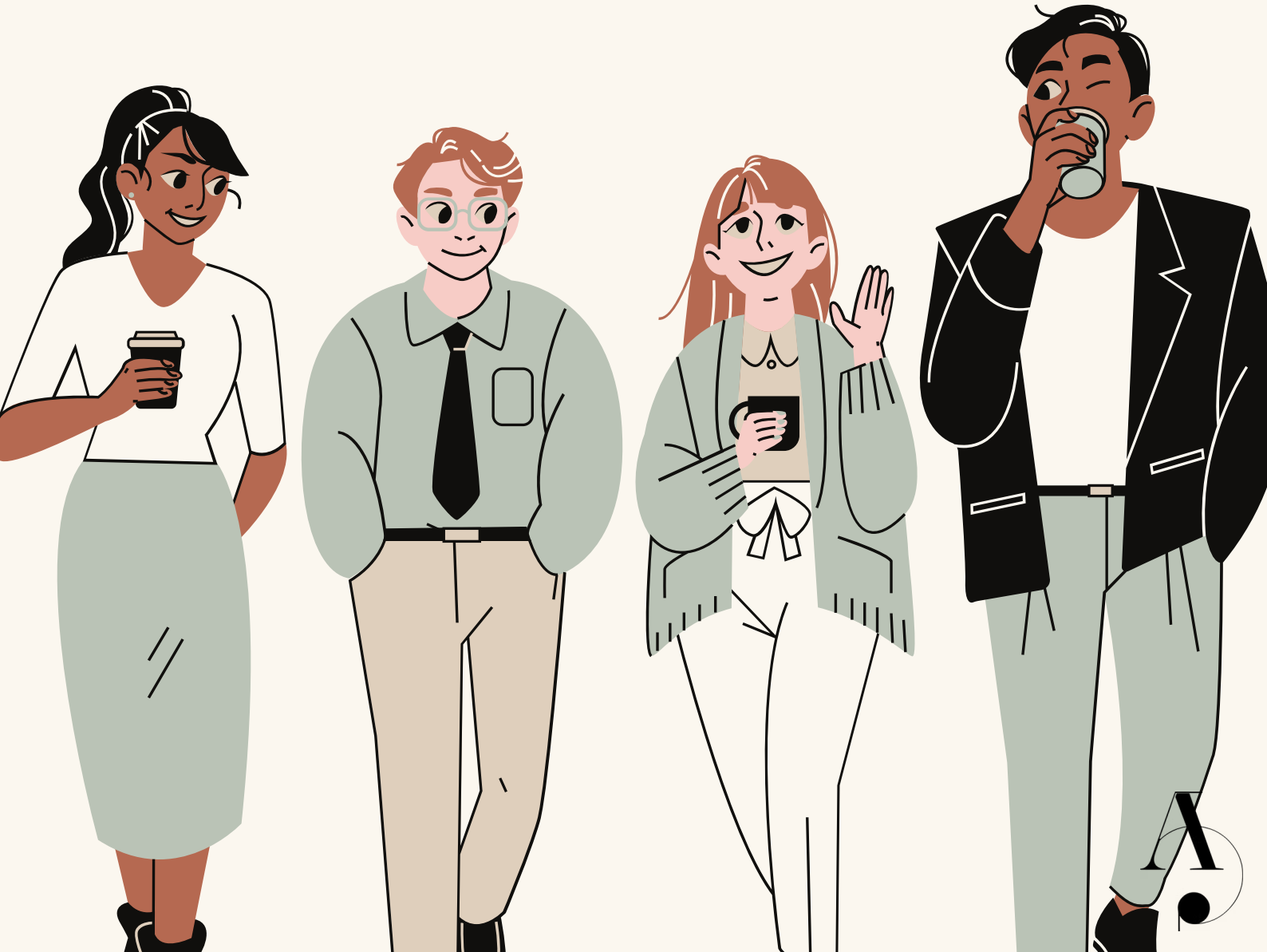
All Adelaide Speech Pathology presents

WORKING MEMORY

A Guide for Speech Pathologists



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What is Working Memory?

Working memory is the ability to hold and manipulate information in your mind for a short period. It is necessary for complex tasks such as language comprehension, learning and reasoning. This definition has evolved from what is commonly known as short term memory. Short-term memory stores information briefly, while working memory actively holds and manipulates information to complete a task.

Working memory is typically divided into three components:

1) Central Executive:
- Controls attention and manages information.
- Helps with tasks like problem solving (e.g., playing chess).

2) Visuospatial Sketchpad:
- Holds and works with visual and spatial information (e.g., pictures, directions).
- Useful for tasks like drawing or remembering where things are.

3) Phonological Loop:
- Stores and repeats spoken information.
- Important for learning new words in both first and second languages.

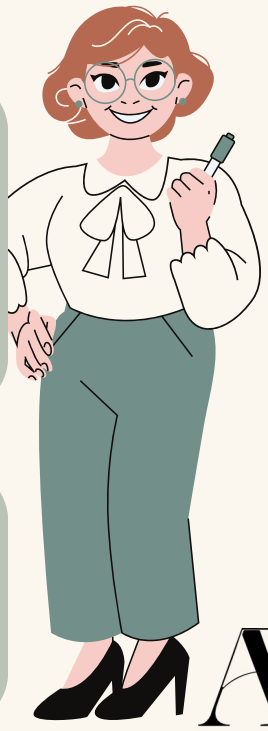
In speech pathology, addressing working memory is particularly important for children and adults with language disorders, acquired brain injuries, neurodegenerative disease or developmental conditions. Understanding the components of working memory is important for speech pathologists because many communication tasks rely on a well-functioning memory system. Working memory supports skills like following multi-step directions, holding onto ideas during storytelling and learning new vocabulary. By knowing how the central executive, phonological loop, and visuospatial sketchpad work, speech pathologists can better identify where breakdowns may occur and tailor their assessment and intervention accordingly. For example, a child who struggles to repeat sentences may have difficulty with the phonological loop, while a person with a brain injury may have reduced attentional control due to central executive impairment. This knowledge also allows speech pathologists to build strengths-based supports such as visuals, repetition, and step-by-step scaffolding into therapy to reduce memory demands and enhance communication success.

Key Points

Understanding working memory helps speech pathologists:
- Identify specific areas of difficulty affecting communication.
- Choose therapy tasks that match the client's cognitive strengths and needs.
- Support functional language tasks like following instructions and telling stories.
- Adapt therapy for clients with cognitive changes, such as those with brain injury or dementia.
- Use strategies that reduce memory load and support language learning.

People with working memory difficulties may:
- Lose track of multi-step instructions
- Appear inattentive or distracted
- Struggle with academic tasks or learning new concepts

Working memory is crucial for:
- Following instructions
- Learning new vocabulary
- Reading comprehension
- Maths problem-solving
- Social communication

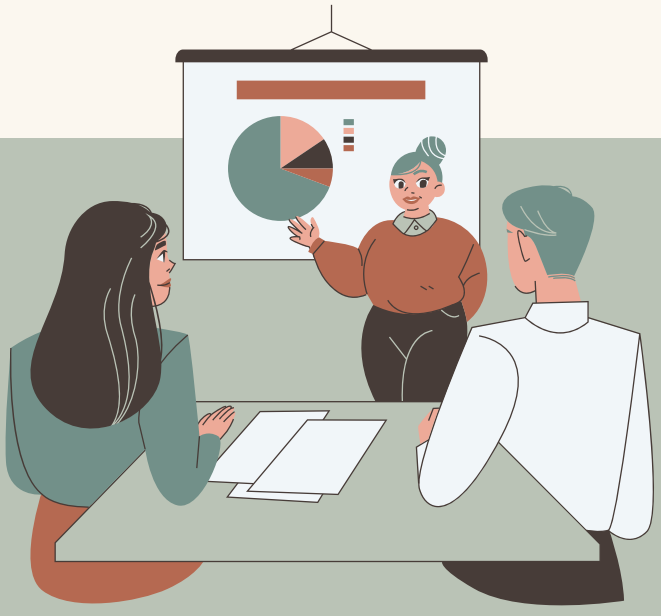


What does the evidence tell us?

Working memory challenges in children may stem from broader executive functioning difficulties specific to language processing. Research has shown that children with working memory difficulties are unlikely to catch up to their peers level of functioning, however, this does not mean their individual working memory capacity will not increase with age. Targeted intervention programs, along with individualised or small group therapy sessions, can help children develop compensatory strategies. Research indicates that children with speech difficulties frequently exhibit immediate working memory impairments, which may contribute to speech difficulties. In light of this, Waring (2017) advocates for the inclusion of working memory considerations in the assessment and treatment of children with phonological speech difficulties, noting that such goals are currently underrepresented in clinical practice.

The following strategies have research supporting the improvement of working memory:

- **Repetition:** Presenting information multiple times reinforces learning by strengthening memory retention, increasing the likelihood of accurate recall.
- **Chunking:** Organising complex information into smaller, more manageable units reduces cognitive load, enhancing both comprehension and retention within working memory.
- **Visual Supports:** Incorporating visual elements such as images, diagrams, or structured outlines facilitates the formation of mental representations, improving both understanding and memorability.
- **Rehearsal Strategies:** Engaging in active rehearsal (whether through immediate repetition or later review) consolidates information in memory and enhances the ability of effective recall.



The Role of a Speech Pathologist

1. Assessment

Speech Pathologists can use formal and informal assessments to evaluate working memory, especially in relation to language tasks like recalling sequences, repeating words, or following instructions

2. Intervention

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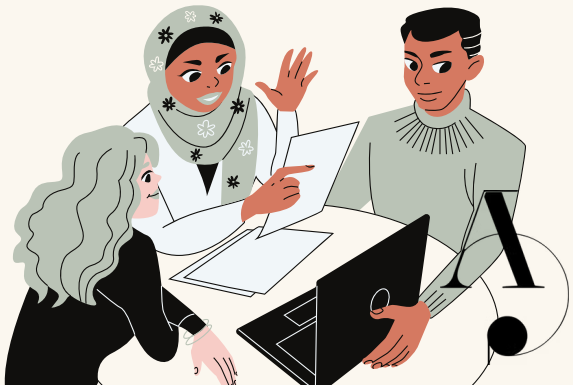
3. Collaboration

Speech Pathologists can work collaboratively with other professionals, such as education staff, psychologists or occupational therapists, to address working memory difficulties in a comprehensive manner.

Formal Assessment

While a Speech Pathologist can informally assess aspects of working memory, this is typically considered secondary to an underlying condition. At present, there are limited assessments within the scope of speech pathology that directly evaluate working memory and executive functioning. One option is the Executive Functions Test–Elementary (EFT-E), a language-based measure that examines executive functions such as working memory, problem-solving, inference, prediction, and task-shifting. These skills may also be observed through subtests of broader language assessments, such as the TILLS (e.g., digit span forwards and backwards, story retell, delayed retell) and the CELF-5.

If a client requires formal scores and a detailed profile of working memory and executive functioning, referral to a Neuropsychologist is recommended, as they can provide a comprehensive cognitive assessment.



Intervention: Memory Games

Studies have shown that brain training games have shown increased performance in cognitive tasks such as speed and accuracy, visuo-motor coordination, attention, memory, working memory, and global cognitive function. Although findings have not consistent across all studies, the majority of findings suggest brain training games as effective intervention for cognitive improvement. These games involve repetition of sequences of information, such as “I went shopping and I brought…” help to improve working memory as it involves retaining and recalling a sequence.

It is important to consider that the effectiveness of memory games can vary depending on the type of game, the individual's age, and their cognitive abilities.

Paediatric Focused Intervention

Activity 1: Simon Says

Simon Says can be used as a flexible and fun therapy tool to build working memory skills, because the game naturally requires children to hold information in their mind, process it, and act on it correctly. Simon Says can be adapted to target different goals by:

- **Increasing instruction length** (start with 1-step commands, gradually building to 2-3 step commands)
- **Adding order recall** (Give a series of actions, then ask the child to repeat the sequence in order
- **Delayed recall** (Provide the instruction then ask the child to wait before acting)
- **Incorporating language concepts** (e.g. Simon says, put your hand under your chin, then behind your back).

Activity 2: Zoo Game

The Zoo Game (“I went to the zoo and I saw…) can be used as an engaging activity to build working memory skills, as the child must listen, retain and recall the sequence before extending the sequence.

- Various levels of complexity
  - Basic level - animal names
  - Intermediate - animal + action
  - Advanced - animal + action + detail
- Use visual supports (pictures, toys) at first, then fade

Activity 3: Memory (card game)

A Memory Card Game (sometimes called *Concentration* or *Pairs*) is an excellent way to target working memory, as it can be easily adapted beyond “find two that match”

- **Verbal recall** - Child says the card aloud each time they flip it over, even if they do not match
- **Increasing memory load** - start with a smaller card set, 6-8, then increase to 12+ cards
- **Incorporate multi-step instructions -** Give the child a directive before flipping the card
- **Semantic Pairs** - Instead of identical pairs, the child must find a pair based on semantic relationships and explain the connection to build their semantic working memory

Intervention: Memory Games

Adult Focused Intervention

Activity 1: Card games

Card games like memory matching naturally target working memory, as players must hold card locations in mind, recall them, and update their strategies as new information is revealed. In this activity, players flip two cards at a time, remember their locations and match pairs until all the cards are gone.

Memory match can be adapted to target different goals by:

- Increasing card pairs: Begin with a small set (e.g., 6 cards) and build up to larger sets to increase memory load.
- Adding delayed recall: After a set number of turns, ask the player to recall the locations of specific cards before flipping them.
- Introducing sequences: Instead of matching immediately, ask players to remember and flip pairs in a given order (e.g., “Find the heart, then the diamond”).
- Incorporating reflexive questions:
  - “How did you keep track of the cards?”
  - “What helped you remember where a card was?”
  - “What could you try differently next round?”

Activity 2: Delayed Story Recall

Delayed story recall is an activity where you read a short passage aloud, wait a given period of time, then ask the person to summarise the story and answer questions about key details. This activity targets working memory by requiring adults to hold information, delay recall, and retrieve key details after a short interval.

Delayed Story Recall can be adapted to target different goals by:

- Adjusting story length: Begin with a short paragraph, then progress to longer, more detailed texts.
- Adding delay: Introduce increasing pauses (e.g., 30 seconds → 2 minutes → 5+ minutes) before asking for recall.
- Changing task demands: Ask for a free retell, a summary in their own words, or answers to specific comprehension questions.
- Incorporating reflexive questions:
  - “What helped you remember the story?”
  - “What was hardest to recall?”
  - “Did you use a strategy, like making a picture in your head or noting keywords?”
  - “What could you try differently next time?”

Compensatory Strategies

1. Following an Organised Routine

Establishing a predictable routine and structured environment is essential whenever possible. For adult clients, this may involve implementing visual schedules, checklists, and reminders, as well as adhering to a consistent daily routine. In contrast, when working with pediatric clients, it often includes the use of interactive visual schedules that clearly represent each task. For both populations, this approach supports task recall and enhances engagement by providing a consistent framework for daily activities.

2. Reduce the Memory Load

To reduce cognitive load and support memory, tasks should be broken down into smaller, manageable steps. Providing written instructions can further assist clients during task completion by offering a visual reference. Additionally, when verbal guidance is necessary, information should be brief, clear, and directly relevant to the task at hand to minimise overload and enhance comprehension.

3. Memory Aids

External memory aids can be a useful compensatory strategy to offload information from the brain.

Low-tech items such as:

- Paper based lists
- Signs
- Visual cues

High-tech items such as:

- Smartphone apps
- Digital calendars or reminders

These aids make retrieving information more accessible, and allow individuals to focus on complex tasks by providing readily available prompts and reminders for past and present information.