

# Strategies to Support Students' Working Memory and Retention

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# Introduction to Whole School SEND

## Aim 1

- Drive education institutions to prioritise SEND within their CPD and school improvement plans including facilitating greater links between mainstream and special schools.

## Aim 2

- Equip schools to identify and meet their training needs in relation to SEND.

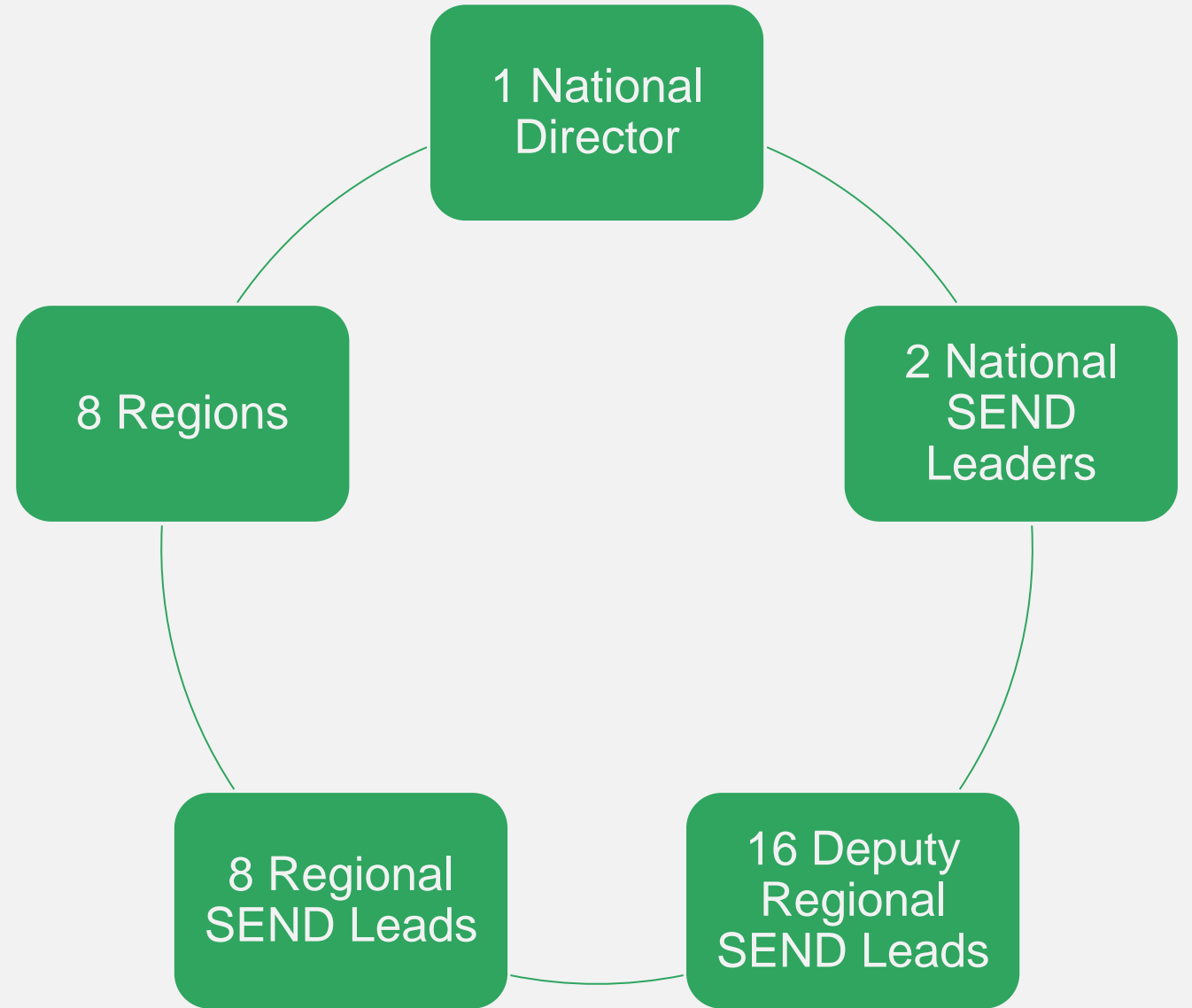
## Aim 3

- Build the skills of teachers working in mainstream and special schools and of SENCOs and teachers of classes of children and young people with sensory impairments by promoting best practice.

## Aim 4

- Identify and respond to any gaps in the training and resources available to schools.

# Regional SEND Leadership



# UNDERSTANDING WORKING MEMORY

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EDUCATIONAL PSYCHOLOGY  
SERVICE



*BASED PRIMARILY ON:*

***UNDERSTANDING WORKING MEMORY: A CLASSROOM  
GUIDE***

*BY GATHERCOLE AND ALLOWAY (2007)*

FREELY AVAILABLE FROM:

[WWW.MRC-CBU.CAM.AC.UK/WP-CONTENT/UPLOADS/2013/01/WM-CLASSROOM-GUIDE.PDF](http://WWW.MRC-CBU.CAM.AC.UK/WP-CONTENT/UPLOADS/2013/01/WM-CLASSROOM-GUIDE.PDF)

# OUTLINE

What is working memory (WM)?

Why is working memory important in the classroom?

Low working memory

Strategies for supporting children with low WM

# WHAT IS WORKING MEMORY?

- WORKING MEMORY DESCRIBES OUR ABILITY TO (A) HOLD IN MIND AND (B) MENTALLY MANIPULATE INFORMATION OVER SHORT PERIODS OF TIME.
- MORE RECENTLY, SOME RESEARCHERS HAVE DEFINED IT AS THE ABILITY TO KEEP INFORMATION IN MIND *IN THE FACE OF DISTRACTION*.
- IT IS OFTEN DESCRIBED AS A 'MENTAL WORKSPACE'.

# WHAT IS WORKING MEMORY?

- PLEASE CALL ME BACK ON 03000 263 333.
- TURN LEFT AT THE LIGHTS, THEN RIGHT AT THE ROUNDABOUT; KEEP GOING UNTIL YOU REACH THE SCHOOL THEN IT'S SECOND ON YOUR RIGHT.
- WHEN YOU'VE COMPLETED YOUR SENTENCES, PUT YOUR BOOK IN THE FINISHED TRAY, COLLECT A WHITEBOARD AND PEN FROM THE BACK AND THEN COME AND SIT ON THE CARPET.
- 43 X 13



# WHAT ARE THE COMPONENTS?

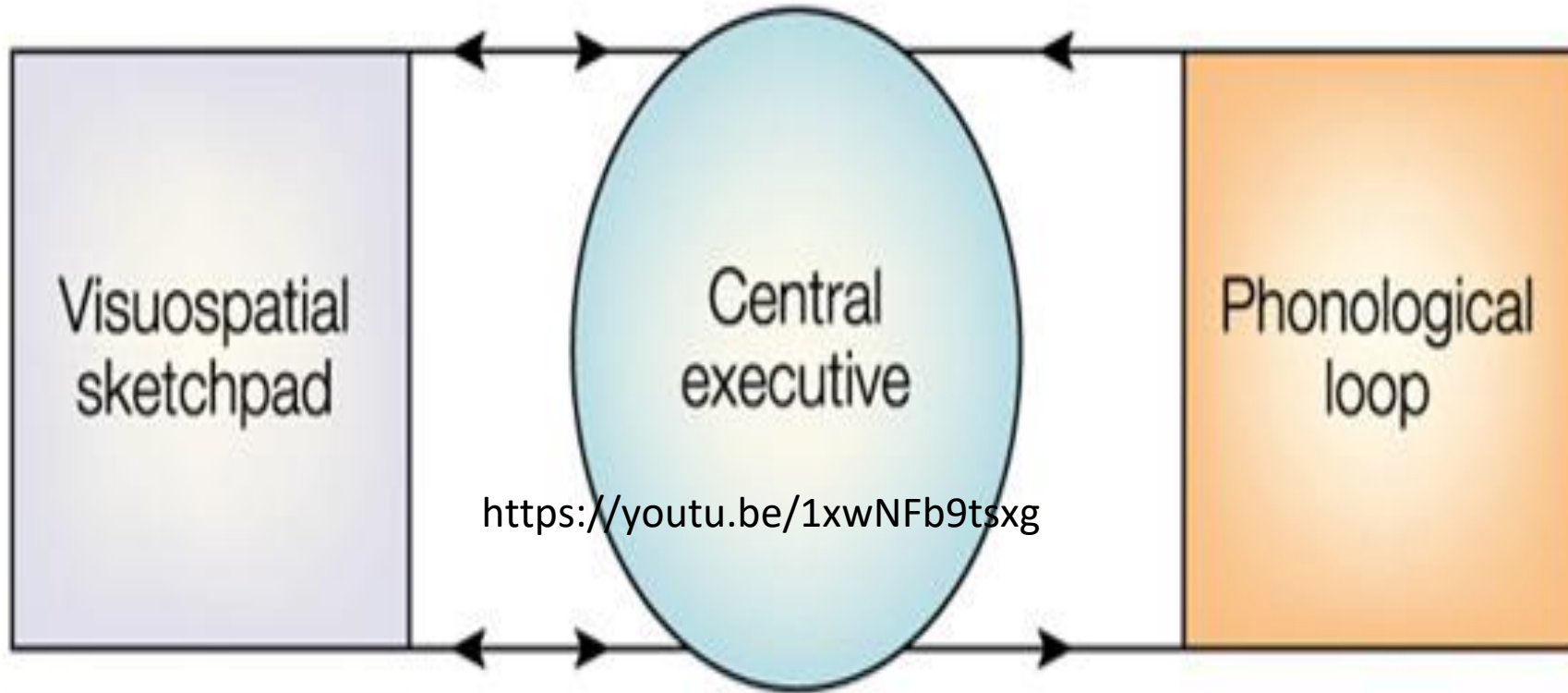
Visuospatial short term memory—  
can hold images,  
pictures and  
information about  
locations

[Right  
hemisphere]

Central executive-controls  
attention, coordinates  
processes of storage and  
processing [front regions  
of left and right  
hemisphere]

Verbal short term  
memory stores  
material that is  
expressed such as  
numbers, words  
and sentences

[Left hemisphere]



# WHAT IS WORKING MEMORY?

BADDELEY'S ORIGINAL (1974) MODEL OF WM:

# WHAT IS WORKING MEMORY?

## Executive Functions:

- Co-ordination-
- Switching strategies- Cognitive Flexibility is being able to come up and think of multiple ways of doing something

Inhibition-  
Inhibitory control  
or self control-  
being able to  
ignore  
distractions and  
resist  
temptations

- Hold and manipulate information in long term memory

# DEVELOPMENT OF W.M. AND RATIONALE

- MARKED WM CAPACITY BETWEEN 5 AND 14
- SMALL BUT SIGNIFICANT INCREASE UP TO 15 YEARS
- OPTIMUM WM CAPACITY BETWEEN 15 AND 30 BUT DECLINES FROM 50 TO 60
- ADULT MEMORY SPAN 2 TO 3 TIMES GREATER THAN THAT OF A YOUNGER CHILD
- FORWARD DIGIT SPAN FOR AN ADULT IS APROX. 7 ITEMS AND BACKWARD DIGIT SPAN AROUND 4 ITEMS
- INCREASINGLY EFFICIENT MENTAL PROCESSES OVER TIME UNTIL ADULT LIFE E.G. COUNTING, FLUENCY
- MORE BOYS THAN GIRLS [3:2 IN LOWEST 10% OF GATHERCOLE STUDY]



# LOSS OF WORKING MEMORY

- INFORMATION CAN BE LOST FROM WM IN A NUMBER OF WAYS:
  - DECAY (I.E. LOST OVER TIME)
  - DISTRACTION
  - TRYING TO HOLD TOO MUCH INFORMATION
  - ENGAGING IN A DEMANDING TASK
  - DOING SOMETHING AT THE SAME TIME
  - LOCATION OF ITEMS [E.G. MIDDLE OF A LIST]



# BARRIERS TO WORKING MEMORY

---

Language Delay and understanding

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Processing difficulties

---

Limited attention

---

Obsessive traits and rituals

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Sensory needs [noise, light, texture]

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Confidence and self-concept

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Social interaction



# WHY IS WORKING MEMORY IMPORTANT IN THE CLASSROOM?



Maths and knowledge of numbers and operations



Reading and letter sound, decoding knowledge



Writing a sentence and story...



Following multi-part instructions...



Copying information from the board...




Planning a task


# LOW WORKING MEMORY

- WE DON'T KNOW EXACTLY WHY SOME PEOPLE HAVE A LOW WM CAPACITY. IT IS NOT STRONGLY RELATED TO **ENVIRONMENTAL FACTORS**, AND IT SEEMS LIKELY THAT **GENETICS** PLAY A PART (LINKED TO THE DEVELOPMENT OF CERTAIN AREAS OF THE BRAIN).
- WE DO KNOW THAT IT CAN HAVE A BIG EFFECT ON LEARNING AND PROGRESS... DUE TO THE EFFECTS OF WORKING MEMORY 'OVERLOAD'.
- IT HAS BEEN SUGGESTED THAT HAVING A POOR WM CAPACITY ACTS AS A BOTTLENECK FOR CLASSROOM LEARNING.






# LOW WORKING MEMORY INDICATORS




- SOME THINGS TO LOOK OUT FOR OR HALLMARKS:
  - MIND WANDERING OR ZONING OUT WITH CHALLENGE
  - SHORT ATTENTION SPANS OR EASILY DISTRACTED
  - FORGETTING THE CONTENTS OF MESSAGES OR INSTRUCTIONS
  - LOSING TRACK IN A COMPLEX TASK
  - FREQUENTLY LOSING THEIR PLACE / NOT FULLY COMPLETING TASKS
  - RESERVED IN GROUP ACTIVITIES / RARELY VOLUNTEERING ANSWERS OR FAILING TO ANSWER QUESTIONS
  - LIMITED ACADEMIC PROGRESS, PARTICULARLY IN MATHEMATICS AND READING




POOR WORKING MEMORY CAN BE CHARACTERISTIC OF  
CHILDREN WITH:

- POOR CENTRAL EXECUTIVE
- LANGUAGE IMPAIRMENT LINK TO GREATER VERBAL WM DEFICITS
- READING AND NUMBER DIFFICULTIES INCLUDING DYSLEXIA
- NEURODEVELOPMENTAL DISORDERS INCLUDING ADHD AND ASD WITH IMPACT ON EXECUTIVE FUNCTIONS AND ATTENTION

WM AND  
LEARNING  
DIFFICULTIES





# VISUAL AND AUDITORY MEMORY ASSESSMENT

Visual	Auditory
Recall of an object	Digit span forwards
Recall of the order of the objects	Digit span backwards
Recall of the objects within a group of objects	Sequencing

# DEBATE: MEMORY TRAINING

- THERE ARE TWO APPROACHES TO ALLEVIATING WM DIFFICULTIES
  1. MINIMISE FAILURE IN THE CLASSROOM VIA EFFECTIVE MANAGEMENT OF WM LOADS
  2. IMPROVE WM DIRECTLY AND MEMORY TRAINING

[HTTPS://YOUTU.BE/S65D2OAZF8M](https://youtu.be/S65D2OAZF8M)





# DEBATE: MEMORY TRAINING

- THERE IS SOME EVIDENCE THAT IT CAN LEAD TO IMPROVEMENTS IN TASKS RELATING DIRECTLY TO WM
- IT IS FELT THAT THIS MAY BE BECAUSE SUCH TRAINING ENCOURAGES THE DEVELOPMENT OF SUPPORTIVE STRATEGIES.
- **BUT** VERY INCONSISTENT EVIDENCE AS TO WHETHER SUCH TRAINING LEADS TO TRANSFERABLE IMPROVEMENTS IN OTHER AREAS OF LEARNING.



Contents lists available at SciVerse ScienceDirect

## Journal of Applied Research in Memory and Cognition

journal homepage: [www.elsevier.com/locate/jarmac](http://www.elsevier.com/locate/jarmac)



Target article

### Cogmed working memory training: Does the evidence support the claims?☆

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#### ABSTRACT

Cogmed working memory training is sold as a tool for improving cognitive abilities, such as attention and reasoning. At present, this program is marketed to schools as a means of improving underperforming students' scholastic performance, and is also available at clinical practices as a treatment for ADHD. We review research conducted with Cogmed software and highlight several concerns regarding methodology and replicability of findings. We conclude that the claims made by Cogmed are largely unsubstantiated, and recommend that future research place greater emphasis on developing theoretically motivated accounts of working memory training.

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# DEBATE: MEMORY TRAINING

- IN 2010 A LARGE SCALE STUDY BY JOE ELLIOT AND COLLEAGUES COMPARED THE TWO APPROACHES, CONCLUDING:
- “AT THE END OF THE YEAR, THERE WAS NO EVIDENCE THAT EITHER OF THE INTERVENTION PROGRAMS HAD RESULTED IN GREATER WM OR ACADEMIC PERFORMANCE... THAN FOR CONTROLS. HOWEVER, CLASSROOM OBSERVATION DATA INDICATED THAT THE EXTENT TO WHICH TEACHERS IMPLEMENTED DESIRABLE STRATEGIES AT ANY TIME POINT... PROVED TO BE A PREDICTOR OF THE CHILDREN’S ATTAINMENT.”

# SUPPORT FOR LOW WORKING MEMORY

1. RECOGNISE WORKING MEMORY FAILURES AND BUILD A PROFILE. THESE CAN INCLUDE:

- INCOMPLETE RECALL [E.G. PART OF A SENTENCE]
- FAILURE TO FOLLOW MULTI-STEP INSTRUCTIONS
- PLACE KEEPING ERRORS [E.G. REPEATING A WORD OR NUMBER, OMISSION, MISSING LINES]
- TASK ABANDONMENT [E.G. ZONING OUT, OFF TASK]

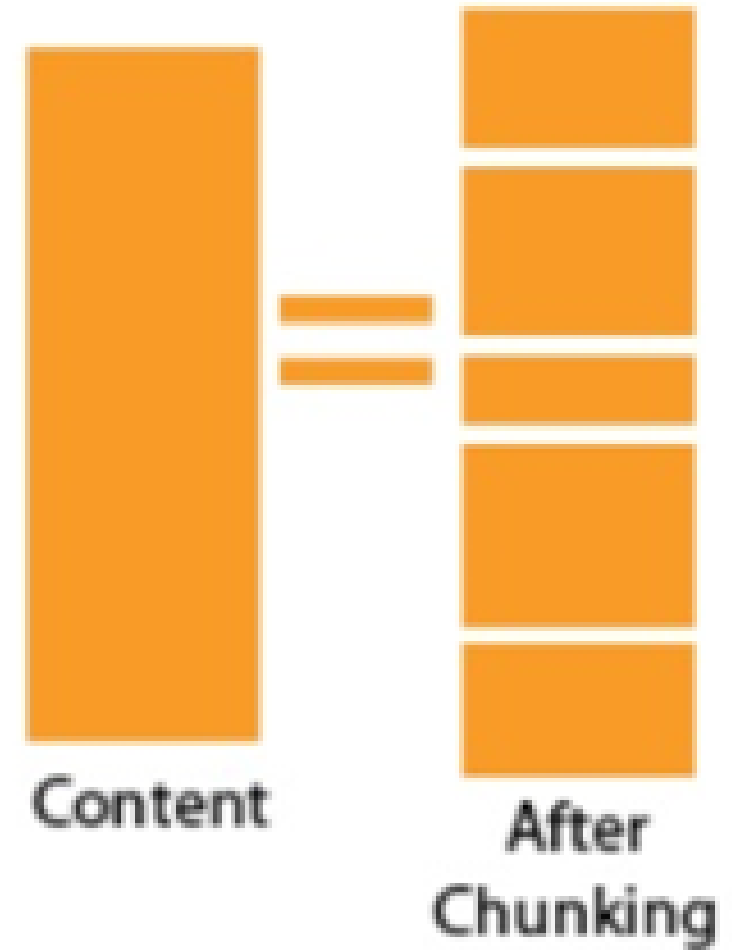
2. MONITOR THE CHILD WITH SIGNS OF FAILURE AND DISCUSSION



# SUPPORT FOR LOW WM

## 3. EVALUATE THE WM DEMANDS OF LEARNING ACTIVITIES FOR:

- LENGTH WITH INFORMATION AND INSTRUCTIONS [MORE THAN 3]
- SEQUENCES INVOLVED
- MEANINGFULNESS
- AMOUNT OF UNFAMILIAR INFORMATION
- GRAMMATICAL STRUCTURE



# STRATEGIES FOR SUPPORTING LOW LW

4 REDUCE WORKING MEMORY LOADS TO PREVENT OVERLOAD BY:

- USING LESS STEPS AND SHORTER SENTENCES
- REVIEW A TOPIC TO ACTIVATE LONG TERM MEMORY
- RE-PHRASE INSTRUCTIONS
- BREAK INSTRUCTIONS DOWN INTO SEPARATE STEPS WITH PROMPTS
- REMOVAL OF NON-ESSENTIAL ELEMENTS



# STRATEGIES FOR LOW WM

PROCESSING DEMANDS INCREASE WM LOADS AND INCLUDE  
ADDITIONAL TIME, VISUAL CUES AND REPETITION

10 SECOND RULE.

FREQUENTLY REPEAT IMPORTANT INFORMATION

- KEY WORDS
- VISUAL CUES
- ENCOURAGE CHILDREN TO REQUEST REPETITION IF NEEDED
- PARTNERS AS GUIDES

# ORGANISATIONAL STRATEGIES FOR LWM

DUE TO POOR RETRIEVAL AND STORAGE SYSTEMS, ENCOURAGE THE ROUTINE USE OF

- VISUAL SCHEDULES AND COLOUR CODING ITEMS
- CHECKLISTS AND KEY WORDS
- MEMORY AIDS-POSTERS, WORD BANKS, NUMBER LINES
- DIAGRAMS AND FLOW CHARTS
- AUDIO DEVICES SUCH AS DICTAPHONES, APPS
- INDIVIDUAL WHITEBOARD / NOTEBOOK
- MNEMONICS AND ACRONYMS



# STRATEGIES FOR SUPPORTING LOW WM

## DEVELOP THE USE OF MEMORY-RELIEVING STRATEGIES

- REHEARSAL
- VISUALISATION (E.G. MAGICAL SPELLING)
- CHUNKING / GROUPING
- COLOUR CODING (E.G. COLOURFUL SEMANTICS)




# MEMORY GAMES

- HOW MANY DIFFERENCES CAN YOU FIND? ACTIVITIES
- CONCENTRATION GAME
- SCRABBLE AND CARD GAMES
- SHOPPING LIST GAME
- BRAIN GYM AND THINKING SKILL ACTIVITIES
- LISTENING ACTIVITIES
- EXECUTIVE FUNCTIONING CARDS
- MEMORY BOOSTER [A SERIES OF COMPUTER GAMES]



# SUPPORT FOR TASK INITIATION

- ELIMINATE DISTRACTIONS WHEN POSSIBLE AND ENSURE YOU HAVE FULL ATTENTION
  - GOAL SETTING AND CHILD FRIENDLY TARGETS
  - VISUAL TIMER
  - BREATHING EXERCISES
  - CAREFUL SEATING ALLOCATION
  - SENSORY AUDIT
  - INCREASE AND TEACH SELF-HELP SKILLS
- 

# WM AND ASD

- [HTTPS://YOUTU.BE/FHCFOTWJDX4](https://youtu.be/FHCFOTWJDX4)
- ONE STEP OR RULE AT A TIME
- MINIMISE OVERSTIMULATION TO AVOID OVERLOAD
- SET SOCIAL ROUTINES



# OPTIMUM WM LEARNING ENVIRONMENT

- SHORT INTERVALS OF 10 MINUTES FOR INSTRUCTIONS AND TASKS, WAIT TIME AND RECAPS
- MULTI SENSORY STRATEGIES WITH TEACHING
- INTERACTIVE DISPLAYS
- TASK LISTS AND STEP BY STEP INSTRUCTIONS THAT ARE COLOUR CODED
- REPEATED INFORMATION
- ALTERNATIVE WAYS OF RECORDING
- MEMORY AIDS DISPLAYED AND AVAILABLE

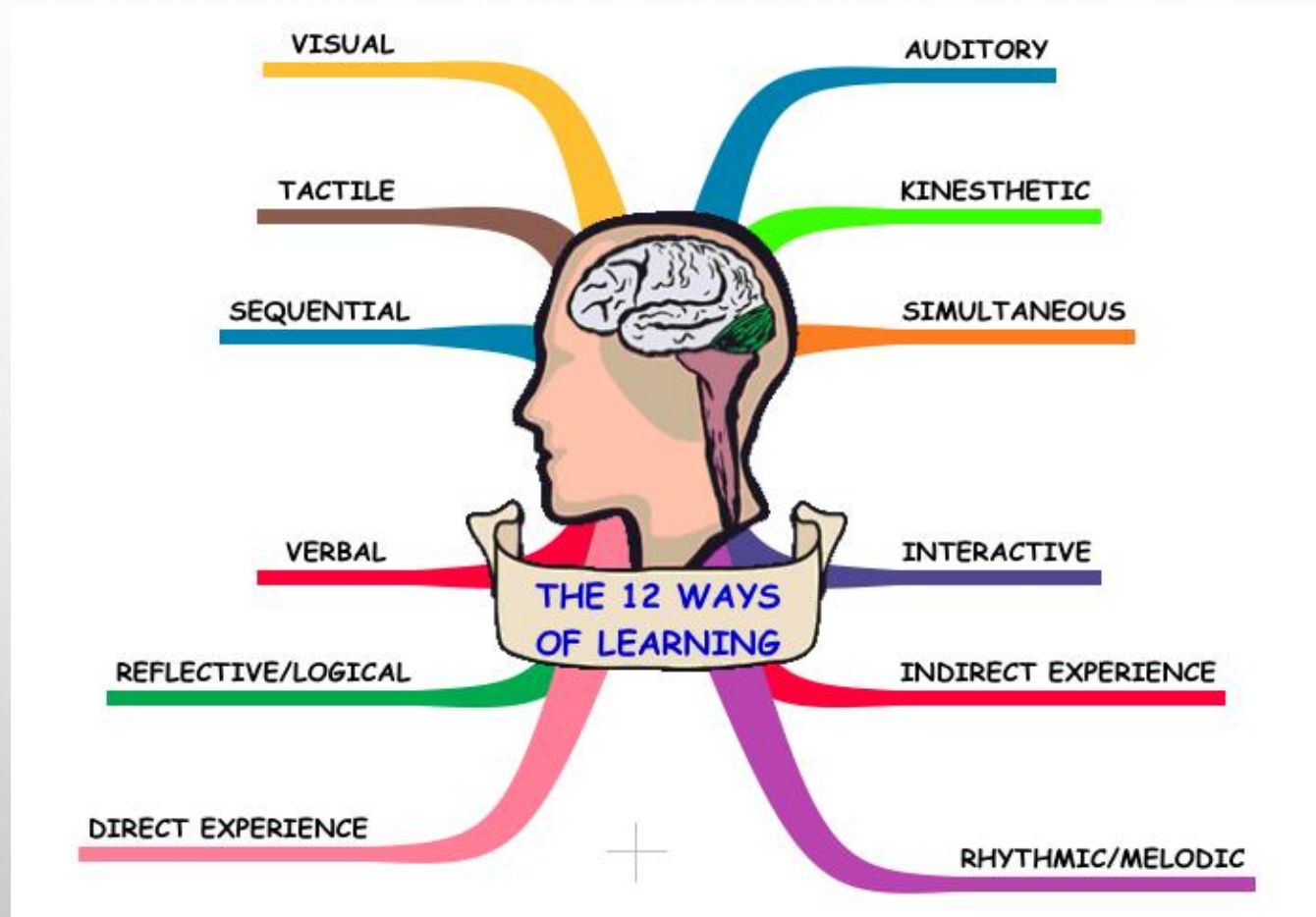
# STRATEGIES FOR SUPPORTING CHILDREN WITH LOW LW

- TO SUMMARISE!
  - **RECOGNISE AND MONITOR** WM DIFFICULTIES
  - **EVALUATE AND REDUCE** WM DEMANDS
  - **REPEAT** KEY INFO AND ENCOURAGE REQUESTS FOR REPETITION
  - UTILISE **MEMORY AIDS**
  - DEVELOP MEMORY-RELIVING **STRATEGIES**
  - PLUS...

# OUTCOMES FOR MEMORY

KEY QUESTIONS INCLUDE:

- WHAT DO YOU SEE THEM DOING AND WHAT IS THE EXPECTED CHANGE?
- HOW DO THEY APPROACH AND PERSIST WITH TASK?
- WHAT DO THEY RESPOND TO WITHIN TASKS AND ENVIRONMENT? WHAT HELPS?
- WHAT ARE THEIR STRENGTHS AND LIMITATIONS?
- HOW CAN WE MEASURE PROGRESS?
- WHAT IS OUR BASELINE DATA, INTERVENTION AND EVIDENCE?



# Why Experiential, Activity Based Learning

## The Cone of Learning

After 2 weeks,

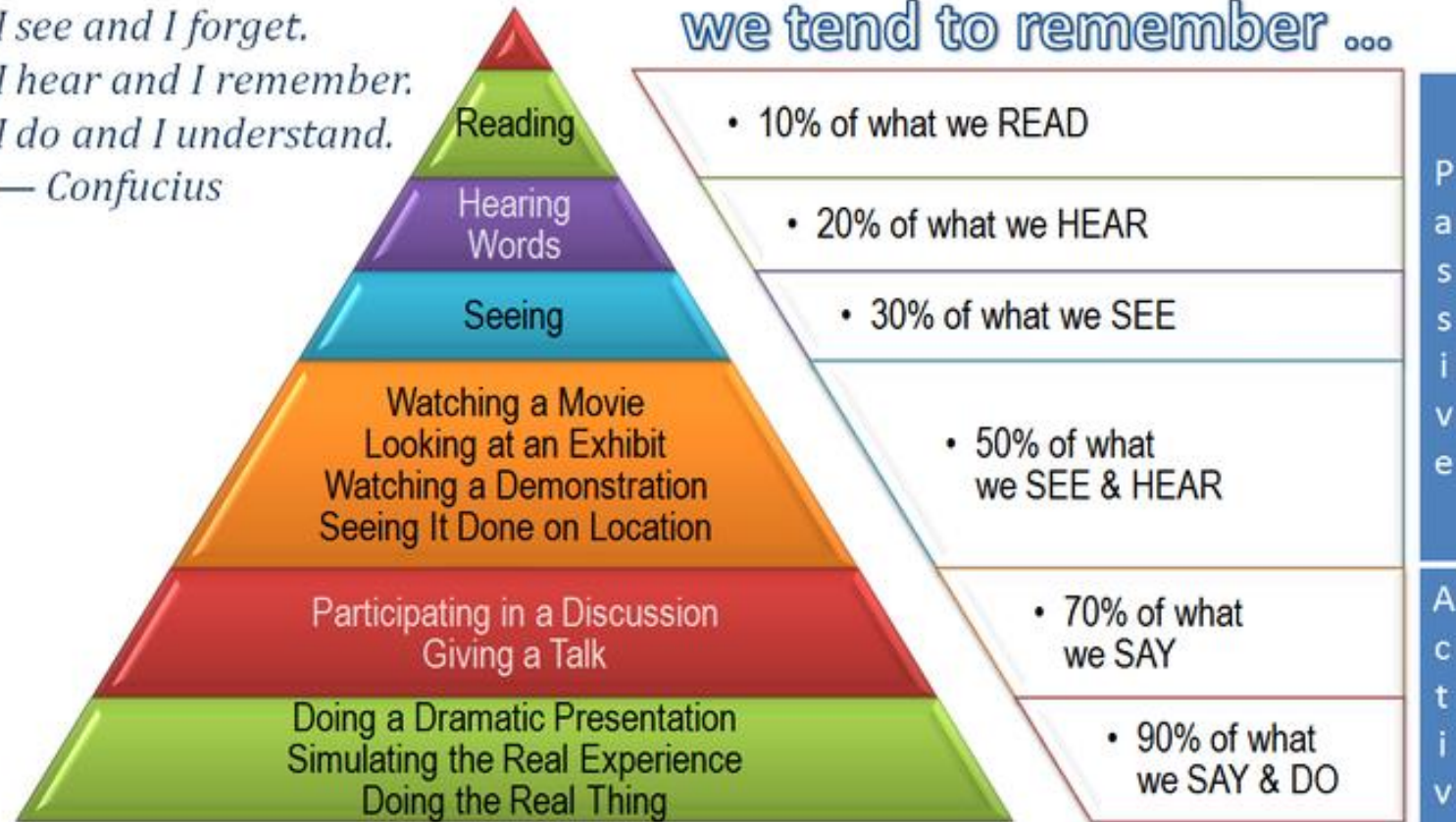
we tend to remember ...

*I see and I forget.*

*I hear and I remember.*

*I do and I understand.*


— Confucius



Source: Edgar Dale (1969)



# FREQUENTLY ASKED QUESTIONS

- DO I HAVE TO CHANGE WHAT I TEACH?
  - IS WORKING MEMORY AFFECTED BY PHYSICAL FACTORS? DIET EXERCISE
  - CAN STRESS OR ANXIETY CAUSE POOR WORKING MEMORY?
  - CAN WORKING MEMORY BE IMPROVED BY TRAINING?
  - DO WORKING MEMORY PROBLEMS PERSIST BEYOND EARLY AND MIDDLE CHILDHOOD?
  - WHEN DOES WORKING MEMORY DECLINE?
- 



Thanks for  
listening

Questions and  
Answers

# REFERENCE S AND LINKS

- AUDITORY MEMORY SKILLS BY MARK & KATY HILL, LDA ?  
VISUAL MEMORY SKILLS BY MARK & KATY HILL, LDA
- WORKING MEMORY AND LEARNING. A PRACTICAL GUIDE  
FOR TEACHERS BY S GATHERCOLE AND T PACKIAM  
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- WORKING MEMORY AND EDUCATION BY S.J. PICKERING  
AND G. PYE [2006]
- <HTTPS://YOUTU.BE/S65D2OAZF8M?T=21> [WM  
GATHERCOLE]
- <HTTPS://YOUTU.BE/UWKVPFZJWCE> [TED TALK]
- <HTTPS://YOUTU.BE/FHCFOTWJDX4> [WM AND AUTISM]



# FAQ Answers

*Do I have to change what I teach?*

No, but the following will help:

- Modifications to the content to prevent overload
- Avoiding memory failure
- Teaching strategies and providing memory aids

# FAQ Answers

*Is working memory affected by physical factors?*

Like all cognitive abilities, working memory depends on parts of the brain. A healthy diet and exercise are vital for functioning.

# FAQ Answers

*Can stress or anxiety cause poor working memory?*

Stress can lead to temporary reductions in working memory capacity. Severe depression is linked with reduction of focus. Anxiety should be treated as reason for disturbance in memory and function.

# FAQ Answers

*Can working memory be improved by training?*

Working memory can be enhanced by training which improves attention and provides strategies.

# FAQ Answers

*Do working memory problems persist beyond early and middle childhood?*

Children do not grow out of working memory problems and attention difficulties persist. Strategies do help in later life such as taking notes, breaks and rehearsal. Access to IT can also aid memory.

# FAQ Answers

*When does working memory decline?*

Working memory declines in middle age and continues in gradual loss. Engagement in strategies can and demanding activities can help engage attention and cognitive skills.

# Regional SEND Lead Contact Information and Download Links

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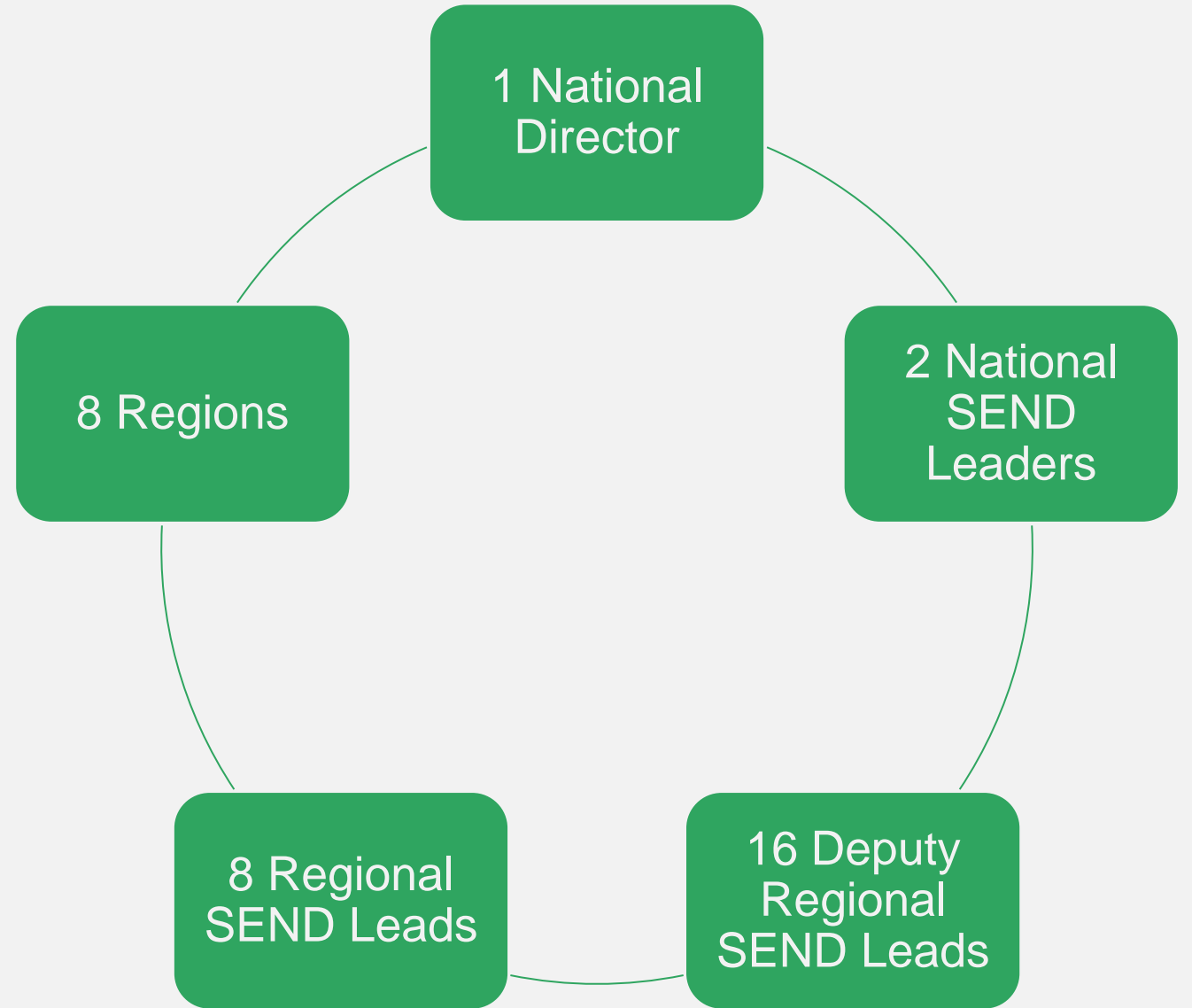


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# Regional SEND Leadership





# Find your region

- The Regions are based on the boundaries used by the Regional Schools Commissioner areas.
- You can find out which region your local authority comes under here:

<https://www.sendgateway.org.uk/whole-school-send/regions/>

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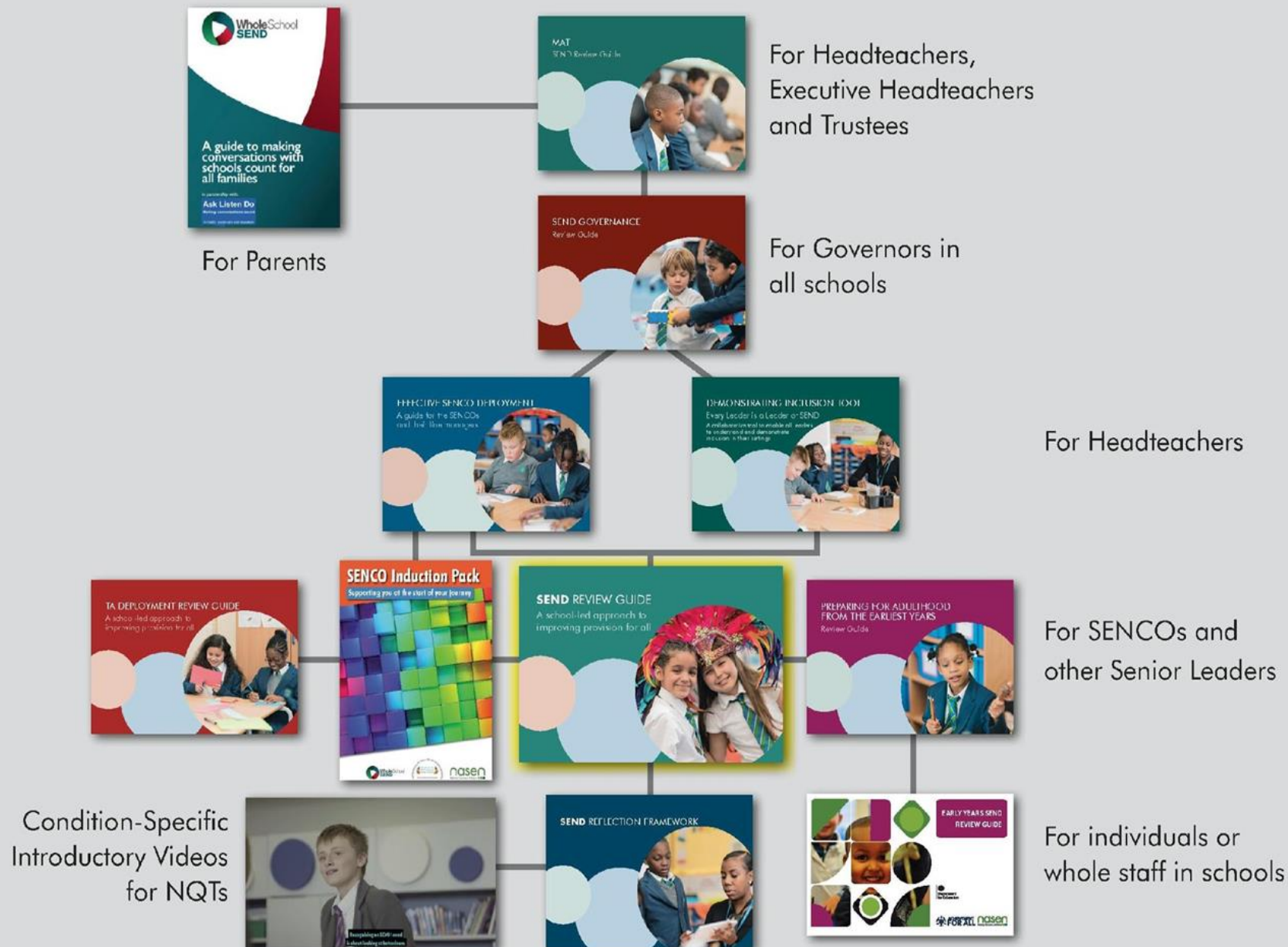
- Emma Vyvyan

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# Resources

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# WHOLE SCHOOL SEND RESOURCES



# Whole School SEND Resources

- The Review Guides can be downloaded here:

<https://www.sendgateway.org.uk/whole-school-send/find-wss-resources/>

- The SENCO Induction Pack can be downloaded here:

<https://www.sendgateway.org.uk/whole-school-send/sencos-area/>

- The Condition-Specific Videos can be viewed here:

<https://www.sendgateway.org.uk/whole-school-send/find-wss-resources/nqt-videos.html>

# Recordings

- You can find recordings of our past webinars on our YouTube channel.
- Subscribe here to keep updated:  
[www.youtube.com/c/WholeSchoolSEND](https://www.youtube.com/c/WholeSchoolSEND)



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Please get in touch if you are struggling  
to locate any of the resources from this  
session

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[info@wholeschoolsend.com](mailto:info@wholeschoolsend.com)



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