Parents and teachers often hear that children with Down syndrome (DS) are visual learners who find learning from listening alone difficult. Information presented visually is easier to understand and remember than information presented solely in verbal form. Why? Research suggests working memory may play a role.¹

WHAT IS WORKING MEMORY?

Working memory describes the mind’s “mental workspace” or the system responsible for temporary storage and manipulation of visual and verbal information. The working memory system is based on a model that identifies three interlinked components: central executive, verbal short-term memory and visuo-spatial short-term memory. The central executive directs attention and is involved in higher-level mental activities that require coordinating storage and processing, such as mental math. The two other components temporarily store different types of information. Verbal short-term memory stores information you hear or that can be expressed in spoken language, such as words and numbers. And visuo-spatial short-term memory stores information you see, such as shapes, colors or the location of objects in space.²

WHY SHOULD WE CARE?

Working memory is important for a wide range of skills, including organizing, concentrating and problem-solving. For young children, working memory is involved in speech and language development and following directions. In elementary school, working memory impacts reading comprehension, the ability to listen to a teacher and stay on task, mental arithmetic and writing. In junior high and high school, working memory directs attention for finishing projects, prioritizing activities and handling conflicts.³

It is well accepted among researchers that short-term and working memory function is impaired in children with DS. It is also known that visual short-term memory skills tend to be less affected than verbal (or auditory) short-term memory skills.⁴ Hence, the traditional intervention has been to focus on teaching with visual support and to minimize strategies that rely solely on auditory input (i.e., show it, don’t just say it). But is there more we can do? Researchers at Down Syndrome Education International suggest the following activities and interventions to support improved memory function and enhanced learning.⁵

WHAT CAN WE DO?

• Get routine hearing tests.
  Make sure your child can hear. If she has a hearing loss, consult your doctor about medical options (such as using ear tubes or hearing aids) and non-medical options (reducing background noise, speaking clearly and enunciating consonants). If she has a hearing loss, she will not be able to establish clear representations for spoken words or discriminate consonant sounds. Hearing loss may impact her speech, language and memory.
• **Engage in literacy activities.** Research shows that children who engage in reading instruction have better verbal and visual short-term memory spans. Create a language-rich and language-demanding home with plenty of opportunities to practice reading, phonics, spelling and writing. Read aloud to your child and have him read aloud to you. Have him practice reading grammatically correct sentences to help memory for longer sequences of information and to improve speech production and clarity.

• **Play games to improve phonemic awareness and sound discrimination.** So your child knows the difference between rhyming or similar sounding words, plan activities to help her develop letter sound knowledge and discrimination skills. Developing these listening skills helps her with reading, writing and memory. For younger children, you might play the “sound-word” game, in which you move through the alphabet saying each letter sound and a word that starts with that letter (e.g., “a-acorn, b-bear,” etc.). Your child may also have fun playing a “show me” game, in which you display two or more rhyming objects and ask her to “show you” one object (e.g., dog and frog are showing, say “show me the frog”). For older students, games can be more challenging. “I Spy” games in which you spy objects that start with a chosen letter sound or rhyme with chosen word can be fun. (“I spy something that rhymes with floor.” The answer might be “door.”). 

• **Use games to improve attention and increase processing capacity.** Give your child activities that require him to pay attention and process information. Playing board games, coloring or painting, using Play-Doh and even reading a book together all require focused attention. If he has trouble paying attention, start with short, high interest activities. Move to longer activities as his attention span increases. Also, give him opportunities to make choices. Holding information in mind while making a decision builds processing capacity, so let him choose between food items, clothing, books and games. Start with a choice between two items (“Would you like crackers or an apple?”) and move to choices between more items (“What game would you like to play?”).

• **Practice remembering activities.** Help your child build memory with remembering activities. Younger children can play games in which objects are hidden or removed. In a “Where did it go?” game, you show her one to three items, then hide the item(s) under a cloth or cup and ask her to find it/them. In a “What’s missing?” game, you show her a group of objects, she closes her eyes, and then you remove one object. She must identify what is missing. In addition, children of all ages...
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can play memory pair or concentration games. Simply vary the number of pairs to match a child’s age and ability.

**Conduct rehearsal training.** Rehearsal training refers to a wide range of activities designed to teach children to remember information in the order presented. For example, if a child sees pictures of a bird and a hat, he works on rehearsal training when he is asked to say the name of the pictures in the order shown — first bird and then hat. Rehearsal training can be conducted with information presented visually or verbally. For younger learners, start with visual picture cards. Show two picture cards and say or have him say aloud the name of the item depicted. Then, turn the cards over and ask him to recall the pictures in the correct order. As children become more comfortable and confident with tasks, you can move to information presented verbally. Since information presented verbally will be more difficult to recall, be patient. Start with recall of only two or three words or numbers.

Many of these activities can be created from items and objects you already have in your home. However, commercially available products are also available to support development of many of these skills. For more information on memory activities, contact Down Syndrome Foundation of Orange County at info@dsfoc.org.

**WRAPPING IT UP**

Educational interventions follow research. As researchers learn more about short-term and working memory function in children with DS, we can create appropriate supportive interventions. Hopefully, these targeted activities will help improve memory function and result in improved academic outcomes.

Try some of the ideas and activities outlined above and let us know if you see improvements.

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To read more about memory development or for additional ideas for working with your child at any age, visit Down Syndrome Education International at www.down-syndrome.org. DSEI is in the process of developing materials for See and Learn Memory, expected to launch in late 2012.

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Editor’s note: Dana Halle, J.D., is the parent of 13-year-old Nick, who has DS; executive director of Down Syndrome Foundation of Orange County; and developer of The Learning Program™, a nationally-recognized program that delivers evidence-based educational support to children, parents and teachers. Halle also is vice-president of Down Syndrome Education USA, a U.S. non-profit affiliated with Down Syndrome Education International, a recognized world leader in scientific research into early intervention, education and cognitive development for children with DS. At the NDSC Convention in Washington, D.C., Halle will present a preconference session and five workshops, including one on working memory.

**ENDNOTES**


3 www.cogmed.com


5 Buckley, Sue and Bird, Gillian, *Memory Development for Individuals with Down Syndrome*.

6 If you use an iPad, iPod Touch, iPhone or tablet with your child, there are many applications to help build memory skills. Additionally, sound discrimination games, picture flash cards and other helpful tools are often available at Target and local teacher supply stores.