# Working Memory
## - Reading and Spelling Strategies

By Jason McGowan

# Introduction

- Who Matters?           THINKING DIAGNOSTICALLY
- What is it?            TERMINOLOGY

- Why is it Important    TROUBLE

- How to Manage         TEACHING

# Who Matters

# Thinking Diagnostically

# No Two Minds Are Alike

## Diagnosing

Not by:

- Diagnostic Categories      Categorization
- Special Education Labels      Labelization
- Test Scores      Standardizaton

- Maggie's Case

# Build a Profile-Strengths and Weaknesses

- Understand and therefore teach a child according to strengths and weaknesses

- Teach the child who is sitting in front of you

Whatever the belief is about the nature and severity of a child's difficulty the most important point is that if there is a basic conviction that a child needs help then such help should be arranged as a matter of urgency.

Therefore the emphasis must always be on formulating and responding to intervention not on defining or diagnosing pathology or attaching labels.

# RTI – Response To Intervention

- Respond to Their Response
- Diagnostic Categories and Labels Soon Disappear

# What is it?

# Terminology

# Terminology

Memory

How Many Terms Are There?

# How Does Your List Compare?

| | |
|---|---|
| Auditory | Short |
| Episodic | State Dependent |
| Explicit | Visual |
| Implicit | Eidetic |
| Long | Working |
| Rote | Image |
| Semantic | Photographic |
| Sensory | Really Bad |

# The Memory Process

- Memory is a highly complex process involving multiple components working simultaneously.

- Our description of isolated components is only a representation because in reality our brains process information in an integrated fashion.

# The Memory Process   ... Cont'd

- Everything begins as sensory input from our environment. Using our sensory systems, we see, taste, hear, or feel a sensation or stimuli

- We have a mechanism to filter out and discard irrelevant or unnecessary data, such as the feel of the carpet as we walk or the sound of the air conditioner.

# The Memory Process ... Cont'd

- This same filtering mechanism organizes relevant data into meaningful patterns.

- In figure 1, the funnel and the filter represent these processes: sensory input and sensory (Working) memory.

# Memory Process Schema

# Neurodevelopmental Framework

# Three Main Terms

- Long

- Short

- Working and or Active

MEMORY

# Long Term Memory

- Permanent Storehouse

- A system for permanently storing, managing, and retrieving information for later and ongoing use. Items of information stored as long-term memory may be available for a lifetime.

- Information which has been registered, encoded, rehearsed, and stored for future retrieval; Material and information retained in LTM underlies cognitive abilities.

# Associated Learning Problem with LTM

## "Black Hole" Brain

- Loss of Knowledge and or Skill despite Rehearsal
- Inability to Access Knowledge
- Are these the "Treatment Resistors"

# Short Term Memory

- Temporary Storehouse
- Small amounts of information in an active, readily available state for a short period of time
- Not stored because of <u>Rehearsal or Association</u>
- Only for seconds or small amount of minutes. Estimates of short-term memory capacity limits vary from about 4 to about 9 items

# Associated Learning Problems with STM

- Disorganization
- Dis-prioritization
- Procrastination

All these can be evident in the context of otherwise normal intellect and behaviour

# Working Memory

- Manipulation of Presently Active Information

- Receive and Use or Receive and Lose
  (What are my senses telling me?)

- A Form of Multi-Tasking Without  Prioritizing

# Working Memory – 5 Purposes

1. Holding an Idea in mind while developing, elaborating, clarifying or using it

2. Recalling information from long term memory while holding related information in short term memory

# Working Memory – 5 Purposes    ... Cont'd

3.  Holding the components of a task together in memory while completing the task

4.  Keeping a series of pieces of information together so that they remain meaningful

## Working Memory – 5 Purposes   ... Cont'd

5.  Holding a long term plan while thinking about a short term need – Starting with the End in Mind

# Computer Analogy

*Computer = Mind?*

- Computers take a symbolic input, recode it, make decisions about the recoded input, make new expressions from it, store some or all of the input, and give back a symbolic output.                    *(Lachman, 1979)*

**Compare the above quote with the way the human mind operates:**

- Humans code information, remember it, make decisions based upon it, change their internal levels of knowledge and turn all this into a behavioural output.*(Pennington, 2002)*

# Five Key Areas of Similarity Between Computers and the Mind

- Coding; important for both humans and computers - raw data has to be converted into a form that the processor understands

- Channel Capacity - there is an upper limit to the amount of information that can be dealt with at any one time

- Span of Apprehension - the amount of information that can be taken in at any one time will depend on how it is organised: some processes allow for 'compression' of data

- Central Processing Unit - performs processing on the data

- Information storage - resultant information is stored in memory, either short term (RAM) or long term (hard drive).

# Computer Analogy

- The computer analogy is a useful one but it can only be carried so far. Computers are electro-mechanical devices whose operation is entirely predictable.

- Any information stored on a computer can be transferred to any other computer with relative ease. Can the same be said of human knowledge?

- Humans are self-aware and conscious, how does this compare with computers?

# Sub Systems of WM

1. Phonological Loop

2. Visual-Spatial Sketchpad

3. Central Executive

# Phonological Loop

- Phonological memory refers to coding information phonologically in working memory for temporary storage in short-term memory. When you attempt to remember a phone number you have looked up, as you make your way to the phone, you are storing the number temporarily in working memory. You probably do so not by storing a visual representation of the sequence of digits (although you may be able to do this if you try), but rather by storing a phonological representation of the sounds of the digit names.

# Phonological Loop   ...Cont'd

- It is the part of memory most involved in storing, phonological information. The phonological loop provides a brief, verbatim storage of auditory information (Baddeley, 1986, 1992; Torgesen, 1996).  The phonological loop consists of two parts working together.  The first is a phonological store, which can be thought of as a tape recording loop that retains the most recent 2 seconds worth of auditory information that has been recorded. The second is an articulatory control process that provides input to the phonological loop initially and also can refresh information already in the loop so that it can be stored for longer than 2 seconds.

# Visual Spatial Sketchpad

A parallel system akin to an artist's sketchbook for stimuli that cannot be verbalized, such as spatial information.

# Central Executive

A system responsible for supervisory attentional control and cognitive processing. This last system, though poorly defined, is most alluring because it represents the very stuff of thought.

# Why is it Important?

## Trouble

# Trouble

Students who struggled to learn academically will almost certainly have working memory difficulties

Problems are best defined in terms of **Capacity** and **Time**

# The Theories of Capacity and Time Decay

Working Memory problems can be divided into:

1.  Capacity  –    (The Neurological Scratchpad)

2.  Time      –    one, four, what oh, oh, nine – oh
                    I forgot

# Capacity Decay

**Neurological Scratchpad**

The Postage Stamp Analogy

How Big is Your Mental Scratchpad?

# Time Decay

**Time**

Individual pieces of Information
are presented too far apart

**Example**

- Instructions
- Sounds Within a Word – Resynthesis Problems

# How To Manage

# Teaching

# Teaching

Working Memory Can be Taught/Improved

# Reading

- Phonological Awareness

- Phonological Memory

- Automatic Rapid Naming

# Phonological Awareness

- Phonological awareness refers to an individual's awareness of and access to the sound structure of his or his oral language (Mattingly, 1972). The spoken words of a language represent strings of phonemes that signal differences of meaning. The spoken word *sit* has three phonemes, each of which happens to correspond to the sound made by the three letters of the printed word SIT. Change the first sound from "s" to "b" and you have the spoken word *bit*. Children who have some awareness of this structure seem to have an advantage learning to read the printed forms of a language.

# Phonological Memory

- Phonological memory refers to coding information by working memory for temporary storage in short-term memory.

- The part of memory most involved in storing, phonological information is called the phonological loop. The phonological loop provides a brief, verbatim storage of auditory information (Baddeley, 1986, 1992; Torgesen, 1996).

- The phonological loop consists of two parts working together. The first is a phonological store, which can be thought of as a tape recording loop that retains the most recent 2 seconds worth of auditory information that has been recorded. The second is an articulatory control process that provides input to the phonological loop initially and also can refresh information already in the loop so that it can be stored for longer than 2 seconds.

# Automatic Rapid Naming

- The third kind of phonological processing is automatic rapid naming (ARN). ARN of objects, colours, digits, or letters requires efficient retrieval of phonological information from long-term or permanent memory. When reading, young readers presumably retrieve (a) phoneme associated with letters or letter pairs, (b) pronunciations of common word segments, and (c) pronunciations of whole words. The efficiency with which children are able to retrieve phonological codes associated with individual phonemes, word segments, or entire words should influence the degree to which phonological information is useful in decoding printed words (Baddeley, 1986; Wolf, 1991).

# Automatic Rapid Naming ... Cont'd

- Measures of ARN require speed and processing of visual as well as phonological information. Some researchers who study ARN suggest that ARN tasks assess the operation of a precise timing mechanism that is important for the developing knowledge of common letter patterns in printed words. Consequently, individuals who show poor performance on ARN tasks are expected to have difficulty reading fluently.

# Strategies (1:1) - DVD

- Sequential Repetition (Ch 2, 5 Strategies DVD)
- 3SW (Ch 4, 5 Strategies DVD)
- Tactile Elision Drill (Ch 5, 5 Strategies DVD)
- Coloured Arrows (Brain Skills)
- Automatic Rapid Naming
- 8 Step Cumulative Reading Drill

# Principles

- Algorythmic Repetition – One Step after another repeated (Drill-Like Repetition)

- Cumulation -  1,  1-2,  1-2-3,  1-2-3-4

  Almost everything that requires algorythmic repetition and cumulation will exercise working memory

# 2.1.4 CVC Words

## "a" words

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| bad | dad | pad | had | sad | mad | lad |
| lab | dab | cab | nab | ham | jam | ram |
| Sam | bag | sag | tag | gag | pat | fat |
| sat | hat | mat | rat | cap | map | tap |
| lap | sap | ran | pan | can | fan | man |

# CCVCC Words

| | | | | | |
|---|---|---|---|---|---|
| block | black | blend | blunt | blush | blank |
| flock | slack | spend | stunt | crush | flank |
| crock | crack | trend | grunt | flush | crank |
| stock | stack | | brunt | slush | stank |
| chock | smack | | shunt | plush | spank |
| knock | knack | | | brush | shank |
| frock | track | | | | |

| | | | | | |
|---|---|---|---|---|---|
| brick | bridge | bright | bring | grant | chunk |
| flick | fridge | slight | sling | slant | flunk |
| quick | | flight | sting | chant | drunk |
| slick | fresh | plight | string | plant | stunk |
| trick | flesh | fright | fling | scant | plunk |
| prick | thresh | knight | cling | | trunk |
| click | | | bling | | clunk |
| chick | | | swing | | skunk |

# Coloured Arrows



green      blue      red      yellow      black

blue      black      yellow      red      blue

yellow      green      yellow      red      red

- Overload and Adapt

a greater than normal stress or load on working memory is required for training adaptation to take place. What this means is that in order to improve the capacity of working memory we need to increase the workload accordingly

# Programs

- Brain Skills
- PACE
- GREAT LEAPS
- Cogmed

# Tests for Working Memory

- **WISC IV** – Cognitive Only
- **CTOPP** – Very Practical
- **PACE Test** – Coloured Arrows Segment

# Treatment Resistors

1-2% of Learning Disabled children will resist most forms of treatment and management

Not Your Fault and Certainly Not Their Fault

# Take Away Messages

- There is a lot we know about it – So become more educated
- It can be trained – So learn how
- It is essential in the remediation of Learning Disabled Children – so include it in your programs
- It is not everything.  Children still need to be taught

Remember We Teach Children Not Programs

# Thanks