound to lead to cognitive delay for any child (for a more detailed explanation and evidence for this view see^[47]).

Milestones

Typically developing children usually produce their first word at about 11 to 12 months of age. Their first 10 words are then acquired relatively slowly over the next 3 to 5 months. Now they have got started, new words are learned at a faster rate. From 19 to 24 months, children learn about 25 words per month. At 5 years of age, the average child's vocabulary is around 2,000 words. It is important to remember that vocabulary learning then continues throughout childhood and that it accelerates during school years. It has been estimated that children typically learn about 3,000 words each year between the ages of 7 and 16 years^[48/49]. This typical rate of vocabulary learning is almost certainly influenced by being able to read by 7 years of age. Many new words will be encountered in books and in project work at school.

Learning grammar

Once babies have mastered some 50 or so words (on average at about 19 months), they begin to join them together to communicate a wider variety of meanings, such as 'big dog', 'mummy's car', 'daddy gone', 'more drink', 'cat sleep'. First vocabularies are made up of mainly nouns, verbs and adjectives^[50]. These are the content words that carry the main meanings of the sentence. When toddlers have vocabularies of about 300 words (on average at 24 to 30 months), they begin to use some grammar. These will be the rules for expressing plurals, past and future tenses, possession, question forms and so on.

Grammatical markers and rules are learned by children in a fairly predictable order. In this way, children slowly produce longer and more complex utterances until they talk in

grammatically complete sentences like the adults in their community. It has been argued that children with a productive vocabulary of 300 words or less have very restricted grammatical abilities and that this vocabulary size is a 'critical mass' necessary for productive grammar to develop^[48/51].

The closed class grammar - sometimes called function words - is the last to be mastered. Function words in English include the auxiliaries (is, are), articles (a, the), pronouns (she, him, they), prepositions (in, behind). These are the little joining words that may add to meaning in subtle ways or may just be conventions of the particular language being learned. It has been pointed out that function words are hard to perceive as they tend not to be stressed when we speak^[12/51]. The learning of grammar is also influenced, like vocabulary learning, by the quality and quantity of talk with the child^[52-56].

Speech

Speech refers to the child's ability to produce intelligible words. In order to be able to speak clearly, the child has to be able to hear and copy accurately the sounds and word patterns. Once they wish to talk in sentences, they have to be able to produce a sequence of words. In typical development, babies produce speech sounds in their babble and then approximations of words. When they do this, parents respond, repeating back and giving meaning to these attempts. Here again we see the importance of the child's own output in setting up language learning opportunities^[57].

2. What is the typical profile of speech and language development for children with Down syndrome?

This section provides an overview of the main ways in which children with Down syndrome may be different from the typically developing child. It is important to remember that no two children are alike and that there is just as much variability in the rates of progress and individuality of children with Down syndrome as there is among all children. This issue of variability is explored more fully in the next section of the article.

Early communication skills

Most babies with Down syndrome have good early non-verbal skills. They make eye-contact, look and smile a little later than the typical infant, but they are then very social. They like to communicate and enjoy smiling and babble games. This is a good foundation for being

social and wanting to communicate, which continues through life for most children^[58]. However, babies with Down syndrome are slower to move on to explore the physical world around them, both visually and by interacting with objects and toys. They are also slower at initiating those joint attention sessions that are so important for language learning.

They find it harder firstly, to maintain their attention on a toy or activity, and secondly to keep switching attention from one toy or activity to another. Research with babies with Down syndrome has shown that it is important to follow the babies' lead and to talk about what they are already doing and attending to. For example, in one recent study, the mothers of typically developing children who kept initiating new activities for the child, had children with bigger vocabularies later. However, for the babies with Down syndrome in the study, this strategy did not help them. In this group, the mothers who followed the child's lead and did not try to keep switching the child's attention had children with bigger vocabularies later^[59].

Gesture

Most children with Down syndrome from about 18 months of age begin to imitate gestures, learning to wave and to point, just like other babies. They will go on to learn more gestures and to use gesture naturally as they get older.

In addition, many children with Down syndrome will be frustrated by delay and difficulty in producing clear words, but will be able to learn specific signs to use instead of words at this stage (about 2 to 4 years). This will help them to communicate when they do not yet have the words that they need to convey their message or when their speech is not understood. The pros and cons of teaching signing at this stage will be discussed later in the article.

Talking - comprehension and production

Most children with Down syndrome are late in starting to talk. The average age for the first spoken word is about 18 months and for the first ten words, the average is about 27 months. Like other children, children with Down syndrome start using two words together when they have a productive vocabulary of about 50 different words. This occurs at around 37 months on average^[31/32/60].

After this progress is usually steady but slow.

The children begin to use three and four word sentences and to learn the grammatical markers and different sentence structures. However, most children with Down syndrome understand significantly more than they can say. Jon Miller and his colleagues, at the Waisman Centre, University of Wisconsin - Madison, USA, have carried out the most comprehensive studies of early vocabulary development in children with Down syndrome^{[17/61] [18/19/62]}.

Firstly, they have identified three profiles of early language development. One third (34%) of the children's profiles showed language production skills, which were at the same level as their language comprehension and non-verbal mental age measures. The majority of profiles (64%) showed language production skills lagging behind language comprehension skills, which were at the same level as non-verbal mental age measures. A small number of the children's profiles (2%) showed language production behind language comprehension, with comprehension behind non-verbal mental age.

Secondly, their data shows that as the children grow older, the proportion that show a gap, with production skills lagging behind comprehension, increases to some 85% or more.

So, for many children with Down syndrome, even the production of first words lags behind their comprehension of words more than it does in typically developing children. This is a very frustrating situation for the children and being able to sign at this stage may help them to communicate effectively. If they can indicate their understanding by signing, this will encourage parents and carers to keep talking and including them in conversations.

Speech

Most children with Down syndrome find all aspects of speech production difficult. While a number of studies indicate that babies with Down syndrome babble normally, they seem to struggle to say single words as early or as clearly as their typically developing peers. They then find producing three and four words in a sequence difficult. Even words that they can say clearly as single words, become less clear when produced as part of a sentence.

There are almost certainly many complex reasons for these speech production difficulties, most of them needing further research. However, it is likely that many, if not most, children with Down syndrome discover that they are more likely to be understood if

they use only two and three word utterances, increasing the chance of producing those words clearly enough for them to be recognised^[8/20/63].

These production difficulties will, in turn, influence input to the children. Communication needs a partner and it is likely that children who are not producing sounds and words are spoken to and included in conversations much less frequently than those who are. This will be a risk from babyhood right through to adult life.

Grammar and sentence structures

Most children with Down syndrome struggle to learn the grammar of their language. While they do begin to join words together when they have a vocabulary of about 50 words, like other children, they do not show the same progress with grammar when their vocabulary reaches 300 words. It has been suggested that this may be the result of difficulties with auditory processing and auditory short-term memory^{[9/10/64][51]}.

As children with Down syndrome get older their knowledge of vocabulary is usually ahead of their comprehension of grammar. In addition, as emphasised above, their production of grammar lags behind their comprehension of grammar. Many teenagers are still using phrases made up of the key words but without the function (joining) words or all the grammatical markers. For example, saying 'he sit chair' instead of 'he is sitting on the chair'. This is referred to as 'telegraphic' speech^[29/65].

Robin Chapman and her colleagues, also of the Waisman Centre at the University of Wisconsin - Madison, have carried out the most extensive studies of the development of speech and language skills in older children. Their data shows that most teenagers with Down syndrome are still making slow but steady progress with productive grammar as they get older. That is, they have not reached a ceiling^[66-69]. This view is supported by one of our intervention studies with teenagers, which provided activities targeted at production of grammar in sentences. This training over the period of one school year led to increases in conversational utterance length and grammatical complexity in the speech of the teenagers^[29/30].

Intelligibility

Unfortunately, the speech of many children and teenagers with Down syndrome is not always easily understood, especially when they are talking to strangers. This is largely the

result of poor speech clarity but it is probably also influenced by the telegraphic style as well. In a survey of 937 families in America carried out by Libby Kumin and colleagues, 58% of the parents reported that their children with Down syndrome frequently had difficulty being understood, whereas only 5% reported that their children rarely or never had difficulties^[3]. The majority of typically developing children are intelligible at four years of age. In a survey of teenagers with Down syndrome that we carried out in the UK, while 80% of the parents reported that they understood their teenagers most of the time, only some 30% reported that strangers could usually understand their children when they were out and about in the community^[70].

This highlights the fact that that parents and teachers, who are with the young people regularly, may be underestimating the communication difficulties that they will experience when trying to talk to people who have not known them long enough to become familiar with their speech.

3. How much do children with Down syndrome vary in their progress?

All research studies document a wide range of progress with speech and language development among children with Down syndrome. The data reported in a recent American study of 168 children published by Libby Kumin and colleagues in Maryland, USA, illustrates this wide range. This study documents the children's progress with total productive vocabulary and this includes words that are signed as well as those spoken. For example, while the average vocabulary in speech and sign was 168 at 3 years of age, the range was from 5 to 675 words for the children studied. Similarly, at 6 years, the average vocabulary was 468 words but the range for the children was from 57 to 652 words^[60].

By 5 years of age all the children were using multi-word utterances, 27% sometimes and 73% often. At this age, 54% were using plurals sometimes, 23 % often and 23% not at all. At 6 years of age, 60% were using the possessive 's' often and 33% sometimes.

In our teenage study, three out of 90 young people had no speech at all. For the 87 with speech, parents were asked about the length of utterance their teenagers used, as an estimate of productive grammar. While 70% of all the girls (at 11 to 17 years) and the older boys (14

to 17 years) regularly used sentences of five words or more, only half the younger boys did so. Conversely, 18% of the younger girls and 33% of the younger boys were limited to communicating in three word utterances or less, and 10% of the older teenagers were equally limited^[70].

We do not know enough about the reasons for this variability. Our own data^[70] and our practical experience suggests that some 85 - 90% of children with Down syndrome show similar profiles of development, as already described, with some progressing faster than others and achieving higher levels of functioning in adult life, just like the rest of the child population. However, some 10 - 15% of children with Down syndrome are significantly more impaired than the rest of the group and make significantly slower progress.

These children have often had additional medical problems and some have additional brain damage as a consequence, so are slower in all areas of development and remain more dependent throughout their lives. Some of this group seem to have more profound language learning difficulties.

Autism

A few children with Down syndrome show autistic profiles and these children do not have good non-verbal skills such as eye-contact or smiling and they are not keen to communicate^[71/72]. In our experience, some children who appear 'autistic' in later childhood did have typical early non-verbal skills but did not go on to develop sign or speech and slowly become more withdrawn and 'autistic' over time. Some of these children are the ones with the more severe hearing losses (greater than 60 dB). In our view, the dual diagnosis of autism is being made too often and is only real in about 3 to 4 % of children. Most of the children being labelled autistic have severe communication difficulties which could be improved and they do not have some underlying fundamental autistic social impairment.

Dyspraxia

Other children in the more speech and language delayed group are those with unusually severe speech production difficulties, which we would define as dyspraxic. Often these children do not have delayed comprehension early on, at the first word stage, but if they have very great difficulty making sounds and then words, this will have a significant impact on their experience of

communicating and rate of language learning. Most of these children make slow but steady progress with speech during primary school years. It is important that the children with dyspraxic difficulties are identified as early as possible and that they receive more intensive and specific speech therapy.

4. What does recent research tell us about the possible reasons for the delays and difficulties with talking experienced by most children with Down syndrome?

If we are going to try and improve the development of speech and language skills for the children we need to identify as many of the specific reasons for the above characteristics as possible. We have some pointers but by no means a complete picture of the causes let alone their interactive effects on the children's progress.

Hearing loss

There are consistent reports highlighting the high risk of mild to moderate hearing loss for children with Down syndrome^[73]. This is usually conductive loss due to glue in the middle ear and therefore fluctuates over time. It affects up to 70% of children in their early years^[22]. There is also an increased likelihood of sensori-neural loss and this will have a permanent effect on hearing ability. In my view, the significance of this high incidence of hearing loss on language learning is still underestimated. The long-term effects of glue ear are also not trivial. Michael Marcell and colleagues have demonstrated that as many as 40% of young adults may have permanent middle ear dysfunction and that these young people have poorer speech and language skills than those without the loss. Not only was their language knowledge less, they were also impaired on immediate speech recognition tasks^[74].

Auditory discrimination

In our practical experience, we see children who have difficulty in discriminating between similar sounding words, such as 'dolly' and 'lolly', 'red' and 'bread', 'horse' and 'sauce' even when their hearing is within normal limits. This will make it very difficult to learn to understand the words that they are hearing as toddlers and slow up vocabulary comprehension.

These examples are taken from one of our children's case histories. He wanted to use a single sign for each pair of words although he

could demonstrate comprehension of the different meanings. We could conclude that he was only hearing 'olly', 'ed' and 'orse' for each of the pairs and he must have been very confused by the adult language system. To him it must have seemed as if we have one word for very different things! We suspect that this may be a common experience for children with Down syndrome. Imagine how much more difficult this would make language learning.

Auditory short-term memory

This is the system which holds incoming sensory information long enough for the brain to process it for meaning - not to be confused with long term memory which is not generally impaired in persons with Down syndrome. The capacity of this auditory short-term memory system can be measured by finding out how many digits, said in random order at the rate of one per second, a child can repeat immediately in the same order (digit span). Typically, this digit span increases during childhood from about 3 digits at 4-5 years to 6-7 digits at 16 years^[75/76].

Research has indicated that this system reflects the listener's efficiency at speech perception and speech production, and children usually get quicker at recognising and reproducing speech as they get older as a result of practice. Children's spans at any age therefore, are approximately what they can say in 2 seconds. Research has shown that the efficiency of this auditory short-term memory system influences the speed at which children learn new vocabulary and learn to read. It is also thought to play a significant role in the processing and comprehension of speech and in organising speech production^[49/76].

For children with Down syndrome, short-term memory span is not usually increasing with age at a typical rate and most teenagers and adults only have spans of 2 to 4 digits^[29/30/77-80]. The research on its significance in typically developing children indicates that this will delay vocabulary learning. It might be predicted to have an even bigger negative effect on the children's ability to master grammar as this will usually require the ability to hold a whole phrase or sentence in short-term store in order to process it for meaning.

These first three points can be summed up as indicating that learning language from listening, the way most babies do, will be difficult for children with Down syndrome.

Speech motor difficulties

The unclear speech of most children is likely to be due to a number of difficulties ranging from less effective operation of some or all of the brain mechanisms needed to plan and organise speech production to difficulties in moving the oral facial muscles and tongue with precision^[4/8/20/81/82]. Even if these speech mechanics work effectively, the children may be having difficulty in hearing speech sounds and word patterns clearly enough to establish good templates to guide their production.

Learning interactions and opportunities

The evidence that babies with Down syndrome are not quite so good at initiating joint attention sessions, maintaining attention on the task or switching attention between tasks suggests that they will need carers who are aware of these issues and who plan to compensate for them. Later, everyone needs to be aware and try to compensate for the delayed and limited production of speech, recognising that this is likely to reduce the quality and quantity of opportunities to learn and to practice language and communication skills.

5. Does the research provide any guiding principles that should inform intervention activities for children with Down syndrome?

Hopefully, all readers will agree that the information presented so far suggests that all children with Down syndrome will benefit from specific attention to their language learning needs. Many of the issues identified can be addressed with targeted remedial strategies. While the literature is full of studies that describe the delays and difficulties observed in the children's speech and language development, and a small number which try to identify the reasons, there are very few studies which have evaluated the effectiveness of speech and language interventions. There is an urgent need for further research in this area, but meanwhile the best we can do is to plan interventions to target the areas of difficulty that we know about at present.

This section sets out the principles which can be drawn from what we know influences language learning in all children and from what we know of the specific difficulties that are likely to be experienced by children with Down syndrome. The principles are set out in developmental order, but many apply at all ages and these are discussed first.

At all ages

Consider all aspects of speech and language skills. At any age, it is important to consider the child's needs in each area of language and to work on them simultaneously. That means thinking about speech, vocabulary, grammar and communication skills. Typically, vocabulary and communication skills will be relative strengths with grammar and production lagging behind. However, that does not mean that vocabulary learning and communication skills are to be neglected.

Increase the quality and quantity of daily communication. Try to include babies and children in as much social communication as possible. Create opportunities to engage each child in conversations, remember to listen and encourage the child to share his or her experiences. The more the child joins in conversations, the more speech practice he or she is getting to improve articulation and clarity. He or she will also be gaining more opportunities to learn new vocabulary and grammar.

Try not to be too ready to prompt or to repeat utterances for the child. Try to expand and extend the child's contribution to the conversation. As children get beyond the one-word stage, remember to ask open questions such as 'what would you like to drink?' rather than closed questions such as 'would you like milk or orange? We often become too helpful and make it easy for the child to get by with one and two word utterances, when they could be doing better with a little encouragement.

Be patient and listen. Information may be processed and understood more slowly. Right from babyhood give children and adults with Down syndrome more time to respond, do not rush them and learn to listen. Give them time to organise what they want to tell you and do not keep prompting.

Multi-sensory input is needed - learning from listening only is not effective. Use signs, pictures, reading and symbols to aid children's understanding of words and sentences.

Work at each child's own pace - remember that children with Down syndrome vary widely in the level of difficulties that they experience, in all areas of their development. This is a very difficult issue as we do not want to set expectations too low or too high. In the past, most children have suffered from low expectations and few learning opportunities. Our advice is to follow the child's lead. All

children progress through the stages of speech and language learning in the same order within each domain (communication, vocabulary, grammar, speech) even though progress in one domain may be ahead of another. Therefore, we start with activities suitable for the child's present stage in each domain and try to make all the learning fun. We need to think up as many activities as we can which keep the child engaged and interested in communicating and only move on once each step has been mastered.

Take account of hearing loss. Given the high incidence of hearing loss for children and adults with Down syndrome, the possibility of hearing loss needs to be taken account of in all situations - at home and at school. Regular hearing assessments should be the norm, every 6 months up to school age and then annually. Quiet environments will greatly reduce the difficulties experienced when listening to speech, so remember to turn off the TV and radio. Try to speak clearly, at reasonable volume and to be where the child can see your face. At school, sit the child at front of class. If a child has a loss of 40dB or more, then the advice of a teacher for the deaf will be valuable, at home and at school. It has been suggested that removing cow's milk from children's diets reduces the incidence of glue ear and runny noses and although there are no scientific studies to confirm this, in our experience it is often helpful.

Hearing aids may help some children but the benefit must be monitored to ensure that the child really is hearing more effectively.

Expand vocabulary. At any age, children should be learning new vocabulary (we have already identified that words = world knowledge). A child with a wide vocabulary and confidence will be able to communicate quite successfully even with limited or immature grammar.

Infancy

Pre-verbal communication skills - encourage eye-contact, smiling, singing, babbling and talking to babies from the first month of life. Follow the baby's lead as much as possible and talk about what the baby is doing, looking at or playing with. Encourage joint attention sessions and try to keep the babies' attention on task to build up the length of attention on an activity.

Speech - from infancy activities that will lead to clear speech need to be a concern. Many aspects of the babies' development will have an

influence on later speech skills. Encourage good feeding, sucking, chewing, drinking and breathing habits. Encourage mouth closure and nose breathing (use of dummy may help, but only when baby is not socialising). Reducing general floppiness or hypotonia, e.g. working on gross motor skills and muscle tone will help.

Encourage looking, listening and copying.

Smiling, babble games, and engagement with others will all keep the face mobile and active and exercise oral-facial muscles. Auditory discrimination training for speech sounds can begin early, in babble games and then in specific sound practice activities. Try to work on sounds, encouraging babies' to copy sound and sign from 18 months of age. We have published Sound Cards for this activity and they are very popular with parents and infants. The babies respond to them and learn to imitate much earlier than most therapists expect them to. Encourage babies to watch lip movements, they can do this from 18 months also, and will copy the mouth shapes that they see. Singing games, working on words and sounds, can be fun and a good way to engage babies and toddlers.

Imitation seems to be an important milestone,

in gesture and in speech. As well as encouraging particular new sounds, imitate the baby's sounds and babble. Later repeat and expand babble and first attempts at words. This is rewarding for the baby as he or she is taking part in a 'conversation' that they have initiated. The baby is also hearing a more accurate version of the sound or word they are trying and you are giving it meaning. Once the child begins to imitate, you can encourage practice.

Signing - we encourage all parents to learn to sign from 7/8 months of age. We stress that we are using sign to support the development of spoken language. We explain that evidence shows that children with Down syndrome do not learn words easily from speech input on its own^[83], and that those who have been in sign supported therapy programmes have bigger spoken vocabularies at 5 years.^[17/21/60]

Practitioners have advocated the use of augmentative signing with babies with Down syndrome since the early 1980's^[28/84] and evidence for its effectiveness has accumulated slowly. It can help in a number of ways. If parents sign as they speak, they make sure the baby is looking, the sign holds the baby's attention and it gives an added clue to the meaning of the words. Parents are also likely to

stress the words they are signing. In other words, signing may help to structure more effective language learning situations.

For infants, signing can increase their productive vocabularies as they can usually sign words before being able to say them. They know what they want to say but cannot yet produce the words. At this stage, signing keeps effective communication, and therefore language learning, going at a much greater rate until speech comes. This will reduce frustration and increase communication opportunities. However, it is essential to keep up activities to encourage sound and speech production alongside the use of signing, if children are to move into using spoken words as early as possible. In our experience, most children are able to drop the use of sign slowly from around four to five years of age, though they should not be discouraged from using sign at any age as a repair strategy when their speech is not understood.

The potential ways in which signing may assist speech and language skills in people with Down syndrome warrants more sophisticated analysis than we have available to date as one study illustrated that the speech clarity of adults with Down syndrome improved when they signed as they spoke^[85]. I have heard many individual case examples from parents and practitioners which indicate that signing often helps the child with Down syndrome to find the word they want and to speak more clearly. Signs for sounds have helped production of initial and end sounds in words and signs for grammatical markers can help to teach grammar.

Early childhood Vocabulary learning

All sorts of games can be played to support vocabulary learning. Finding, matching and sorting real objects, doing the same with picture cards and learning from picture books. These activities provide the opportunity to give children many more opportunities of hearing a word and associating it with the correct meaning than will occur naturally during the course of the day.

The natural opportunities for drawing the child's attention to the language being used in every day interactions are equally important. Speak clearly to children at all times, describing what they are doing or interested in and involving them in the conversation. When teaching vocabulary, remember to teach some verbs, adjectives and pronouns as well as

nouns. If a child only has nouns i.e. names for people and things, he or she cannot move on to put two words together. Two word utterances need nouns plus an adjective or verb - 'red car', 'big car', 'car gone', 'baby sleeping'. At the two-word stage, symbolic play activities can be a good way to introduce more verbs, adjectives and prepositions, and to use them in two and three word utterances. For example, home games with dolls and teddies provide opportunities to 'give dolly a wash - cuddle - drink', 'put dolly to bed - on the chair - in the pram'. Try taking turns with the child, so that he or she can have fun asking you questions and giving you instructions.

Remember that comprehension comes before production, especially for children with Down syndrome. It is very important to continue to expand the number of words that children understand even though they cannot say them, if we do not want to hold back cognitive development, that is world knowledge, thinking and reasoning and remembering. The child's understanding can be checked by asking them to choose the right picture or object from a choice of items for verbs and adjectives, place things correctly for prepositions and act out themselves or with toys for verbs. We encourage parents to keep a list of the words that their child a) understands, b) signs and c) says. It is important to go at the child's pace and to be sure that he or she is really understanding and responding at each step. Plenty of fun repetition from playing games, singing rhymes and reading stories will help the learning process.

Grammar needs to be taught

All the evidence indicates that few children with Down syndrome will learn grammar easily from just listening. The main reason for this may be the slow development of auditory short-term memory spans. Learning grammar involves the processing of sentences rather than single words and this will be very difficult for most children with Down syndrome. There are many ways in which various aspects of grammar can be taught - games to teach singular/ plural, possession, pronouns and prepositions, are not difficult but we would argue that reading is the most powerful way to teach grammar^[86/87] once children have reached a two-word stage in comprehension.

Take account of auditory short-term memory

As with every possible barrier to learning, we try to think of ways to reduce the barrier and ways to go around it. So we would consider both ways of improving memory span and ways

to reduce the demands on short-term memory.

Our research suggests that memory training activities and games can improve short-term memory spans and that the gains can be sustained^[88-90]. Examples of the activities used and a book describing the principles can be obtained from The Sarah Duffen Centre. The memory card games available in toy shops will also help and there are also computer programmes available now, based on the research on working memory.

While specific memory games may help, encourage children to be active memorisers as they go about their everyday activities, do not always step in and organise them. For example, expect the child to remember what he or she needs for school, may be starting with a picture prompt card for the items. This approach can be used to help the child remember the order of events and lessons in school. Active remembering strategies such as rehearsal of information can be practised for all school learning, from single, two and three word phrases, to learning printed words, spelling, telephone numbers, addresses, days of the week, birthdays, class names. Remember to make the items visual in picture, print or symbol form to support the memorising. Try not to use long, complicated spoken instructions, particularly in school. Make instructions visual with a book - using symbols or print for daily routines, completing class activities and things to remember from home.

Build on visual processing strengths

The computer is an ideal teaching/learning aid. Visual processing and visual memory skills are strengths (compared to auditory processing and auditory memory skills) therefore visual cues and information will be retained better. The computer builds on these strengths. New and better computer programmes for children are appearing all the time and many children with Down syndrome enjoy using computers from an early age. It can be a good way to build confidence, concentration and independent working - at home and at school.

Teach reading

Teaching children with Down syndrome a sight vocabulary should be a routine part of speech and language therapy and a priority in all early intervention and education programmes^[25]. Learning to read will help vocabulary learning and it will particularly support grammar and sentence learning^[30/47/87/91-94]. Three to four years of age is the optimal time to start for majority of children, 2 years for some, later for others. Once a child has a comprehension vocabulary

of about 40 to 50 words and can play picture lotto games, that is match, select and name pictures in speech or sign, reading should be introduced^[95].

Teach sight words and sentences first - it is important that the child 'reads for meaning'. Reading is a language activity - you decode written language for meaning as you do speech. Choose words based on child's own language learning stage/ needs (and with thought for speech sounds also) and build multi-word utterances from the start. A child with a 40 to 50 word vocabulary is about to start putting two words together and learn grammar, so teach him or her to read some of the verbs, nouns and adjectives that he or she is already understanding and using. Then make two word phrases such as 'mummy sleeping', 'cat sleeping', 'dog gone', 'daddy gone', 'big ball', 'red bus'.

Production of multi-word utterances and sentences with correct grammar can be greatly assisted by reading print or symbol sentences.

Make reading fun and interesting by making games and personal books about child's own family and activities. Read along with the child, they do not have to be able to read every word in sentences for themselves. They will soon learn the unfamiliar words and the function grammar from the repetition, if they enjoy sharing the books with you.

Remember that only a small sight vocabulary (40 or 50 words) can be used in short sentences to considerably improve a child's spoken sentence length and speech clarity. Use vocabulary about the child's own world so that you can improve his or her ability to talk in their everyday world, about the things that they are doing, did, are going to do, are interested in and want to talk about with others at home or at school.

Reading supports speech practice and can improve articulation. Teaching a sight vocabulary, choosing words with different initial sounds, sound patterns and number of syllables, will help to build speech practice. The sounds and word patterns become visual - clues to how to say the sound or word - even for children who do not know the letter-sounds. Once letter-sounds are known letters can be used to support practice. Letter-sounds can be taught from 3 years of age for some children, in order of usual emergence, but we do not encourage the explicit teaching of phonics before a child has a 40 to 50 word sight vocabulary and is reading words and sentences for meaning.

Storytelling

Encourage children to tell stories from 5 years of age - to make simple books, to narrate activities that they are engaged in. Narratives have been shown to produce longer, more complex utterances in teenagers. Work on verb use and on function grammar in sentences as children get older. Start extending children's two and three word utterances to shortest grammatically correct sentences as soon as possible - in talking and reading from 4 years or even earlier.

Practice at talking

The single most important piece of advice that we can give any parent or teacher is to keep talking with their child - about what they are doing, seeing or interested in. Language is learned in every day social interactions with others and the more we talk, the better our speech rate, clarity and fluency become. ALL MENTAL SKILLS IMPROVE WITH PRACTICE as we use them everyday in childhood, including thinking, reasoning, remembering and talking. A considerable amount of the speech and language delay and difficulty seen in most children and teenagers with Down syndrome could be explained by lack of practice. The amount of talk that they are engaged in since infancy is probably less than 10% of that of a same age non-disabled child (even a shy one). This means dramatically reduced language learning opportunities and speech practice opportunities.

Social interaction

Engaging babies, children and adults in as much conversation as possible is the most effective way of improving their speech and language skills as well as their social competence. Properly planned and supported inclusion in mainstream school, providing a normal language environment and competent role models, is essential for optimal development.

6. What are the practical implications of this research for those caring for babies, toddlers, preschoolers, children in primary school, junior school, secondary school or college?

Keep talking

First it is important to remind ourselves that language learning takes place all day, everyday as we talk to children and they join in the conversations. The most effective way to make use of the information in this article is by absorbing the principles into your ordinary

daily activities and play. Remember to speak clearly and to encourage eye-contact with children with Down syndrome. They need to be looking and listening. They will also be helped by visual cues in sign or picture. Remember also that background noise will make listening much more difficult for them if they have any hearing loss. Small rooms help, turn off the TV and radio and sit children near the front of the class.

We are striving for normality plus

It is not enough to just treat children with Down syndrome like other children. We want them to have all the same learning experiences, but they will need scaffolding and supporting to benefit fully from them. Small children spend more of their waking hours with their families than elsewhere, and at all ages we believe that parents are the best speech and language therapists once armed with the appropriate information. Parents need the continuous support of expert practitioners to help them in this task.

Speech and language therapy

It is clear from the evidence reviewed that children with Down syndrome will benefit from speech and language therapy from birth to adulthood^[23/25/26]. Ideally, this should be on an individual basis in the first months of life, as parents are adjusting to the new baby, and may have many questions to ask. However, in our experience, offering group sessions can be a very effective way to support parents and children in the pre-school years. In a group, parents benefit from the opportunity to share their experiences and gain information and emotional support from one another. Group services are cost effective and make good use of professional time, especially as speech and language therapists are often a scarce resource. From 18 months of age, children with Down syndrome are capable of 'working' in a group and they benefit from the social interaction and the models provided by the other children.

We offer fortnightly groups for parents of children from birth to five years. During the 2 hour sessions, parents can discuss individual issues with each other and a therapist during an informal first hour, while the children play. In the second hour, we model activities with the children, which parents are then encouraged to continue daily at home. From 18 months of age, the children work as a small group of 5 to 7 children with the therapist. The key to holding their attention and keeping them engaged is to be prepared with a variety of activities for speech and for language work.

We end with songs and a story. The children learn to sit, take turns and attend, so that we are building social skills and learning skills as we progress, as well as speech and language skills.

Parents book places in the groups and pay a small contribution towards the cost. We ask them to commit to attending regularly for a term at a time. Since we made these formal requirements, the demand for the groups has grown.

We try to share as much of our knowledge and skills with parents as possible, as they are the ones who can have the biggest influence on their child's progress. In addition to sharing knowledge at the group sessions, we also run workshop days for parents when we can discuss the research on Down syndrome and language learning in more detail. We provide our book and videos as additional resources to be shared with the rest of the family at home.

Early intervention and home teaching

In many communities, families with a child with Down syndrome will receive a home visiting teacher during the preschool years. Teachers working in these services need to be fully informed about the child's speech, language and cognitive development. It is during the pre-school years that typically developing children master their native language and these years are probably critically important for language learning in all children. We would build the pre-school curriculum around language development, as we see language and cognitive development as inextricably linked. With all children, adults use words for everything they want to teach children, in addition to modeling activities.

Psychologists have described the way in which all children's learning is socially mediated or scaffolded, that is by the way that parents and others model how to play and how to achieve the next step with children^[38/96]. We would suggest that this scaffolding or modeling of learning is even more important for children with Down syndrome. For example, we would teach symbolic (imaginative) play by modeling it and taking turns with the child in the game, while talking about the activities as we go. The use of two words together is considered to be linked to the first stages of symbolic play and we sometimes hear that parents have been told that they have to wait for the child to show this kind of play before they can encourage two word speech. In our view, both the play and the language can be taught together and

we think that waiting, on the assumption that some sort of cognitive maturation is going to take place on its own, is unwise. We prefer to continue to scaffold all aspects of the child's learning and development.

Once children are in nursery or school, we would encourage speech and language therapists to spend time training school staff so that they understand the children's speech and language needs. It is important that those working with young children can sign and this does not need to be too demanding. Teachers and other children can learn the sign vocabulary for an individual child with Down syndrome (50 to 100 signs) relatively easily in our experience.

Once a child is in school

In the UK children start full time school at between four and five years of age. If a child with Down syndrome is joining a mainstream class, it is important for the teacher to understand that he or she is significantly delayed in speech and language. The typical child with Down syndrome will have about a 500 - 600 word comprehension vocabulary and be speaking in mainly two or three word utterances. He or she will understand more than they can say and so comprehension may be underestimated.

Speech and language is central to all learning and the stage of the child's speech and language development will influence all aspects of the curriculum. One of the areas most affected will be literacy. Teachers need to understand that the child's reading programme needs to take account of his or her language level so that the child can read with comprehension. They also need to understand that reading activities, in turn, can be used to teach more vocabulary and grammar, to support speaking in sentences and to improve articulation. The regular support of a speech and language therapist can be invaluable in helping to make maximum use of literacy instruction in this way. (However, for all those teachers reading this article who do not have the support of a speech and language therapist, if you follow the child's interests and you make books using short sentences building from what the child can already say and/or sign, you will be on the right track).

Throughout school years and into adulthood, most children and young people with Down syndrome can still be helped to improve their speech and language. Many could improve their articulation and therefore speech

intelligibility, with the right help. There are recent examples of both parent focused and clinic based speech programmes working. In one, parents received training and specific activities to help them work with their own children^[97]. In the other, children and teenagers attended specialist sessions with a therapist. In this study, as speech production improved, the young people began to use longer and more grammatically advanced sentences^[98].

Social experience and friends

Most of us developed our speech, language and conversational skills as we played with friends and were absorbed into everyday activities with them. We need to be socially confident and to have friends in order to have the maximum opportunity to develop our conversational skills. So, my final piece of advice is to try to create as many social opportunities as possible where your child can join in with disabled and non-disabled friends. Conversations among same age friends are different to conversations between adults and children and both are equally important. In school, teachers need to think about the child's social inclusion. It is not easy for all children with Down syndrome to make friends and join in the usual chatter and play of the other children. Bear in mind that too much adult support may actually make an additional barrier between the children. Good adult role models will help the other children. If the teacher and assistant communicate effectively and can engage the child with Down syndrome in communicating, in sign or speech, then the other children will be more confident and pick up on the role models.

In conclusion

I hope that I have convinced all readers that there is much that we can do to overcome or reduce the many barriers to effective speech and language for children with Down syndrome. I hope that I have provided some practical guidelines that can be absorbed into the every day practices of parents and teachers. Just as we were going to press, I received a review copy of a new book called *Improving the communication of people with Down syndrome* edited by Jon Miller, Mark Leddy and Lewis Leavitt of the Waisman Centre, University of Wisconsin-Madison. This book is full of optimism. Like me, these authors and their colleagues believe that most children and adults with Down syndrome could considerably improve their speech and language skills. The book will be an invaluable resource to speech and language therapists, parents and teachers and I have been able to

add its chapters to my references and to the list of recommended resources available from The Sarah Duffen Centre.

We have listed the practical resources that we currently recommend at the end of the article and we are increasing the range of workshops and training opportunities on speech and language issues during the next school year. These are listed on our new schedule in the conference section.

I would like to acknowledge the contributions of my colleagues, especially Gillian Bird and Pat Le Prévost, to the information and ideas expressed in this article. I would also like to thank all the parents and children who continually contribute to our knowledge as they participate in our services and research programmes.

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