Why All The Fuss About Short Term & Working Memory?

Introductions and Information

- Dana Halle
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  - Lawyer/Developer of The Learning Program™
  - Mom to Lauren, Patrick and Nicholas

- Parents – ages of children?
- Teachers – grades? Therapists?
- Currently work on memory?

- Questions welcome within reason
- Available after session
- LP Email Group

Take-Away Points:

- Basic understanding of STM and working memory
- Research relative to children with Down syndrome
- Activities to build & support memory
- Classroom interventions
- Resources
Why Talk About Short Term & Working Memory?

- Area of recent interest, attention and research
- Provides understanding of some learning challenges faced by students with Down syndrome
- Guides us towards interventions that may improve our children’s ability to learn and to process the world around them

What Is Working Memory?

- The ability to keep information in your mind for a short period of time – seconds - and be able to use the information in your thinking
- A system for **temporary storage** and **manipulation** of information necessary for a wide range of cognitive tasks

Working Memory Impacts Daily Life

Working Memory is used for:
- Problem solving
- Remembering tasks
- Concentration/Attention
- Organization

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## Working Memory Impacts Learning

<table>
<thead>
<tr>
<th>Age</th>
<th>Working memory needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-school</td>
<td>Learning the alphabet&lt;br&gt;Learning to talk&lt;br&gt;Focusing on short instructions like “come brush your teeth”&lt;br&gt;Remaining seated to complete independent activities (puzzle)&lt;br&gt;Listening to and following directions</td>
</tr>
<tr>
<td>Elementary School</td>
<td>Reading and understanding the content (comprehension)&lt;br&gt;Mental arithmetic&lt;br&gt;Writing while formulating next part of sentence&lt;br&gt;Interacting and responding appropriately in peer activities (group projects/recess)</td>
</tr>
<tr>
<td>Middle School</td>
<td>Doing homework independently&lt;br&gt;Planning and packing for an activity&lt;br&gt;Solving multi-step math problems&lt;br&gt;Participating in team sports</td>
</tr>
<tr>
<td>Adults</td>
<td>Getting to work on time, prioritizing activities, handling conflict</td>
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</tbody>
</table>
Working vs. Long-term Memory

- Different systems
- Long-term memory stores information for hours to a lifetime
- Types of long-term memory include:
  - **Episodic**: details of experiences, events & life (what you ate for breakfast or wore yesterday)
  - **Autobiographical**: basic personal facts and major lifetime periods (name, information about your family, schools attended)
  - **Semantic**: stored knowledge about world, things you simply know or learned long ago
  - **Procedural**: actions or skills learned through practice that become automatic (walking, riding a bike, whistling, driving a car)
- **IMPORTANCE**: Can use long-term memory to supplement weak working memory

Working Memory Model - System of Interlinked Components

- Central Executive
- Verbal short-term memory
- Visuo-spatial short-term memory

Verbal STM – stores any material with a verbal label – (words, sentences, numbers)

- Presented verbally, visually or both
- Also called phonological loop

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Working Memory Model - System of Interlinked Components

- Central Executive
  - Coordinates storage and effortful mental processing

- Visuo-spatial short-term memory
  - Also stores shapes, orientations and patterns of movement.

- Verbal short-term memory

Visuo-spatial STM – stores images, pictures, information about locations.

No link between visuo-spatial and verbal STM – can't communicate directly.

They store information in fundamentally different forms.

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How Do You Measure It?

- **Automated Working Memory Assessment (AWMA)**
  - Newer, simple and reliable measure of all significant elements of working memory, computer-based program

- **Forward digit recall** (avg. 7 units)
  - must store and accurately reproduce material in same order (measures verbal STM)

- **Backward digit recall** (avg. 4-5 units)
  - must store, reverse the order and recall (measures working memory because have to manipulate numbers)

*Limits to these types of assessment (number based and only relate to information stored in verbal short term memory)*

More Ways To Measure

- **Picture, Word or Nonword recall**
  - similar to digit recall but using pictures, words or nonwords (measures verbal STM)
  - can be presented verbally or visually

- **Pattern recall**
  - recall order of presented pattern (measures visuo-spatial STM)

- **Corsi blocks task**
  - must recall order in which blocks are marked or tapped (measures visuo-spatial STM)

- **Reading Span**
  - listen to sentences – tell true/false and last word of sentence (measures working memory)

- **Odd Man Out**
  - Which shape different and where was it on the page (measures WM and VS STM)

Crazy Slide – Measurement Overlap
WM Development - Additional Facts

- Working memory capacity increases with age to about 15 years old
- Large variations between individuals
- Ability to pay attention and shut out distractions is important to WM
- Also important is ability to shift attention between activities

What Does Research Show?

- Specific impairment in auditory STM
  - Means processing verbal information is more difficult
  - Makes learning from listening more difficult
  - Impacts vocabulary and sentence learning
  - Believed to explain some of the speech and language delay

Source: DSE International, Dsii - Memory Development for Individuals with Down syndrome

Contributing Factors?

- Hearing loss and weak sound discrimination provides poor information to store
  - If can’t hear – can’t store
- Impairment in phonological loop - verbal storage function
  - If can’t capture – can’t recall
- Less vocabulary = harder to rehearse and recall
  - Harder if unfamiliar with info
- Slower retrieval from long-term memory or slower speech rate
  - May lose some recall because takes longer to rehearse
- Lack of rehearsal strategies
  - Harder if unfamiliar with info
What Does WM Deficit Look Like?

- Is easily distracted when working on or doing something that is not highly interesting.
- Struggles with reading comprehension and has to read through texts repeatedly to understand.
- Struggles with problem solving that require holding information in mind, for example, mental math calculations.
- Is inconsistent in remembering math facts.
- Struggles with completing tasks, especially multiple step tasks.
- Has difficulty remembering long instruction given in several steps (i.e., directions for school/work assignments).
- Struggles to understand the context in a story or a conversation.
- Has difficulty integrating new information with prior knowledge.
- When called on, forgets what he/she was planning to say.
- Has difficulty taking notes and listening at the same time.
- Has difficulty staying focused during cognitively demanding tasks but attends well when cognitive demands are minimal.
- Has difficulty integrating new information with prior knowledge.
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What Can We Do At Home/School?

1. Check hearing regularly
2. General literacy instruction
3. Targeted activities
4. Rehearsal training
5. Working memory support in classroom

Interventions

What Can We Do?

General Literacy Instruction
- Reading, phonics & spelling = improve auditory discrimination
- More accurate phonological representations
- Practicing sentences helps improve memory for longer sentences
- Reading aloud may help with clarity of spoken words and more accurate storage
- Increasing vocabulary
- Language rich and language demanding setting
Targeted Tasks/Games

Activities to improve sound discrimination and phonological awareness
Activities to improve attention and increase processing capacity
Activities to improve remembering of lists or numbers of items—called rehearsal training

Memory Training Tasks – Rehearsal Training

Rehearsal training can improve STM
Both visual and verbal memory spans can be improved
Visual STM improvements greater than verbal

Parents can be effective trainers
Periodic maintenance necessary to make improvements last longer than months
Remaining Questions – Can skills can be generalized and transferred to other tasks? Do they translate into better academic performance?

Digit span tasks:
- You show
- Child says, signs (or shows)

<table>
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<tr>
<th>Numbers</th>
<th>Pictures</th>
<th>Direction/Touch Sequences</th>
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<tr>
<td>3 5 1 7 2</td>
<td>dog</td>
<td>wave</td>
</tr>
<tr>
<td>bird</td>
<td>clap</td>
<td>jump</td>
</tr>
<tr>
<td>clock</td>
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Memory Training: Verbally Prompted STM Activities

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<td>wave clap jump</td>
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Classroom Interventions – 7 core principles

1. Recognize working memory failure
2. Monitor the student
3. Evaluate working memory loads
4. Reduce working memory loads when necessary
5. Repeat important information
6. Encourage use of memory aids
7. Develop student's own strategies to support memory

Classroom Interventions – Teacher/Aide Focus

Reduce amount of information to process (simpler sentences, simpler work product)
Use visual notes (words and/or pictures) and actions (pointing and/or using hands) to help student understand lesson and lecture
Break tasks into sequence of independent steps (child can track progress and mark off completed steps)
Repeat information where necessary or have a classmate serve as “memory guide”
Use memory aids (proximity to student and practice at use important)

Classroom Interventions – Teacher/Aide Focus

Position student in classroom to minimize distraction, background noise and within good hearing range of teacher
Use visual support for classroom rules and procedures where possible – such as lists of rules, written directions and daily schedule
Use front-loading (before) and rehearsal (after) to reinforce lesson
Use prompts when it is time to listen to verbal instruction
Example of Verbal Alone vs. Verbal and Visual

Hear:
The dog chasing the tan cat was brown.

What color was the cat? Who was chasing the cat? What color was the dog?

Hear and see:

Classroom Memory Aids
Writing – personalized dictionaries, flash cards, wall charts, word strips.
Math – number lines, multiplication tables, calculators
Computer programs with prompts

Classroom Intervention – Student Focus
Self-help strategies: request help, rehearse verbal information, take notes

Self-help strategy?
Memory Resources – DVDs/Books/Games

www.littlegiantsteps

www.linguisystems.com

DK Games: My First Picture Pairs or any matching game

See and Learn Memory – COMING SOON

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Questions or comments?