Working Memory & Processing Speed in the Classroom

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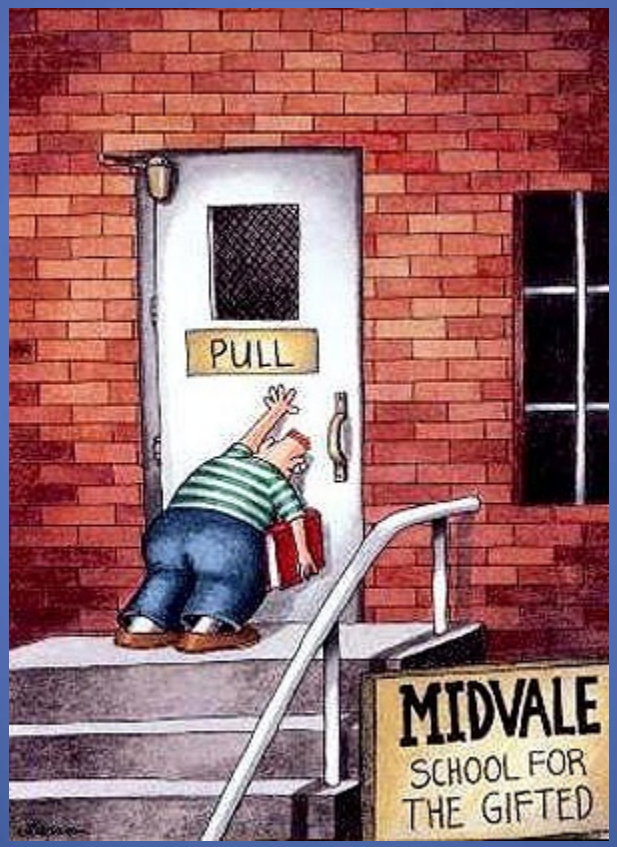
Not all gifted students are built alike!



Slow Processing Speed

- Not always a bad thing?

What's important about Working Memory and Processing Speed?

Problems in WM and/or PS:

…are often part of the reason children struggle in school

…are often seen in *Twice Exceptional* students

…cause troubles at home

…impact children's relationships.

…often define children's feelings about themselves.

Goals

- To demonstrate how Working Memory (WM) and Processing Speed (PS) impact students.
- To demonstrate that WM and PS can be related to the Executive Functions associated with ADHD and with LD.
- To develop more thorough and accurate definitions of WM and PS.
- To plan interventions to address WM and PS problems in the classroom.

What's important about Working Memory and Processing Speed?

- In school, WM and PS impact alertness, learning, expression, social adjustment, academic identity, emotional comfort, etc.

- At home, WM and PS impact homework, chores, relationships, recreation (sports and games), self concept, etc.

WM and/or PS may accompany giftedness (2e)

At this point these are informal labels, but refer to two essential parts:

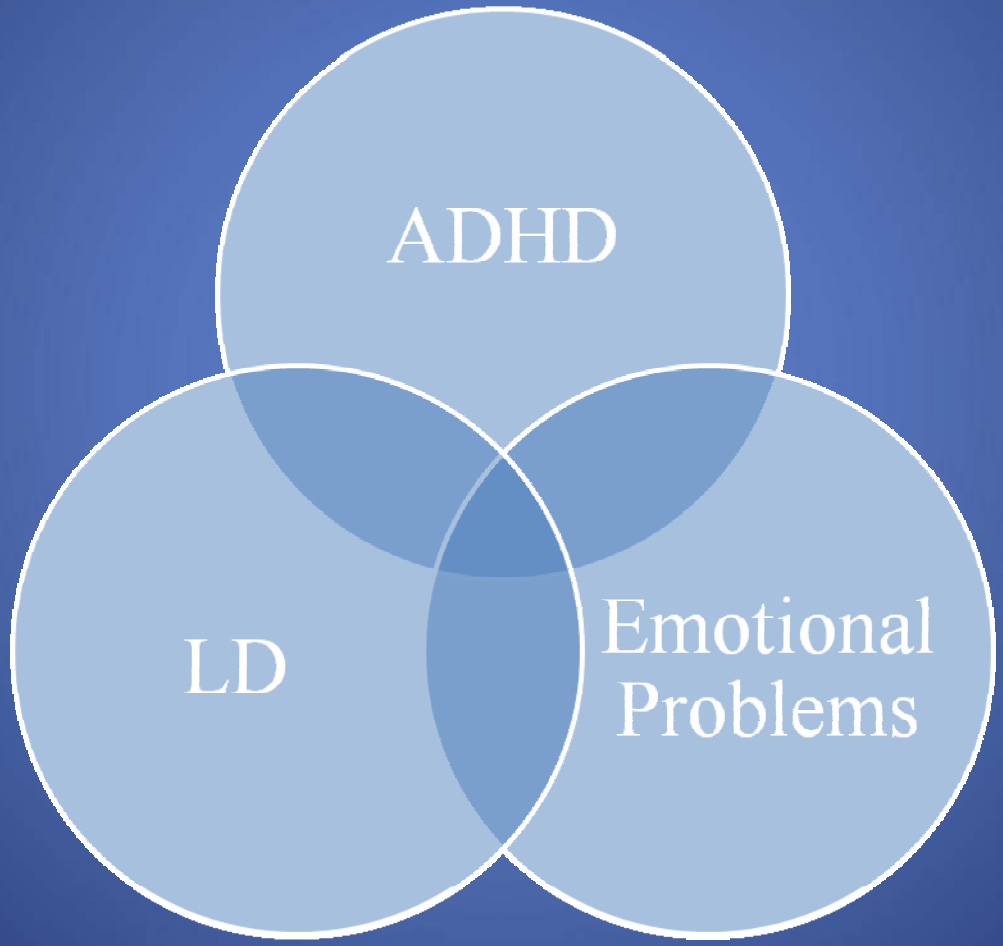
1. Giftedness
2. Learning interference(s)

…which combine to cause the student to underperform.

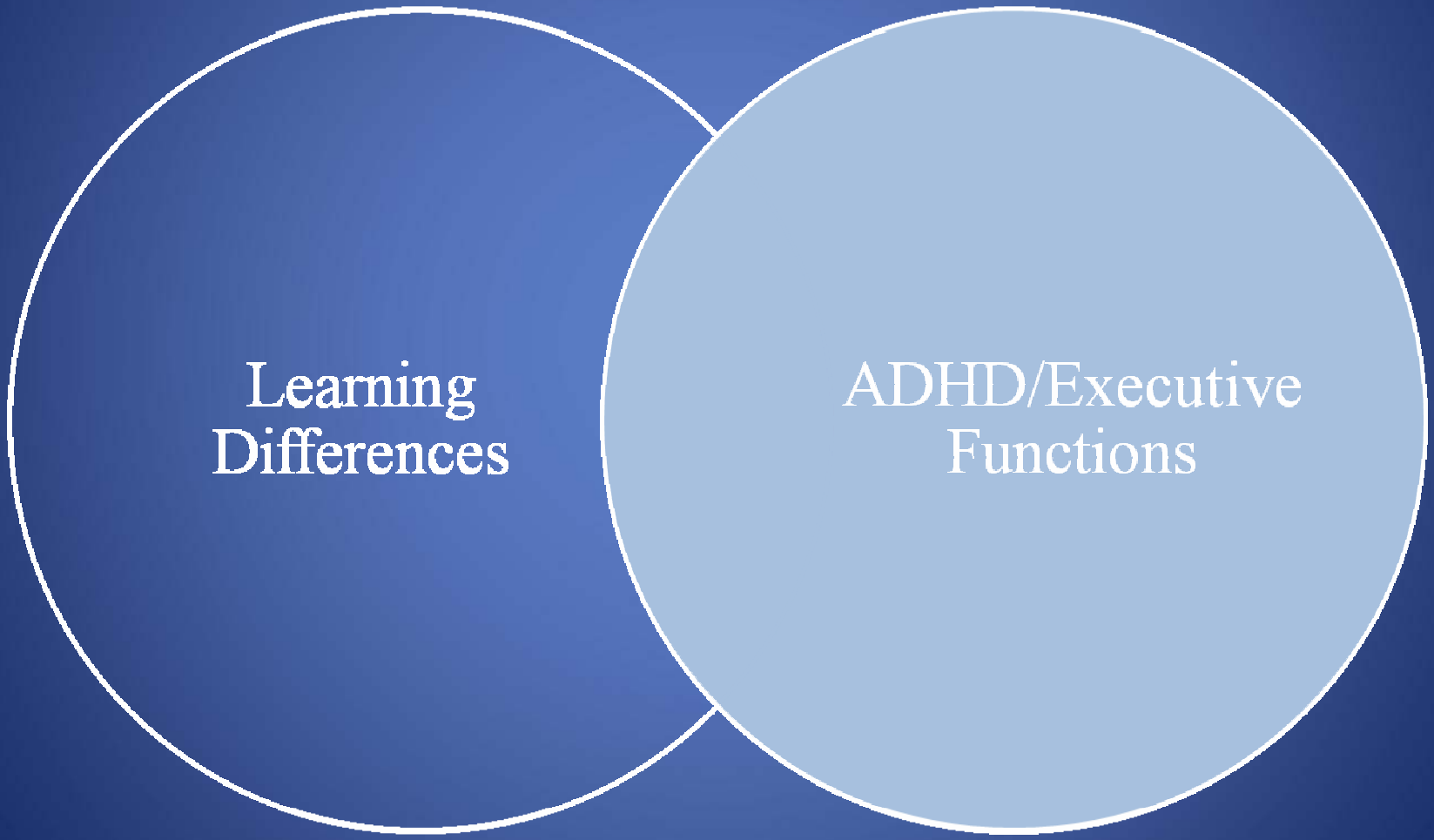
Three subgroups of 2e

1. Students identified as gifted, who develop difficulties in school. Their learning problems remain unrecognized until they fall so far behind their peers that someone finally suspects a disability.
2. Students whose learning disabilities have been identified, but whose exceptional abilities have never been recognized.
3. Students those whose abilities and disabilities mask each other (pressing the gas but the brakes are engaged).

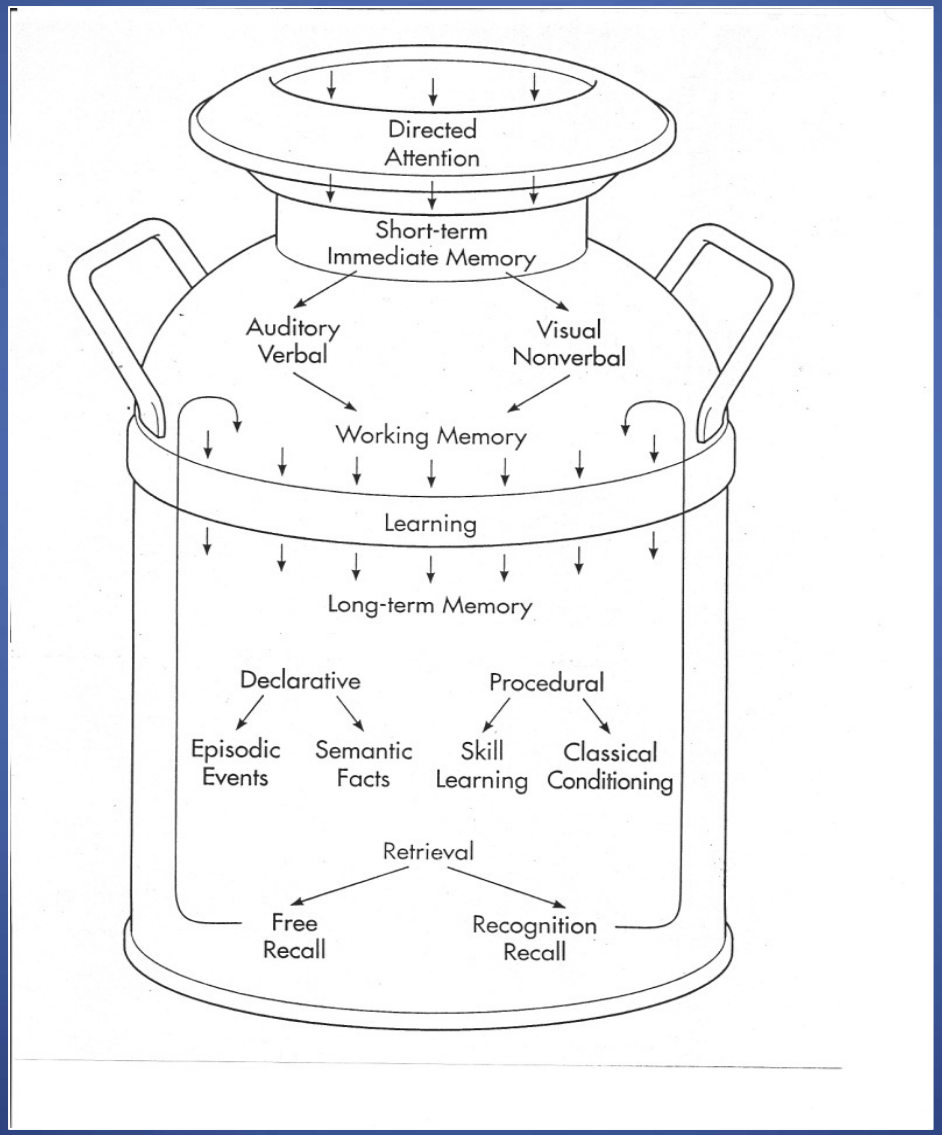
WM and PS in context



WM & PS can be related to ADHD and/or Learning Differences



WM as related to Learning



Ways to measure WM and PS

These factors are included in many standardized tests:

- Psychological
- Educational
- Neuropsychological

WM & PS as related to Structures of Intelligence

- Wechsler Scales (WPPSI, WISC, WAIS)

- Verbal Comprehension Index
- Perceptual Organization Index
- Working Memory Index
- Processing Speed Index
- Full Scale IQ

Basic Definitions (WISC-IV)

Working Memory Index

- The WMI assesses the ability to hold new information in short-term memory, concentrate, and manipulate that information to produce some result or reasoning processes.

  It is important in higher-order thinking, learning, and achievement. It can tap concentration, planning ability, cognitive flexibility, and sequencing skill, but is sensitive to anxiety too. It is an important component of learning and achievement, and ability to self-monitor.

WISC-IV Working Memory Subtests

Digit Span

- Repeating series of digits
- Reversing series of digits

Letter Number Sequencing

- Repeating sequences of numbers and letters in proper order

Arithmetic

- Using mental math to perform basic calculations

Basic Definitions (WISC-IV)

Processing Speed Index

- The PSI assesses the abilities to focus attention and quickly scan, discriminate between, and sequentially order visual information. It requires persistence and planning ability, but is sensitive to motivation, difficulty working under a time pressure, and motor coordination.

  It is related to reading performance and development. It is related to Working Memory, in that increased processing speed can decrease the load placed on working memory, while decreased processing speed can impair the effectiveness of Working Memory.

WISC-IV Processing Speed Subtests

Coding

- Transcribe symbols using a code

Symbol Search

- Mark whether a target symbol occurs in a search group

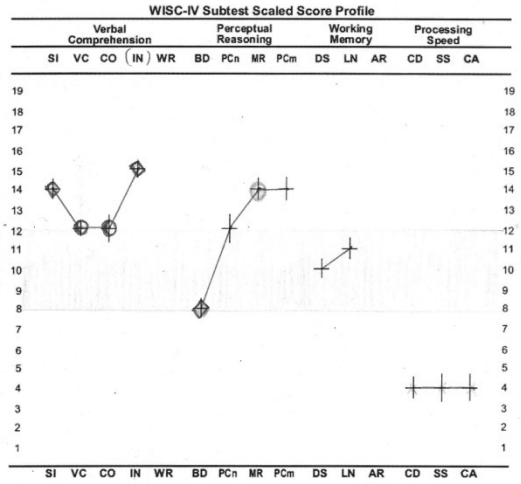
Cancellation

- Mark target members of a category mixed in arrays of targets and non-targets

Working Memory and Processing Speed as basic elements of the WISC-IV's structures of intelligence

Tables and Graphs Report for WISC-IV

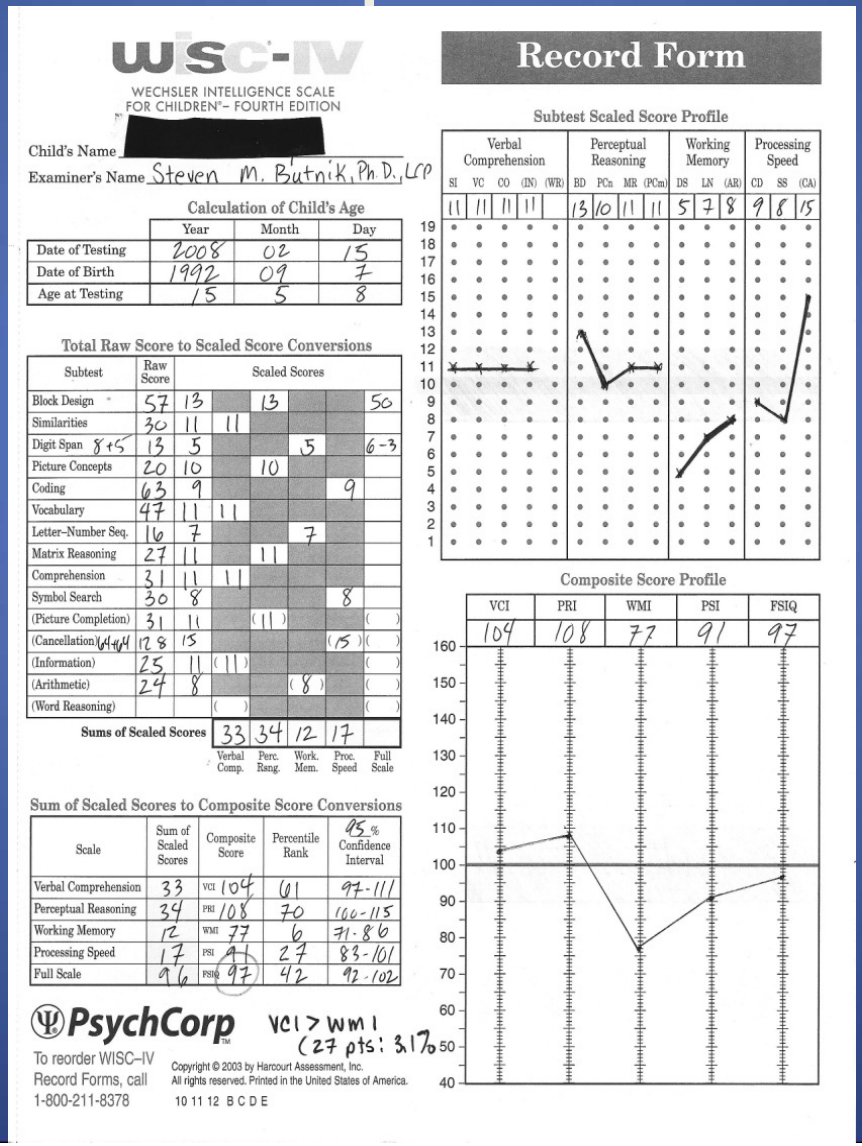
WISC-IV Subtest Scaled Score Profile



Vertical bar represents the Standard Error of Measurement.

Subtest	Score	SEM	Subtest	Score	SEM
Similarities (SI)	14	0.99	Picture Completion (PCm)	14	1.2
Vocabulary (VC)	12	0.73	Digit Span (DS)	10	0.99
Comprehension (CO)	12	1.34	Letter-Number Sequencing (LN)	11	1.08
Information (IN)	15	0.9	Arithmetic (AR)		
Word Reasoning (WR)			Coding (CD)	4	1.08
Block Design (BD)	8	1.04	Symbol Search (SS)	4	1.41
Picture Concepts (PCn)	12	1.44	Cancellation (CA)	4	1.37
Matrix Reasoning (MR)	14	1.12			

Working Memory as a WISC-IV Component



WISC-IV

WECHSLER INTELLIGENCE SCALE FOR CHILDREN®– FOURTH EDITION

Record Form

Child's Name [redacted]

Examiner's Name Steven M. Butnik, Ph.D., LCP

Calculation of Child's Age

	Year	Month	Day
Date of Testing	2008	02	15
Date of Birth	1992	09	7
Age at Testing	15	5	8

Total Raw Score to Scaled Score Conversions

Subtest	Raw Score	Scaled Scores					
Block Design	57	13		13			50
Similarities	30	11	11				
Digit Span 8+5	13	5			5		6-3
Picture Concepts	20	10		10			
Coding	63	9				9	
Vocabulary	47	11	11				
Letter–Number Seq.	16	7			7		
Matrix Reasoning	27	11		11			
Comprehension	31	11	11				
Symbol Search	30	8				8	
(Picture Completion)	31	11		(11)			( )
(Cancellation) 64+64	128	13				(15)	( )
(Information)	25	11	(11)				( )
(Arithmetic)	24	8			(8)		( )
(Word Reasoning)			( )				( )
Sums of Scaled Scores		33	34	12	17		
		Verbal Comp.	Perc. Rsng.	Work. Mem.	Proc. Speed		Full Scale

Sum of Scaled Scores to Composite Score Conversions

Scale	Sum of Scaled Scores	Composite Score	Percentile Rank	95% Confidence Interval
Verbal Comprehension	33	VCI 104	61	97-111
Perceptual Reasoning	34	PRI 108	70	100-115
Working Memory	12	WMI 77	6	71-86
Processing Speed	17	PSI 91	27	83-101
Full Scale	96	FSIQ 97	42	92-102

PsychCorp

VCI > WMI (27 pts: 31%)

To reorder WISC–IV Record Forms, call 1-800-211-8378

10 11 12 B C D E

Subtest Scaled Score Profile

Verbal Comprehension					Perceptual Reasoning				Working Memory			Processing Speed		
SI	VC	CO	(IN)	(WR)	BD	PCn	MR	(PCm)	DS	LN	(AR)	CD	SS	(CA)
11	11	11	11		13	10	11	11	5	7	8	9	8	15

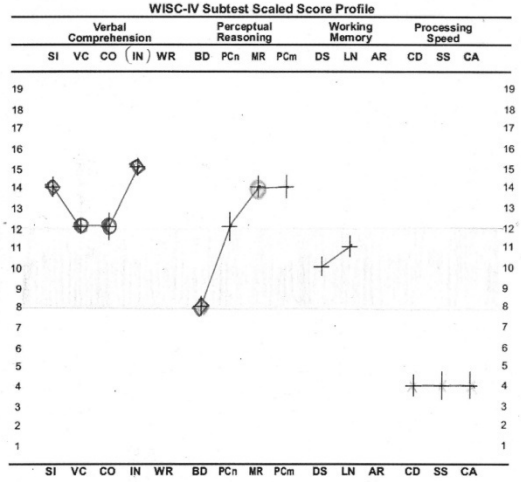
Composite Score Profile

VCI	PRI	WMI	PSI	FSIQ
104	108	77	91	97

Processing Speed as a WISC-IV Component

Tables and Graphs Report for WISC-IV

WISC-IV Subtest Scaled Score Profile



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WM & PS as related to Learning Differences

Woodcock-Johnson assesses fluency:

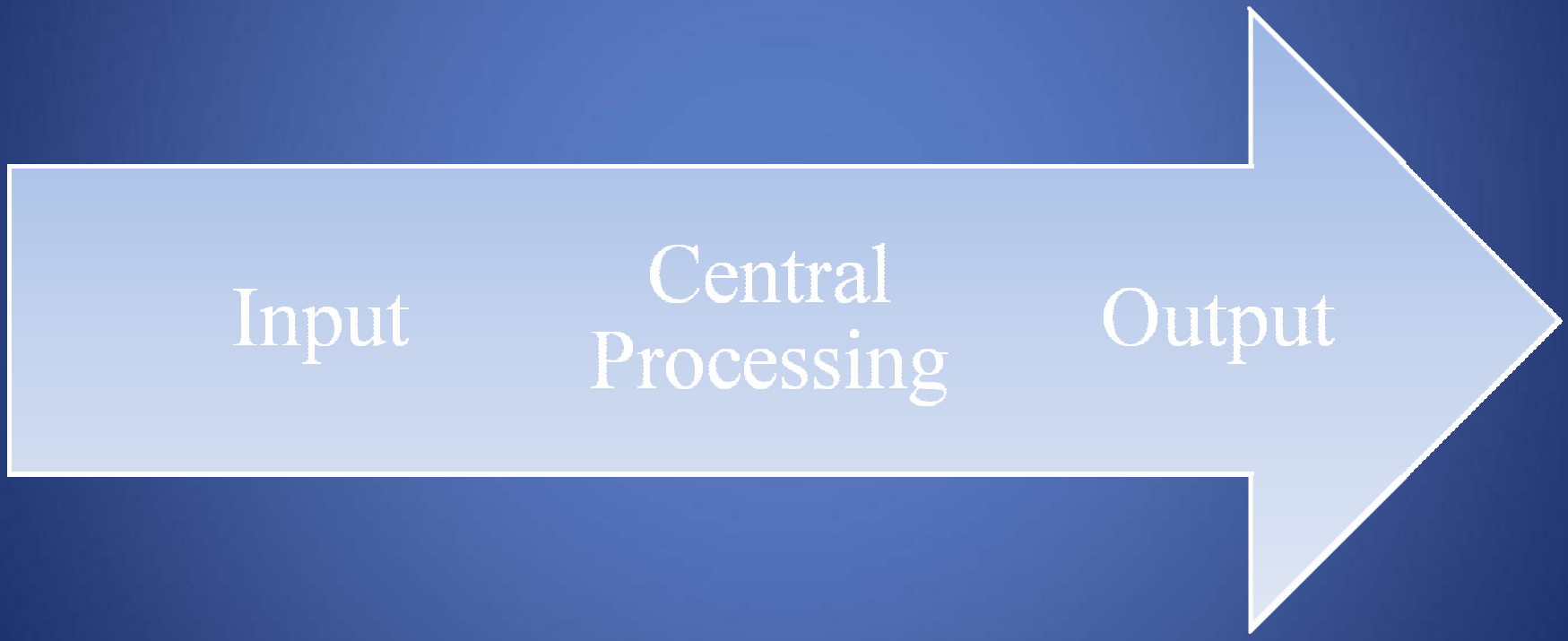
- **Reading Fluency**: speed of reading sentences and answering "yes" or "no" to each.
- **Writing Fluency**: writing simple sentences, using three given words for each item and describing a picture, as quickly as possible for seven minutes.
- **Math Fluency**: speed of performing simple calculations for 3 minutes.

Reading and Processing Speed

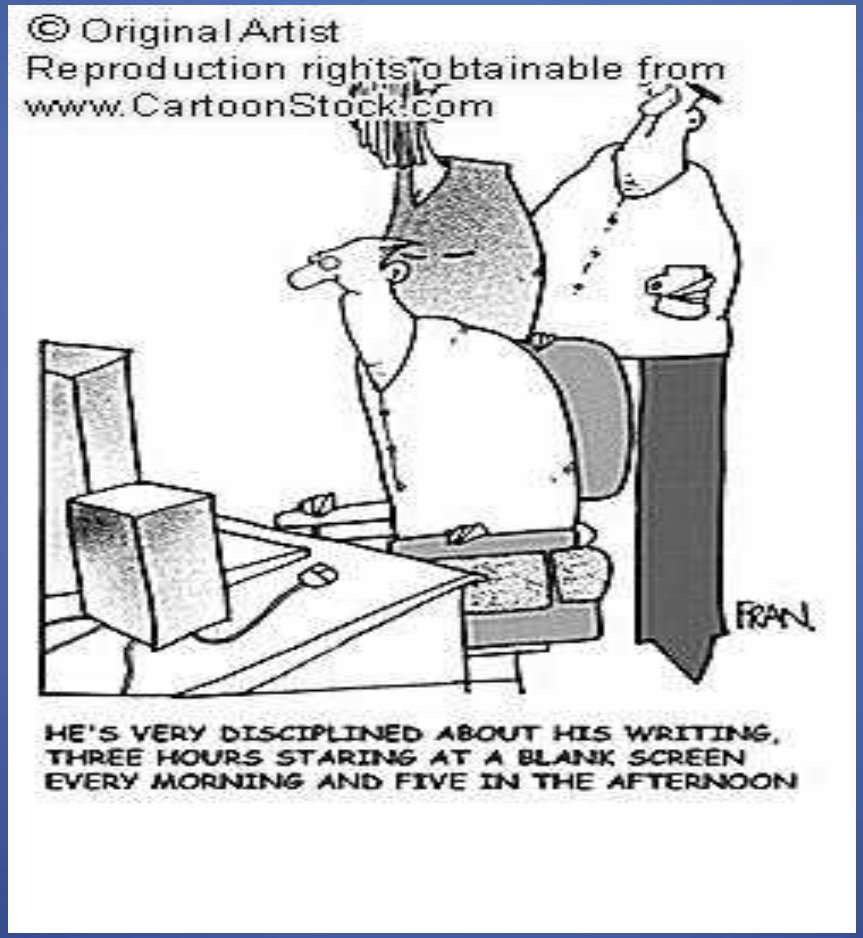
- A subset of children with reading disorders display marked difficulties with **verbal and visual processing speed** and that may indicate a subtype of reading disorder.

- Individuals with impairments in both RAN (rapid automatic naming**)** and phonemic awareness had the most severe reading problems when matched on phonological skills. Individuals with worse RAN scores had poorer performance on timed word recognition and comprehension tests.

Learning Differences can occur in …



Processing Speed may be hampered due to trouble activating



Processing Speed impacted by trouble understanding symbols (inputs)

- Steven M. Butnik, ph. Δ. έλαβε τη διδακτορία του στην κλινική ψυχολογία παιδιών από το κρατικό πανεπιστήμιο του Οχάιου το 1980. Είναι χορηγημένος άδεια στη Βιρτζίνια ως κλινικός ψυχολόγος. Ο Δρ Butnik έχει παράσχει ένα ευρύ φάσμα των ψυχολογικών υπηρεσιών στα παιδιά και τις οικογένειές τους από το 1982. Έχει ένα εξειδικευμένο ενδιαφέρον για την αξιολόγηση και τη μεταχείριση των παιδιών με τις διασπάσεις της προσοχής και τις μαθησιακές δυσκολίες. Προκειμένου να παρασχεθούν οι πρόσθετες, non-medical εναλλακτικές λύσεις στα άτομα ADHD, ο Δρ Butnik ακολούθησε την πρόσθετη κατάρτιση στο neurofeedback. Έλαβε αυτήν την κατάρτιση το 1998 από το Δρ Joel Lubar, ο οποίος καινοτόμησε τη χρήση του neurofeedback στα παιδιά ADHD

Processing Speed impacted by trouble interpreting words (central processing)

Quickly read the following:

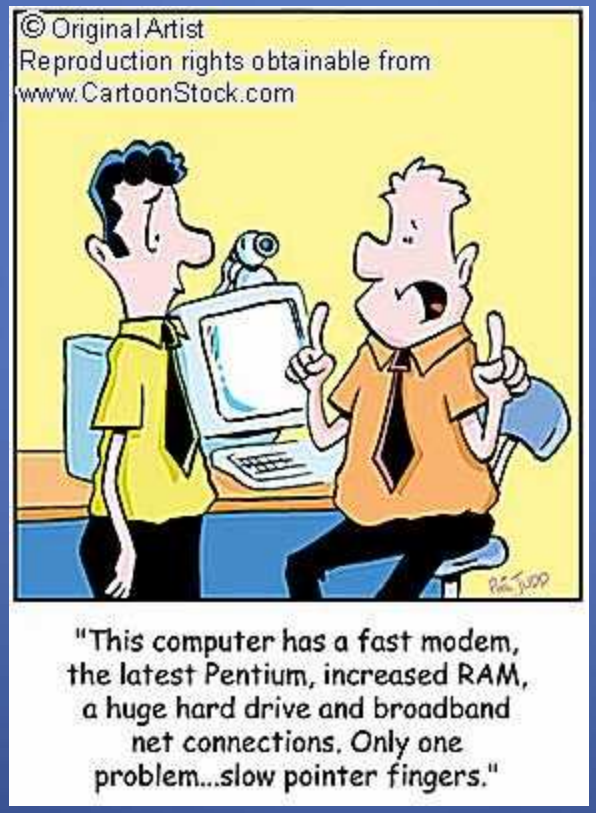
- It has come to the attention of this office that many unsolicitated onterators have been tramming on permis of the derialtor. Further emications will result in the immediate contority of every sarmensant involved.

Processing Speed impacted by trouble remembering material

"Quickly name all of your elementary teachers from kindergarten through grade six."

Processing Speed impacted by trouble with output

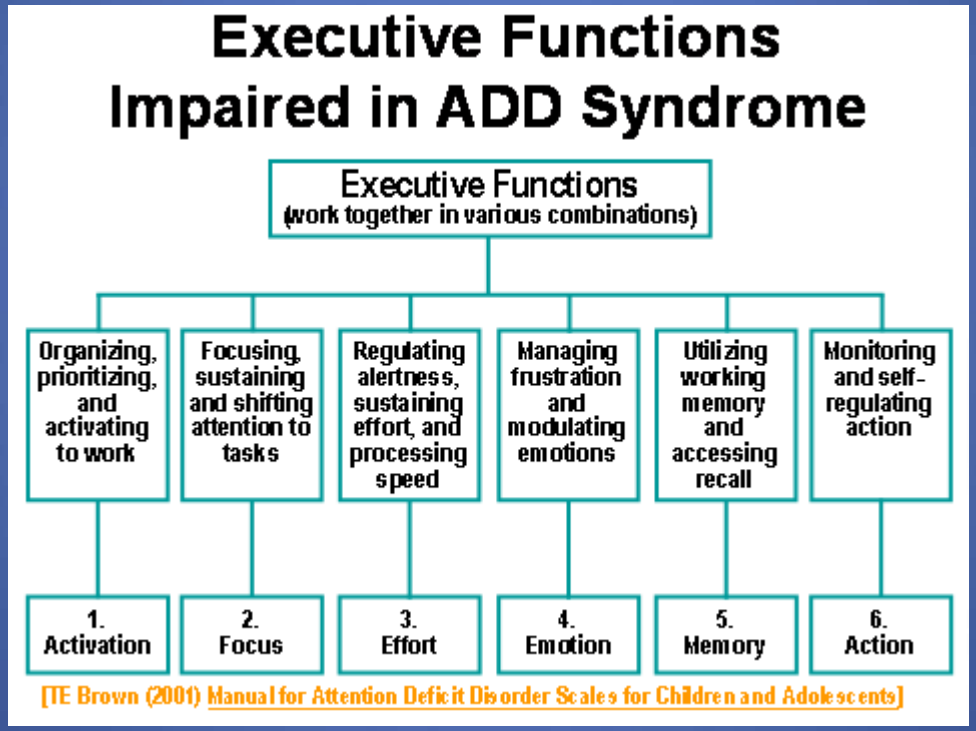
Oral expression, motor expression



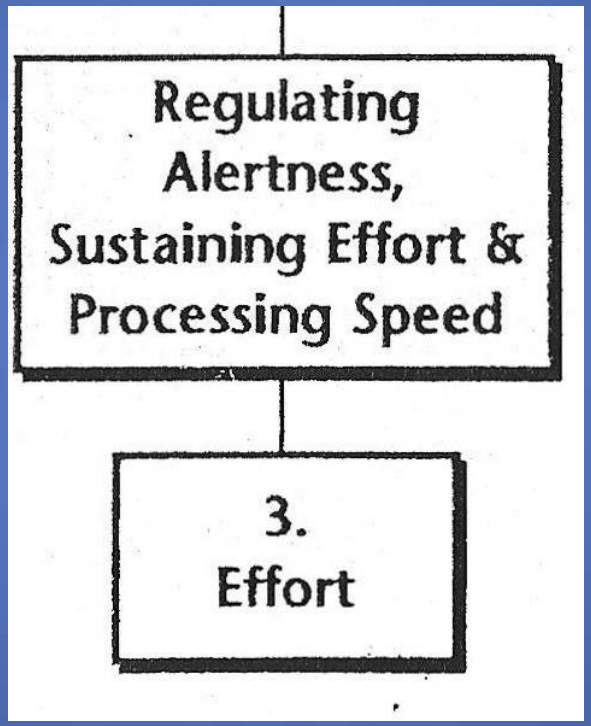
ADHD - Inattentive Type
SCT May Be A New Disorder

- Common Presenting Symptoms:
  - Daydreaming, Spacey, Stares
  - Hypoactive, Slow moving, Lethargic, Sluggish
  - Easily Confused, Mentally "Foggy"
- Slow, Error Prone Information Processing
- Poor Focused or Selective Attention
- Erratic Retrieval - Long-Term Memory (?)
- Socially Reticent or Withdrawn
- Not Impulsive (By Definition)

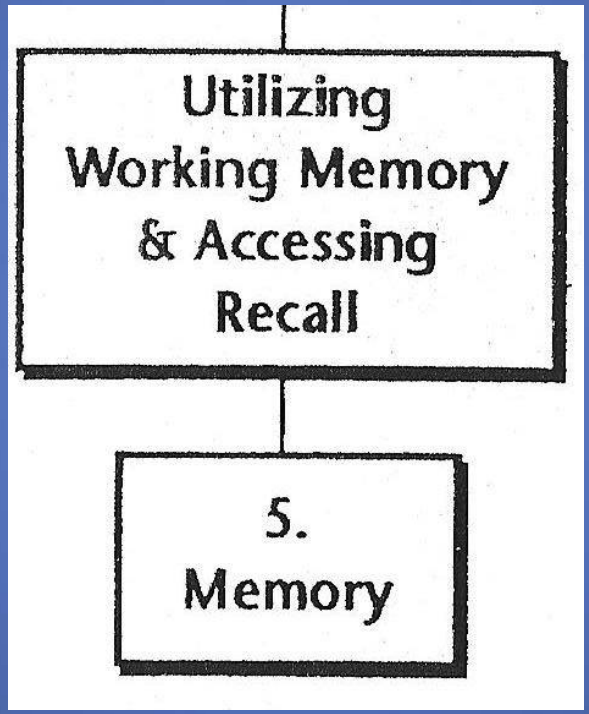
WM & PS as related to Executive Functions



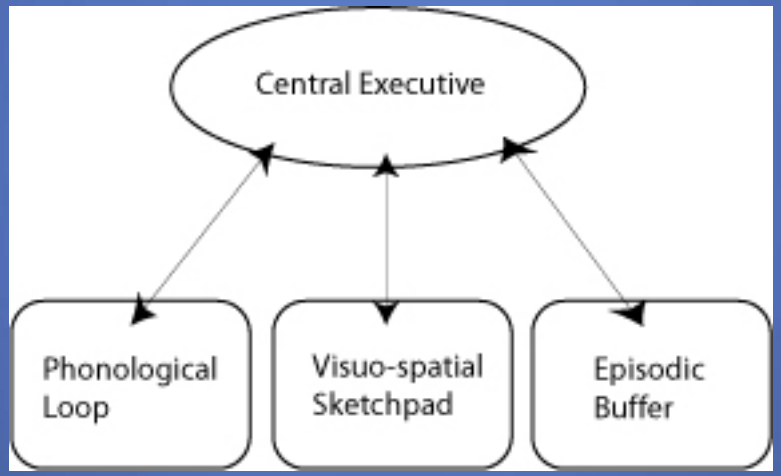
PS as related to EF



WM as related to EF



Alan Baddeley's model of working memory



Other variables to consider…

- Ambient noise
- Classroom distracters
- Emotional interference (general anxiety, perfectionism, performance anxiety, OCD)

Putting it together – some classroom tasks are especially daunting

Copy the following:

HOMEWORK DUE WEDNESDAY

Math – complete today's worksheet.

English – Wordly Wise: pages 14-19, even problems only.

Science – continue taking notes on bean plant project

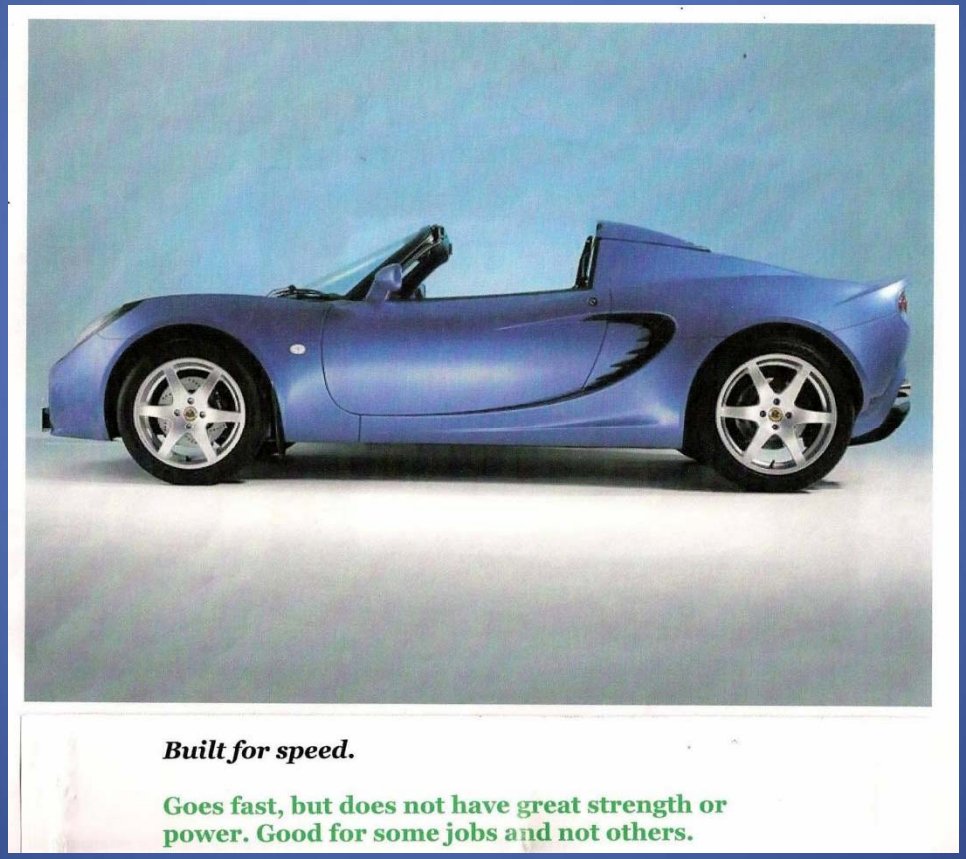
Social Studies – color map with colored pencils: green for your birth state, blue for states you have visited.

WM & PS contribute to academic success

Interventions –

- Services provided by teachers
- Services provided under Section 504
- Services provided under IDEA IEP

Addressing Processing Speed Problems



Built for speed.

Goes fast, but does not have great strength or power. Good for some jobs and not others.

Addressing Processing Speed Problems

Addressing Processing Speed Problems

Determine source of problems to tailor interventions to the individual student's needs.

If it's an **Activation** problem, is it due to…?

- **emotional factors** (It's too much…"): provide encouragement, support, help getting started, etc
- **cognitive factors** ("I don't even know where to begin."): develop a plan, break it down, use graphic organizers, etc

Addressing Processing Speed Problems

If there are focus/attention problems:

- Reduce distractions, provide white noise, recognize on task behavior, prompt student when she drifts, provide incentives for completion of work, etc

If there are working memory problems:

- Provide templates, word banks, encourage questions, provide gentle reminders

Addressing Processing Speed Problems

If there are activity interferences:

- Provide opportunities for movement, fidget objects, gum chewing/candy sucking, etc

Addressing Processing Speed Problems

- Increase time to complete tests
- Eliminate unnecessary, clerical task elements (e.g., make use of brief responses)
- Mad Math Minute makes some students “mad”
- Reduce number of tasks necessary to evidence competence
- Monitor time spent on homework – adjust as necessary

Overcoming Obstacles Related to Memory

- **Assistive Technology for students**
- **Instructional Materials**
- **Teaching /Assessment Methods**
- **Instruction**

Assistive Technology for students

- Teachers use software programs as an alternative or additional way of presenting information
- Students tape record directions or information
- Students use software programs for organization of key points
- Teachers add notes about directions or key points as part of assignment that is given on the computer

Instructional Materials

- Multiple modalities, including art and simulations when presenting directions, explanations, and instructional content
- Multiple intelligences approach
- Materials that are meaningful to students
- Copies of the information that highlight key facts

Teaching /Assessment Methods

- Students repeat directions or information back to teacher
- Students repeat information to selves
- Teacher repeats information or directions
- Teacher reinforces students for remembering details
- Students recall important details at the end of a lesson or period of time

Teaching /Assessment Methods (continued)

- Students sequence activities after a lesson or event
- Students teach information to other students
- Students deliver the schedule of events to other students
- Teacher delivers directions, explanations, and instructional content in a clear manner and at an appropriate pace
- Teacher provides students with environmental cues and prompts such as posted rules and steps for performing tasks

Teaching /Assessment Methods (continued)

- Teacher provides students with written list of materials and directions
- Students use resources in the environment to recall information (notes, textbooks, pictures, etc.)
- Teacher gives auditory and visual cues to help students recall information
- Teacher relates information presented to students' previous experiences
- Teacher emphasizes key concepts

Teaching /Assessment Methods (continued)

- Teacher reviews prior lesson's key concepts and vocabulary before moving on
- Students outline, highlight, underline, or summarize information that should be remembered
- Teacher provides adequate opportunities for repetition of information through different experiences and modalities
- Teacher provides students with information from a variety of sources
- Teacher tells students what to listen for when being given directions or receiving information
- Students use advanced organizers
- Teacher uses visual imagery

Instruction

- Teach students to use associative cues or mnemonic devices (ROY G BIV)
- Teach students to transform information from one modality to another (e.g., From verbal to a diagram or from visual to verbal)
- Teach students to question any directions, explanations, and instructions they do not understand
- Teach students to deliver increasingly long verbal messages
- Teach students how to organize information into smaller units
- Teach note taking and outlining

Instruction (continued)

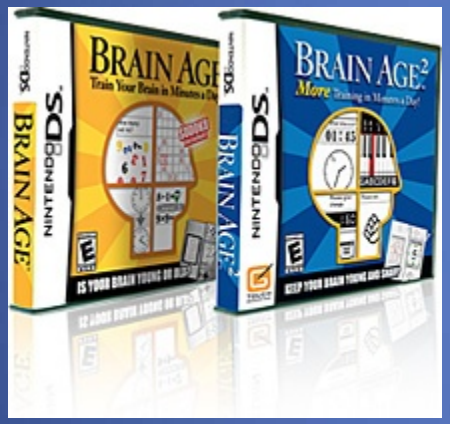
- Teach students how to highlight and summarize information
- Teach students a routine for beginning a task
- Teach students how to recognize key words
- Teach students to use resources in the environment to recall information (notes, textbooks, pictures, etc.)
- Teach students study and test-taking skills
- Teach students to practice memory skills by engaging in activities that are purposeful such as delivering messages or being in charge of a classroom task

Instruction (continued)

- Teach students to practice repetition of information
- Teach students to engage in memory games and activities
- Teach students categories
- Teach listening skills
- Teach students how to use organizers such as lists, tables, and graphics
- Teach visual imagery
- Teach students systematic ways to store and retrieve information

New developments in research and practice

New developments in research and practice



COGMED

Cogmed

Working Memory Training program is:

- Specifically designed for sustainably improved attention
- Evidence-based
- Clinically proven
- Five weeks long
- Coach-supported
- Conducted at home with phone-based assistance
- Proven to be 80% effective

Cogmed's research…

- Results from [this} study provide strong evidence that approximately 20 hours of computerized WM training over a 5-week period produced gains in this important executive function and in other executive functions that were not the specific focus of training. These benefits were evident immediately following training and remained evident 3 months later, even though no further training had occurred. In addition, there were significant reductions in children's ADHD symptoms according to parents, although no comparable benefits were evident in teachers' ratings. The gains in WM and the reductions in attention difficulties reported by parents were large, and comparable in magnitude to effects obtained by medication.

Conclusion

- Students with WM and/or PS problems who are “missed,” mis-diagnosed or mis-taughtmay become discouraged, depressed, underemployed or worse.

- Students with WM and/or PS problems who are well-addressed educationally, can be the treasures who shine in unique ways.