MEMORY

Woodlands Academy 2019
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CHAPTER I

WHAT IS MEMORY?
‘Memory is the ‘residue of thought’. We remember the things that we think about and we forget the things that we don’t think about. Thinking, therefore, is the difference. In order to engage in strategy, one must engage in thought’.

D. Willingham
WHAT IS MEMORY?

- Memory is a neurological storehouse.
- Memory has two distinct aspects:
  1) The structure of memory
  2) The processes of memory.

- Memory has three main functions:
  1) Encoding
  2) Storage
  3) Retrieval
WHAT IS MEMORY?

Memory as a concept consists of differing explanations on how it works:

A. Some see it an unitary, ‘Modal/Multiple-Store’ model (Atkinson & Shiffrin, 1968). However, the below model of memory became the prevailing view in Cognitive Psychology.

B. Baddeley & Hitch (1974), proposed a different construct; the ‘Multi-Component’ model. According to their theory, poor working memory is a component failure to harness together for successful task completion.
WHAT IS MEMORY?

- Multi-Component Model’ consists of several components:
  i. Sensory memory- specific modalities
  ii. Short-term memory- temporary storage unit
  iii. *Working memory*- The process of maintaining and manipulating of information
    
    *(Working Memory =Short-term memory+ controlled attention)*
  iv. Long-term memory

- The interconnectivity of these functions determines capacity
- Implicit/non-declarative/unconscious or Explicit/declarative/conscious (LTM)
- Unlimited in potentiality and storage capacity (LTM)
CHAPTER II

BADDELEY & HITCH’S

‘MULTICOMPONENT MODEL’

OF MEMORY

1974
Executive functions are mental processes for the management (regulation and control) of other cognitive processes in particular in relation to complex actions’

- Using the analogy of a CEO of a company. The CES has three subordinate (slave) systems that work in conjunction with the CES in accessing stored memory for any given task. These being:

  I. The Phonological Loop
  II. The Visuospatial Pad
  III. The Episodic Buffer
The CES is an independent and separate cognitive process responsible for task management. Regulating the flow of information, it maintains, monitors and updates information in STM. (McCloskey & Perkins, 2013)

Core functions of the CES:

I. **Planning** - order/sequence of activity
II. **Attentional awareness** - prioritising where CES attention is focused for the completion of tasks
III. **Monitoring** - ensuring the task is being done correctly
IV. **Inhibition** - ignoring irrelevant information
V. **Shifting/switching** - moving CES attention between activities
THREE COMPONENTS OF WORKING MEMORY

I. The Visuospatial sketchpad

II. The Phonological Loop

III. The Episodic Buffer (a later addition to the model, 2000)
THE VISUOSPATIAL SKETCHPAD

- Mind’s eye/imagination; stores visual information encoded from verbal descriptions (e.g., picturing what characters in a story look like)

- Stores a limited amount of visual and spatial information.

- Baddeley & Lieberman (1980), concluded from their research that the sketchpad could be partitioned into distinct visual and spatial elements.
Logie (1995), developed Baddeley’s theories further by proposing two new components in the Visuospatial sketchpad:

I. The Inner Scribe - organises and arranges objects to transfer information back to the Central Executive

II. The Visual Cache - stores visual data like colour, shape, size etc.
**THE PHONOLOGICAL LOOP:**

- *Articulatory rehearsal mechanism* (like verbally memorising a phone number)
- Connects inner ear and speech facilities together
- STM stores information phonetically.
- Anatomically different to the ‘Visuospatial sketchpad’-located in specific region of the brain.
- Mainly occurring in the left prefrontal cortex (damage to the parietal lobe may result in: dyslexia, dyscalculia, aphasia, apraxia etc.)
The Phonological Loop:

- **Articulatory Process/Internal monologue/Inner voice**
- **Phonological Store/Records audio information/Inner ear**

  - Subject to rapid decay - temporary storage
  - Lasts around two seconds (or as much as you can say in 2 seconds)

  - Can be subjected to phonological ambiguity (or acoustic confusion), if words sound acoustically similar (e.g., blow/below)

  - Key feature in language acquisition (e.g., learning a second language - implications for EAL pupils)

- **Role in mental arithmetic/dyscalculia**
The Episodic Buffer is assumed to be a limited capacity, temporary storage system capable of integrating information from a variety of sources.

(Baddeley, 2000)

- Limited in capacity
- Responsible for conscious awareness
THE EPISODIC BUFFER:

- Binds chunks or episodes of information together
- Temporary store
- Acts as an interaction between working memory and long term memory
- Utilises the ‘Visuospatial Sketchpad, phonological loop and long term memory’ to access information
- Limited data/research on the Episodic Buffer
BADDELEY'S MULTICOMPONENT MODEL

DIAGRAM (2003)

CENTRAL EXECUTIVE
- Prefrontal cortex (PFC) and other cortical and subcortical structures
- Intentionality: Attention, Selection, Inhibition

CONSCIOUSNESS

EPISODIC BUFFER (PFC)
- Integration and temporary storage of phonological store and visuospatial sketchpad

SHORT-TERM MEMORY

PHONOLOGICAL STORE
- Vocal and subvocal articulatory rehearsal of verbal and acoustic stimuli for temporary storage allowing for long-term store

VISUOSPATIAL SKETCHPAD
- Integration and temporary storage of visual and spatial material

LONG-TERM MEMORY

DECLARATIVE LONG-TERM MEMORY
- Memory for facts and verbal material, episodic memory & semantic memory

PROCEDURAL LONG-TERM MEMORY
- Memory for non-verbal, motoric skills & classical conditioning

PRECONSCIOUS & UNCONSCIOUS

(Stored in cortex by hippocampus in humans)

(Stored by hippocampus in primates other than humans)
RATIONALE FOR CHOOSING BADDELEY’S ET AL MODEL OF WORKING MEMORY

- Seminal body of work
- Inspired further research in this field
- Empirical & neurological validation of this construct from findings
CHAPTER III

TYPES OF MEMORY
DIFFERENT TYPES OF MEMORY:

- **Sensory memory**, lasts less than a second, specific sensory modalities (e.g., kinaesthetic-touch, olfactory-smell, gustatory-taste etc.)

- **Short-term memory**  Lasts a few seconds; less than 1 minute.

- **Working memory** consists of iconic memory for visual (VSP), echoic for auditory (PL). Working memory is the ability to hold and manipulate information.

- **Long-term memory**: Lasts a lifetime. Consisting of two types of memory:  
  i) Implicit  
  ii) Explicit
CHAPTER IV

LONG-TERM MEMORY
Different Types of Long-Term Memory:

- **Implicit memories** are stored *without* conscious awareness. They are procedural (e.g., riding a bike, swimming, tying shoelaces)

- **Explicit memories** are *consciously* recalled and are *declarative*. These can be separated into two further sub-types:

  A) **Semantic memories** - recalled information regarding facts about concepts - such as in; general knowledge topics - (e.g., capital city of Italy is Rome, 7x7= 49)

  B) **Episodic memories** are another form of explicit memory; our unique autobiographical memories (e.g., Where you were on 9/11?, the death of a grandparent)
Long-term memory is a lasting experience which can be recalled after 24 hours.

Items can be transferred from STM to LTM through ‘Synaptic Consolidation’. Memory traces are encoded via the synapses. Factors such as interference (noise from the environment) can impair encoding.

The more detailed/deeper that information is processed as; the better it is stored in LTM.
LONG TERM MEMORY
IMPLICIT / NON-DECLARATIVE MEMORY:

- Procedural (like learning to drive)
- Sequential (to drive you have to learn each step)
- Unconscious (once learnt you can drive on autopilot)
LONG TERM MEMORY
EXPLICIT / DECLARATIVE MEMORY:

- Conscious recollection
- Rote learning

- Refers to knowledge about:
  A. Events (episodic)
  B. Facts (semantic)
LONG-TERM MEMORY
DECLARATIVE MEMORY

Semantic:

- Depository of general knowledge about the world consisting of:
  a) Concepts
  b) Facts
  c) Life scripts/schemas
LONG-TERM MEMORY
EXPLICIT/DECLARATIVE MEMORY

Episodic:

- Personally experienced and recalled
- Our own perspective
- When an event occurred in our own timeline
- Can work in conjunction with semantic memory by helping to sequence events. E.g., ‘I know it happened on a Wednesday, as I go to university then’.
LONG TERM MEMORY DIAGRAM

Varieties of Long-Term Memory

Explicit/Declarative Memory
- Memory with conscious recall
  - Semantic Memory
    - General knowledge
  - Episodic Memory
    - Personal experiences

Implicit/Nondeclarative Memory
- Memory without conscious recall
  - Procedural Memory
    - Learned actions and skills
CHAPTER V

SHORT-TERM MEMORY
SHORT-TERM MEMORY

- Lasts seconds; less than a minute.

- Miller (1956) proposed that short-term memory can consciously hold between 5-9 chunks of information. He found that it was 9 for binary items, dropping to 5 for monosyllabic words.

- Cowan (2001) revised that figure to 4 chunks of information.
DEFINITION OF WORKING MEMORY

‘Working Memory is a processing resource of limited capacity involved in the preservation of information while processing the same or other information’

(Baddeley, 1986)

*Working Memory* = *Short-term memory* + *controlled attention*
WORKING MEMORY

Limited short-term storage of information

- A process of how we can manipulate received information

- For WM Example, remember these number: 392-7439

Then you realise a mistake and got the last two numbers the wrong way round, you then correct the error by holding the digits internally, as you manipulate the numbers by switching them around.
CHAPTER VII

THE IMPORTANCE OF WORKING MEMORY IN EDUCATION
Students that have a greater working memory capacity, outperform peers with lesser WM extents.

At least 10% of students have working memory problems (Alloway & Gathercole, 2006)

Working memory is connected to general intelligence (Kyllonen & Christal, 1990)

Academic attainment and achievement rely on the strengths of the components involved in working memory (Swanson & Berninger, 1996; Swanson, 2000)
WHY IS WORKING MEMORY IMPORTANT?

- Working Memory deficits are the principle cause responsible for all types of specific learning disabilities (Swanson & Zheng, 2009)

- Working memory, Attention and the Central Executive Function, are the means by which deficits in WM can be identified when assessed.

- Working memory is part of the Central Executive Function. According to McCloskey & Perkins (2013), identified 32 executive functions separated into six subcategories of WM.
WHY IS WORKING MEMORY IMPORTANT?

- Phonological speed and processing speed depend upon Working memory
- Gives a sense of bearing in immediate environment
- Ties in previously taught concepts, making connections
- Widens general knowledge or ‘Semantic’ memory.
- Working memory correlates directly with fluid intelligence (Carroll 1993)
- Working memory is considered a better indicator to how students perform and achieve (Alloway & Alloway, 2010)
CHAPTER VIII

INDICATORS OF MEMORY DEFICITS
# Behaviours implying problems with working & STM memory

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<td>Prefers simpler tasks over more complex tasks</td>
<td>Fails to repeat what has just been said</td>
<td>Failure to remember what had just been seen.</td>
<td>Does not contribute in class discussions/debates</td>
<td>Difficulty in imagining things</td>
<td>Difficulty in sustaining pace of activity e.g., note taking</td>
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<td>Struggles to retain information for less than a few seconds.</td>
<td>Can’t retain every incremental step for successful task completion.</td>
<td>Slow speed when copying from board, etc.</td>
<td>Inaccurate paraphrasing.</td>
<td>Confusion when shapes or objects are moved/rotated</td>
<td>Distracted easily, lacks focus—can’t sustain attention</td>
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<td>Excessive period of time to complete activities</td>
<td>Verbally communicates in short sentences.</td>
<td>Challenged when remembering names of shapes and symbols, gets confused and muddled.</td>
<td>Repeats words in sentences.</td>
<td>Forgets steps (or misses numbers out when counting) problem or loses place when reading or following text</td>
<td>Lack of available strategies to tackle and answer set questions</td>
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<td>Disengages with activity half-way through.</td>
<td>Difficulty in repeating instructions.</td>
<td>Struggles in assembling puzzles.</td>
<td>Has trouble in ordering written information.</td>
<td>Doesn’t include key details when watching a video/clip</td>
<td>Irrelevant digression/tangents when answering questions verbally or explaining</td>
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<td>Labours to retrieve facts</td>
<td>Failure to learn new vocabulary with ease.</td>
<td>Difficulty in remembering materials used in exact order.</td>
<td>Constant reminders on what needs to be done.</td>
<td>Misses out units of measurement or sum symbols, like +, −, x, etc.</td>
<td>Inadequate ability to multi-task; cannot switch back and forth during activities</td>
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<td>Work avoidance during more complicated activities</td>
<td>Does not rehearse verbal information.</td>
<td>Forgets where certain things are kept.</td>
<td>Can not see written errors in final reread, before submission.</td>
<td>Slow response time on video games (frustration)</td>
<td>Dislikes work where planning and organising are required (or when a task involves split attention)</td>
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<td>The more difficult an activity is, the less well they perform</td>
<td>Phonemic awareness.</td>
<td>Makes frequent and consistent errors when having to copy: definition, explanation and premise of activity.</td>
<td>Omission of key content in answer.</td>
<td>Minimum of details when picturing/describing a scene</td>
<td>Prefers to utilise simple learning strategies over more complicated methods</td>
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<td>Misses key points of instructions</td>
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CHAPTER IX

DEVELOPMENTAL DISORDERS AFFECTING MEMORY
DEVELOPMENTAL DISORDERS

Autism:

- Undeveloped ‘Theory of Mind’ (inability to adequately: communicate, infer & empathise).

- ASD is directly linked to deficits in CES.

- The core CES functions of attention and inhibition are compromised in ASD pupils.

- Also, ASD affects the visual-spatial & verbal aspects of WM.
ADHD:
Is characterised by: impulsivity, hyperactivity and inattentiveness (distraction).

The core symptoms of ADHD, directly correlates with the impairments/deficits in ‘Working Memory’, (see above).

ADHD students are 4x as likely to have poor working memory compared to peers without attention problems.
**ADDITIONAL CONDITIONS/DISORDERS AFFECTING WORKING MEMORY**

- **Anxiety** - pupils perform less successfully on WM tasks, particularly in regards to the verbal & CES. Pupils with anxiety struggle to inhibit irrelevant material, consequently they require longer periods to complete an activity. (Visu-Petra et al, 2013)

- **Stress** - brought on by life events; causes increased levels of cortisol, which at chronic levels- damage neurons and LTM. (Siegel, 1999)
**Depression**- Affects ‘Metamemory’ (the ability to understand our own memories and the processes of recall & recognition behind them)

Limits the functionality in both verbal & visual-spatial aspects of WM (Watts et al, 1987)

Adversely affects encoding and consolidation of WM in tasks.
**Brain Injury**—Should the trauma of injury affect the neural pathways responsible for WM, its capacity will be limited, increasing cognitive load upon pupil.

Difficulties arise in the functionality of CES in regards to:

I. Inhibition of interference.
II. Focusing of attention
III. Organising thoughts
ADDITIONAL CONDITIONS/DISORDERS AFFECTING WORKING MEMORY

**Dopamine Deficiency** - WM performance is related to dopamine levels. (Backman & Nyberg, 2013)

**Premature Birth** - Under 32 weeks, have an increased risk of having WM & LTM impairments.

**Child Diabetes** - LTM & WM are impaired by how well the body regulates glucose. (Hershey et al, 2003)
CHAPTER X

INTERVENTIONS FOR SPECIFIC DEFICITS
STRATEGIES FOR SPECIFIC WORKING MEMORY DEFICITS

Visual-Spatial STM:

I. Visualisation

II. Visual Spatial Recall

III. Programmes that centre on recall of visual-spatial stimuli.
STRATEGIES FOR SPECIFIC WORKING MEMORY DEFICITS

**Phonological STM:**
- Chunking
- Sequential recall of verbally presented items
- Verbal span practice
- Rehearsal
STRATEGIES FOR SPECIFIC WORKING MEMORY DEFICITS (CONTINUED)

Visual-Spatial WM:

I. Dual Encoding

II. Visual Spatial recall practices

III. Online programmes which involve stimuli being moved, rotated and translated
Verbal WM:

- Rehearsal
- Sequential recall of items
- Arithmetic flash-cards
- Last Word exercises
Executive WM:

- Direction exercises
- Arithmetic flash-cards
- Online exercises which incorporate both visual-spatial
- N-back exercises
CHAPTER XI

COGNITIVE LOAD
WHAT IS COGNITIVE LOAD?

‘Cognitive load refers to the total amount of mental activity imposed on working memory at an instance of time’

‘Cognitive load theory asserts that learning is hampered when working memory capacity is exceeded in a learning task’

(De Jong, T., (2010))
THREE TYPES OF COGNITIVE LOAD

*Intrinsic load:* The inherent difficulty of the work set. This load can be reduced if there is existing knowledge of topic.

*Extrinsic load:* The way in which the materials are presented, specifically when it is irrelevant to the task given.

*Germane load:* Responsible for processing & constructing information in the activation and automation of schemas.
**Staff Instruction**

- Only one processing task at a time. (Watching a documentary and making notes simultaneously are two processes - those with WM deficits will struggle to multi-task).

- The quieter the environment, the less interference of noise and distraction which add to processing loads (Gathercole & Baddeley, 1993)

- Instructions given in simple and concise manner. Wording understandable for all levels.

- Adequate time to process what is asked of them, by having ample time to switch between the functions of processing and rehearsal.
HOW TO REDUCE COGNITIVE LOAD

Staff Instruction

✓ Avoid double lessons in timetabling
✓ Streamlined and minimal information given, only related to task at hand
✓ Present the information visually as well as verbally. This allows a compensation to learner’s deficient in one of their modalities. (T. de Jong, 2010)
✓ Direct Instruction- a repetitive and formulaic way of teaching what the success criteria is without the student having to constantly bring it to mind as they answered the question.
HOW TO REDUCE COGNITIVE LOAD

Content & Materials:

✓ Complicated materials simplified for all pupil’s ability levels.

✓ When introducing a new topic, an existing background knowledge should be established and elaborated on. This brings forth long-term semantic memory of the subject into conscious WM. Additionally, it forms a visual and verbal neural connection with the memory and the subject about to be learnt. (Ritchie & Karge, 1996)

✓ Content split into incremental parts and presented as one part at a time. Smaller parts of information require less effort by WM usually spent on processing and maintaining.
HOW TO REDUCE COGNITIVE LOAD

Content & Materials:

✓ Introduce additional information slowly.
✓ Have written examples to show or demonstrate what is needed of them for the activity.
✓ Limit information being split over several worksheets- increases demands placed on WM to select information from different sheets and then compose the answer.
✓ If information does need to be split onto several worksheets, arrange
CHAPTER XII

SELECTION OF WORKING MEMORY ASSESSMENTS
HOW CAN WE ASSESS WORKING MEMORY?

BRIEF- Behaviour Rating Inventory of Executive Function

Automated Working Memory assessment (Alloway 2007)

Working Memory Test Battery for Children (WMTB-C)

Children’s Psychological Processes Scale (CPPS, Dehn, 2012)
CHAPTER XIII

CLASSROOM ACTIVITIES

STRENGTHENING FACETS OF MEMORY
N-Back Game- This activity involves a pupil remembering a letter previously presented. For Example, if we had the letters d-p-g-k-s and said that the rule was 2 back (N=2), this would mean that the pupil would have to say g when they saw s or if they saw k they should say p, etc.

This activity directly increases working memory because of the demands made upon Executive Working Memory by: switching, inhibiting and updating constantly.

Tageuchi et al (2010), reported an increased in neural connectivity from studies that used this game.
How to play the game:

1) Display item for 1-2 seconds

2) Explain how it works and what \( n \) signifies.

3) Repeat the process if the pupil makes an error

4) Once the pupil has managed ten successful recalls of the letters, three times in row, add 1 to \( N \). So if it is \( N=2, N \) now is 3.
N back tips: (Using the same letters as on previous page)

- Teach the strategy of rehearsal, keep repeating the first two letters until the third letter is introduced. E.g., d d d d d, then d-p-d-p-d-p then k without saying the first letter again dropping the d (this is the inhibition task of WM) then just rehearsing p-k-p-k-p (this is the updating task of WM), until the fourth letter is shown and the same process is repeated for all the letters.

This exercise is beneficial to WM because it stimulates its core functions of: rehearsing, switching, updating and inhibiting.
Last Word Game:
This game focuses on verbal WM.

- Pupils are asked a series of questions on which they have to answer ‘yes’ or ‘no’.
- These can be nonsensical questions.
- The objective of the game is to remember the last word of the question.
- For example, ‘Do dogs meow at people?’ Followed by, ‘Can cats drive cars?’ and ‘Does a castle have rooms?’.
- Therefore the pupil should have remembered the words: ‘people, cars and rooms’.
Visual-Spatial Recall 1: (This is a Visual-Spatial STM task)

- This can be played as a paired activity.
- Each pupil is given a grid. The x axis is labelled with letters, the y axis with numbers.
- The pupil records where they have placed their cubes/counters/chips/items on their grid.
- The pupil then shows his partner. The partner has 5 seconds to recall where each item is placed before they are removed completely from the grid.
Visual-Spatial Recall 2: (This is a Visual-Spatial STM task)

- The partner has to place the items back where they initially saw them.
- Can increase difficulty by adding more items or columns to the grid.
- This activity requires very little in processing or strategy.
- It can be made more of a Visual-Spatial WM activity by playing as before, but by rotating the grid 90 degrees before the partner can place the items back.
Counting Span: (Mainly Visual-Spatial WM)

- Suitable for younger pupils.
- Can be played with dots on paper.
- Show first piece of paper with 8 dots on it. Then show a second piece of paper with 5 dots on it. After this, another piece of paper with 3 dots on it.
- The pupil needed to recall 8,5,3.
- Once they have identified these numbers correctly you keep increasing the number of dots until failure.
- You can add in differently coloured dots to act as a distractor and provide more of a challenge to the executive function of working memory.
**Flashcards** *(This is an Executive WM activity.)*

This activity is useful for WM as it utilises several of its processes. *(N.b, The pupil answering correctly is less important, than remembering the sequence once all sums have been shown.)*

I. Hold up the multiplication sum
II. Ask the pupil to say their answer
III. Repeat with another sum
IV. Ask them what their answer is.
V. Show pupil another sum
VI. Ask for their answer
VII. Ask the pupil to repeat all of their answers in order given.
VIII. Keep adding in sums like in *N-back*
IX. Increase challenge by incorporating different types of sums.
CHAPTER XIV

TEACHING STRATEGIES
TEACHING REHEARSAL

- Can be articulated or not.
- A strategy targeting both WM & LTM.
- More rehearsal = increased recall in WM & LTM = significant learning (Turley & Whitefield, 2003)
- It is a means to hold short-term information as WM is being used for task completion.
- Can maintain information long enough to transfer into LTM.
- It provides repeated opportunities for encoding to occur.
TEACHING VISUALISATION

- Transform verbal information into visual format. Read a passage and ask pupils to visualise the content, stop frequently and check the described images match the text.

- Pupils with language disorders or verbal deficiencies in WM, benefit from utilizing the visual-spatial aspects of their WM through visualisation exercises.
Thinking back to Baddeley’s construct of memory, there are two distinct visual and verbal aspects to WM: The ‘Visuospatial sketchpad’ & ‘Phonological Loop’

Visualisation can occur without verbal rehearsal. However, when it is compounded with each other, it becomes ‘dually encoded’. This is a far more effective memory strategy when it is combined, as it reinforces both verbal & visual facets of WM, compensating for weakness or the favouring one facet over another.
Without dual encoding, WM is being under utilized.

Can increase the amount of retention because ‘the amount of content stored in one component, should not reduce the amount held in the other’ (Baddeley, 1986)

From his findings, he concluded that phonological & visual-spatial information does not compete at the expense of the other for storage.
‘Chunking’ increases the WM ability to retain items within the entirety of the process/task.

Existing chunks of information may be added too, deleted or modified as new information is received.

Chunking consists of: pairing, grouping, bunching things together for easier retrieval.
Findings suggest this strategy should be taught as early as possible to children to assist WM growth.

Chunking can be used in both Numeracy or Literacy.

For example, when reading a sum out aloud, e.g., 7489. Separate the numbers into pairs; 7-4 (seventy-four) & 8-9 (eighty-nine). Then progress to 3 digit numbers; 632 (six hundred and thirty-two).
Key implications for Literacy & reading. Pupils learn to read by grouping phonemes together in chunks within their WM.

As a reader’s fluency improves, word recognition and blending become automatic as they have successfully chunked units of information in WM.

During reading activities, demonstrate how to chunk challenging words into syllables. e.g., administration; ad/min/is/tra/tion.
Updating & switching are two natural phenomenon that occurs in conversation. New information is received, being updated from existing information. The switching is using this information to keep up to pace with the flow of conversation.

Switching is a strategy that reduces cognitive load.

It involves processing the task in hand and rehearsing the initial instruction for successful completion.
SUPPLEMENTING WORK ACTIVITIES

- Establish existing knowledge and associations with topic being introduced. This will activate personal schemas & semantic memories.

- Can be differentiated into independent or teacher lead elaborations.

- To develop richer understanding of topic, use: analogies, metaphors, parallels, diagrams, models and mind-maps.
CHAPTER XV

GENERAL SOLUTIONS
GENERAL SOLUTIONS

1. Baseline assessment for all pupils working memory

2. Chunking

3. Mnemonics/WM teaching and learning

4. Metamemory development

5. Teach less, remember more- short-term cost for long-term rewards
6. Increased formative assessment into school structure, beginning & end of every lesson.

7. Dual-coding

8. Coordinated Spiral curriculum

9. Depth of processing
GENERAL SOLUTIONS

- Interspacing
- Flash cards/cue cards
- Reduction of classroom aids/pictorial resources
- Daily monitoring of the emotional well-being of pupils
- Reduced Stress/anxiety levels through ‘mindfulness’ or breathing exercises each morning and after lunch.
Assistive Technology aids:

i. *Sans Forgetica* - A newly developed font. Designed specifically to improve retention. Utilizing the ‘Desirable Difficulty’ principle (Bjork, 1994), it encourages readers to focus longer on the words, facilitating encoding on a deeper level and giving more and longer opportunities to be transferred into LTM.
CHAPTER XVI

SUMMARY
IN SUMMARY

- There are two main kinds of memory, verbal & visual-spatial.
- There are 3 memory systems:
  1. Short-term
  2. Working
  3. Long-term
**IN SUMMARY**

- WM is used whenever you are thinking & remembering.
- People have limited WM. Forgetting things is natural.
- Through training & practice, you can improve memory.
- Repeating information extends the temporary storage of WM.
- STM & WM can only hold limited information for a short period of time.
- Forgetting is more likely if WM is overloaded.
- Weaknesses in WM, requires longer processing for task completion.
- Some information is easier to recall than others.
REFERENCES


REFERENCES


APPENDIX

COMMON ERRORS OF MEMORY
The Seven Sins of Memory


There are three sins of omission, since the result is a failure to recall an idea, fact or event.

1. Transience
2. Absent-mindedness
3. Blocking
THE SEVEN SINS OF MEMORY

Four sins of **commission**, meaning that there is a form of memory present, but it is not of the desired fidelity or the desired fact, event or idea.

4. Misattribution
5. Suggestibility
6. Bias
7. Persistence.
<table>
<thead>
<tr>
<th>Sin</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transience</td>
<td>Decreasing accessibility of memory overtime</td>
<td>Simple forgetting of long-past events</td>
</tr>
<tr>
<td>Absent-mindedness</td>
<td>Lapses of attention that result in forgetting</td>
<td>Forgetting location of car keys</td>
</tr>
<tr>
<td>Blocking</td>
<td>Information is present but temporarily accessible</td>
<td>Tip-of-the-tongue</td>
</tr>
<tr>
<td>Misattribution</td>
<td>Memories are attributed to an incorrect source</td>
<td>Confusing a dream for a memory</td>
</tr>
<tr>
<td>Suggestibility</td>
<td>Implanted memories about things that never occurred</td>
<td>Leading questions produce false memories</td>
</tr>
<tr>
<td>Bias</td>
<td>Current knowledge and beliefs distort our memories of the past</td>
<td>Recalling past attitudes in line with current attitudes</td>
</tr>
<tr>
<td>Persistence</td>
<td>Unwanted recollections that are difficult to forget</td>
<td>PTSD-Traumatic war memories</td>
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