EXECUTIVE FUNCTIONING: UNDERSTANDING AND DEVELOPING THE BRAIN'S COMMAND AND CONTROL SYSTEM

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WHAT IS EF AND HOW DOES IT RELATE TO ADHD, SELF-REGULATION, AND LD?

I. Executive functioning defined (All roads lead to goal-directed behavior)

A. Bruce Pennington: "The ability to maintain an appropriate problem solving set for **attainment of a future goal**". Includes processes for which the prefrontal brain regions are specialized such as:

1. Planning
2. Organizational skill
3. Maintaining mental set
4. Selective attention
5. Inhibitory control
6. Working memory

B. Gerald Gioia et. al: *Behavioral Rating Inventory of Executive Functions (BRIEF)*

1. Started with Martha Denckla's **Initiate, Sustain, Inhibit, Shift (ISIS).**
2. Added **plan, organize, self-monitor, emotional control, working memory**.

II. Recent research suggests that there are three core executive functions. (A. Diamond)

A. Inhibition or inhibitory control (for discipline, self-control, focused and selective attention)

1. Inhibit strong inclination - your first impulse - and do the most appropriate thing.
2. Inhibit impulsive talking (e.g., blurting something out).
3. Inhibit the tendency to be distracted when focusing attention.
4. Inhibit the tendency to quit if bored or give in to temptation.
5. Inhibit the tendency to continue your course if it's not working.
6. Inhibit the tendency to get angry or quit in frustration.

B. Working memory (holding information online while manipulating or updating it)

1. Spatial working memory (mental sketch pad; picturing relevant info)
2. Verbal working memory (e.g, reversing/reorganizing number sequences)

C. Cognitive flexibility (flexibly shifting focus of attention or point of view)

1. Making mental, physical, behavioral transitions.
2. Flexible shifting (versus perseverating or ruminating).
3. Crucial for problems solving, thinking outside the box.
4. Crucial for flexible regulation.
5, This is the hardest one (it may not be present in young children).

III. **Additional general points**:

A. Metaphors

1. Conductor of the orchestra
2. CEO of the brain

B. Anything that affects the brain affects executive functions.

1. The frontal lobes being the most recent to evolve are the most vulnerable.
2. Attention is so fragile and easily disrupted, even by minor stress.

C. All childhood disorders manifest, at least in part, with executive dysfunction.

1. ADHD
2. Tourette's Syndrome
3. Obsessive-Compulsive Disorder
4. Traumatic Brain Injury
5. Depression
6. Learning Disabilities

D. Recent research on Autism Spectrum Disorders suggests a new cluster of core features: (Sam Goldstein and Jack Naglieri)

1. Stereotypical behaviors
2. Social/communication deficits
3. Attention/self-regulation deficits (similar to ADHD)

E. There is very little overlap between EF and "crystalized" intelligence (Diamond).

1. Executive skills are required when going on "automatic" won't suffice.
2. We use the prefrontal cortex when we learn new things.
3. Tests of problem solving (e.g., *Raven's Matrices*) place more demands on EF.
4. If familiar with them, we can do prefrontal tasks without PFC activation.
5. We want most tasks to be processed by subcortical regions.

F. EFs develop with age; problems often become apparent with increased demands.

1. Executive functioning deficits are commonly diagnosed when a child, adolescent, or adult hits a level of "load" or demand in life that he/she cannot manage ('juggling' metaphor).

2. This commonly occurs at the beginning of formal schooling, in fourth grade, and in the transitions to middle school, high school, and college.

3. This may also be related to plateauing in working memory development in students with ADHD, as there is little development in WM from 8 ½ to 15 ½.

4. Very bright and/or highly motivated individuals with strong compensatory skills may not be identified until college, graduate school, or beyond.

IV. **Executive functioning and ADHD**

A. ADHD reflects developmental impairment of multiple executive functions.

B. Russell Barkley's theory of ADHD: ADHD - Combined Type comprises a **primary deficit in behavioral inhibition**, which makes a crucial contribution to four other executive functions.

C. Thomas Brown's opposing view:

1. Poor behavioral inhibition is not the primary executive deficit in ADHD.

2. **Facilitating (activating) and inhibitory deficits** are both important aspects of an underlying problem with self-regulation.

3. Brown emphasizes the **activation** and **effort** aspects of attention, along with the modulation of affect.

VII. Executive functioning and self-regulation

A. Definition of self-regulation (Nathan Fox, University of Maryland): "The self-regulatory system can be described as **adaptive control** of physiological, attentional, emotional, behavioral, cognitive, and interpersonal or social processes."

B. Definition: Donald Winnicot:

1. "Self-regulation refers to the child's ability to plan, guide, monitor, and organize his attention and behavior during challenging goal-directed activities.

2. Resisting or inhibiting impulses, delaying gratification, and sustaining attention are all examples of children's self-control or self-regulatory skill."

C. Common co-occurrence in children of difficulty with the *flexible* regulation of:

1. Attention
2. Sensory stimulation
3. Sleep and wakefulness
4. Stress, frustration, and anger

D. Children today have weaker self-regulation than children 60 years ago.

1. A recent study replicated a study of self-regulation from the 1940's (Bodrova).
2. Today's 5-year-olds functioned like 3-year-olds; 7-year-olds like 5-year-olds.

E. Children today engage in far less dramatic play than earlier generations.

1. Mammals play.
2. Children use private speech more in dramatic play than at any other time.
3. The more structured the play, the less private speech.

F. Children move less, sleep less, are less exposed to nature.
G. Children have more stressful lives due, in part, to being hurried.

HOW DO ATTENTION AND EXECUTIVE FUNCTIONING RELATE TO LEARNING DISORDERS?

I. Executive functioning, learning, and learning disabilities

A. EF skills and school achievement

1. EF skills better predictors of school readiness than IQ or early reading or math.
2. EF skills are extremely important for academic success.

    a. Inhibition and WM each predict math and reading skill in all grades.

    b. Inhibition (self-discipline) accounts for more than twice as much variance in final grades than IQ, even in college.

B. Research indicates executive functions play a role in all academic learning disabilities.

1. Reading: Working memory, inhibition, frustration tolerance
2. Writing: Sequencing, organizing, self-monitoring, working memory.
3. Math: Working memory, cognitive flexibility, inhibition (also role in automaticity).
4. Output/production: Working memory, self-monitoring, organization, flexibility.
5. Content area learning: Strategic organization of information; organized retrieval

II. The key role of inattention and working memory in academic problems (Rosemary Tannock)

A. Inattention is the behavioral risk factor for academic problems in reading, math, and writing. We should **"pay attention to inattention."**

B. A substantial proportion of students with ADHD show working memory problems.

1. Particularly those with behavioral symptoms of inattention.
2. Primary association in children is with visual-spatial working memory deficits.
3. As noted, working memory development plateaus in students with ADHD.

NEUROLOGICAL UNDERPINNINGS OF ATTENTION AND EXECUTIVE FUNCTIONS

I. Neurological foundations of executive functions and executive dysfunction

A. Frontal brain systems:

1. Although executive functions do not "reside" in the frontal lobes, frontal brain systems are extremely important in executive functioning.

2. The frontal lobes are densely connected with other cortical and subcortical brain regions. Deficits in other regions can thus lead to executive deficits.

B. Brain volume (Castellanos et al.)

1. Kids with ADHD have 3-4 percent smaller total brain volume, including unmedicated children. Brain size correlates negatively with symptom severity.

2. Largest difference is in cerebellum; the caudate nucleus (part of the basal ganglia) was smaller in younger children but normal by age 15.

3. Unmedicated children show significantly smaller volume of white matter (myelinated axons), reflecting immaturity and raising the possibility that stimulant medication may actually enhance brain maturation.

C. Relationship between what Martha Denckla calls motor control and mental control: The three parts of brain that are most heavily involved in ADHD are motor regions (Pliszka):

1. Prefrontal cortex
2. Medial frontal area of basal ganglia
3. Cerebellum (see review by

D. EEG and SPECT studies: Frontal slowing and trouble with activation

1. Lou's (1984) SPECT: Hypoperfusion of frontal lobes, increased flow on Ritalin.
2. Daniel Amen's SPECT scans: "The harder they try, the worse it gets."
3. EEG: ADHD kids have 9/1 theta/beta ratio (average = 4/1): mental idling.
4. Joel Lubar: Theta/beta ratio from a single EEG lead accurately identifies ADHD.

E. Motivation, attention, and goal-directed behavior (ADHD is also a motivational disorder, a disorder of intention as well as attention.)

1. Recent study of ADHD adults (Volkow, 2009) found disruption in two dopamine reward/motivation pathways (suggesting dopamine deficiencies in the midbrain).

2. The severity of disruption was related to the severity of inattention.

3. Since 2001 we've known that Ritalin produces a significant increase in levels of dopamine in brain, which stimulates motivational as well as attentional circuits.

4. Direct activation of circuits for motivation and attention makes tasks seem more interesting.

5. Dopamine also suppresses "background" firing of neurons not associated with task performance, allowing a clearer signal. Random activation of other cells can be distracting, increasing the signal–to–noise ratio.

F. High heritability of ADHD

1. If one identical twin has ADHD, there is 80 percent chance the other will too.
2. However, prenatal stress accounts for 22 percent of variance in symptoms at 8.

III. Brain development and executive functions

A. Early development of the frontal lobe:

1. Between 3 and 6 years, the most rapid brain growth is in the frontal lobe areas involved in planning, organization, and maintaining attention and vigilance.

2. This corresponds with "the 5-7 shift" and readiness for formal schooling.

B. Frontal development and developmental stages: There is a close correlation between maturational spurts in frontal lobes and transitions into neo-Piagetian stages (Kurt Fischer).

C. Frontal lobes seem to come "online" at different times for different tasks (Yurgelin-Todd)

1. Verbal fluency is largely a temporal lobe task until later adolescence; it then is done with largely frontal activation.

2. This may be related to the fact that some conditions can show more executive impairment at later ages (e.g., fetal alcohol syndrome).

D. Adolescence and beyond: There is protracted development of the frontal lobe in adolescence and adulthood (myleination not complete until fourth or fifth decade of life).

1. Following a dramatic increase in gray matter in pre-adolescence, cortical thinning (maturation) in adolescents occurs largely in the frontal lobe.

2. A number of EEG studies have found dramatic spurt in frontal lobe maturation between 17-20 (corresponds to Priscilla Vail's 16-19 shift).

3. Kurt Fischer has identified cognitive changes through age 25 with corresponding changes in EEG through early 20's.

E. Maturational delay hypothesis of ADHD (K. Rubia)

1. Symptoms suggest immaturity in higher order executive skills.
2. Structural imaging: delayed cortical thickness in frontal and temporal lobes.
3. Functional imaging shows delays in structures known to mediate EF's.
4. Up to 80 percent of children with ADHD appear to outgrow it.

F. Girls' development is faster in prefrontal cortex.

1. Makes girls better at controlling impulsive behavior. Girls display more mature self-control (e.g., toilet trained earlier and less risk for ADHD).

2. Boys have less patient verbal style (ordering rather than requesting) and more social bluntness (less polite).

G. Girls' development is faster on all "output measures (Martha Denckla)

1. Denckla's *Timed Motor Exam*: Kindergarten girls = first grade boys.
2. Girls are always faster on tests of rapid naming (of colors, shapes, letters)

HOW STRESS AND INSUFFICIENT SLEEP UNDERMINE EF's AND LEARNING

"Stress makes us stupid." (Daniel Goleman)

"While even school-age children are familiar with the food pyramid, virtually no child is taught about the life pyramid, which has sleep at its base." (Mary Carskadon)

I. Take home point: Stress turns off the PFC and turns on much of the rest of the brain:

A. A high level of stress will "disconnect" the frontal lobe's central executive from the more primitive self-protective stress functions.

B. Stress turns on sensory functions, the amygdala, etc., fostering a shift from from reflective to reflexive.

II. The effects of stress on attention and the three key executive functions

A. Stress hormones undermine *selective attention*. (S. Lupien)

1. Children exposed to noise: Higher BP, trouble discriminating relevant/irrelevant.
2. Stress hormones in brain compromise detection of what's threatening or not.
3. Cortisol makes it hard to know what to focus on, what's most important.

B. Stress impairs the *verbal and spatial working memory* functions of the PFC.

1. Studies in humans and animals support this conclusion.
2. Students with strong working memory use primitive strategies under stress.

C. Stress compromises flexible *"shifting"* and reduces mental flexibility.

1. Studies: *Saving Private Ryan* and noise-stress reduce flexibility (not *Shrek*!).
2. Capacity to plan and activate planned, novel or complex behavior is limited.
3. Behavior activated by stress is relatively stereotyped, fear-based, and defensive.
4. Stress reduces the desire to explore new ideas and to solve problems creatively.
6. Stress in rats causes smaller neurons, less branching in orbital PFC (McEwen).
7. Associated with big deficits in shifting attention (almost as much as lesion).

D. Stress makes it hard to *inhibit:* Cortisol treatment in monkeys to simulate prolonged stress: reduced inhibition.

E. More globally: Stress disorganizes the brain and reduces *cognitive efficiency.*

1. Stress literally disorganizes the brain (try to organize and set priorities!)
2. Stress is associated with reduced EEG coherence.
3. Under stress, students will work harder but produce poorer quality work
4. The higher the stress level, the worse the results.
5. In essence, stress causes students to do more but accomplish less.

III. Stress compromises executive aspects of memory and retrieval. (S. Lupien; R. Sapolsky)

A. Acute stress interferes with memory storage, partly by weakening selective attention.
B. Acute stress makes it impossible to retrieve information we know well.
C. This is partly related to the effects of cortisol on the functioning of the hippocampus.

IV. Educational implications of research on stress and learning:

A. The optimal internal state for learning is relaxed alertness.

1. Some stress (or eustress = challenge) may be necessary to activate the brain.
2. **Kids need to feel safe for optimal learning to occur**.

B. The optimal learning environment involves high challenge but low threat: Students learn and perform best when given:

1. Difficult, challenging material
2. A learning environment where it is safe to make mistakes, take extra time, etc.

V. The importance of sleep: "Rest is the basis of activity." (Maharishi Mahesh Yogi)

A. Sleep is crucial for survival, growth, repair and healing.

B. Sleep is highly associated with self-regulation, mental health.
C. Sleep is very important for learning, memory, and retention.

VI. Sleep deprivation impairs executive functioning in children, adolescents.

A.. Study of 10-14 year olds (1998)

1. One night with five hours of sleep produced deficits in verbal creativity (*Torrance Test*), abstract thinking and concept formation (*WCST*), digit symbol substitution.

2. Concluded that EF's may be impaired by sleep loss.

B. Study of fourth and sixth graders (Avi Sadeh, 2003 - discussed in Po Bronson article)

1. Sixth graders who lost an hour of sleep three nights in a row performed at a fourth grade level on a continuous performance test, test of visual digit span .

2. Sadeh: "A loss of one hour of sleep is equivalent to [the loss of] two years of cognitive maturation and development" (*New York Magazine*).

VII. Mind blowers:

A. If you are ever tired during the day, it's because you are sleep deprived.
B. Nature wants you to always go to bed at the same time and wake up without an alarm.

VIII. Sleep, self-regulation, and ADHD

A. There's strong connection between control of sleep and regulation of mood, behavior.
B. Core symptoms and neuropsych. profiles of ADHD and sleep deprivation are similar.

XI. Most of us — and most of our children — are profoundly sleep deprived.

A. Adults sleep 20-25 percent less than 100 years ago.
B. In 1995, adolescents slept 20 percent less than they had eight years earlier.
C. Most middle and high school students still experience severe sleep deprivation.
D. High school students average less than seven hours per night.
E. Many students fell asleep in lab during daytime in 3-4 minutes.
F. Their EEG's are similar to those of individuals with narcolepsy.

ASSESSMENT

I. Testing of executive functions

A. Traditional tests of EF have included:

1. Measures of verbal and nonverbal fluency (e.g., *Controlled Oral Word Association Test; D-KEFS Verbal Fluency; Ruff's Figural Fluency Test*)

2. Measures of word list learning (e.g., *Selective Reminding Test: California Verbal Learning Test for Children-II*)

3. Measures of motor sequencing/motor control (e.g., *Grooved Pegboard; Go/No*)

4. Tasks involving planning (e.g., *Tower of London; Rey Osterrieth Complex Figure*; *CAS Planning* subtests; *TEA-Ch Sky Search*)

5. Tasks requiring interference control (e.g., *Stroop; CAS Expression Attention*).

6. Tests of working memory (e.g., digit span; following directions; *Paced Auditory Serial Attention Test)*

7. Tests of vigilance and impulse control (e.g., *TOVA; IVA; CAS Atttention subtests; TEA-Ch Score!)*

8. Tests of mental flexibility (e.g., *Wisconsin Card Sorting Test; TEA-Ch Creature Counting)*)

9. Tests of problem-solving, hypothesis testing (*D-KEFS 20 Questions Test*)

II. <u>Behavioral ratings of executive functioning in "real life" contexts</u>

A. Rating scale measures of ADHD
B. Contribution of the *Behavioral Rating Inventory of Executive Function* (*BRIEF)*

III. <u>Controversy over laboratory tests</u>.

A. Arguments against "fractionating" EF's, need for more assessment of real-life functioning
B. Barkley's emphasis on the evolutionary role of executive functions

IV. <u>New possibilities</u>

A. <u>Direct physiological assessment</u>

1. Joel Lubar's identification of ADHD based on EEG measurements
2. In strong attenders, theta/beta ratio is 4:1; in ADHD it is 9:1.

B. <u>Assessment through virtual reality (e.g., in a classroom)</u>

INTERVENTIONS FOR IMPROVING THE FUNCTIONING OF THE EXECUTIVE BRAIN

I. <u>Interventions focus on the "inside" (organism) and/or the outside (environment)</u>

A. <u>Interventions for the inside involve trying to make the brain function more optimally</u>:

1. Stimulant medication to improve physiological balance
2. Mind-body interventions for reducing stress, promoting balance, self-regulation
3. Computer training of working memory (*Cogmed Working Memory Training*)
4. Instruction in strategies by teachers, tutors, language pathologists for promoting:

    a. Emotional regulation
    b. Planning/goal setting/time management
    c. Segmenting and sequencing tasks
    d. Monitoring and tracking assignments
    e. Learning-to-learn strategies for organizing time and materials, organizing and remembering information, sequencing ideas (in writing).

B. <u>Interventions on the outside focus on accommodatiing — or providing **support, supervision, and structure**</u> (which the student cannot provide for himself).

C. The goal of both forms of intervention is to help the student become an **active and independent learner**.

1. See Esther Minskoff's "active learner approach".
2. Don't work harder to help the child than the child works to help himself.

II. What does it mean to provide structure?

A.. Structuring time
B. Structuring space and stuff
C. Structuring ideas and information
D. Structuring behavioral expectations

III. Stimulant medication and the executive functions

A. Stimulants improve mental activation, sustained attention, and inhibition.
B. Also improve working memory, rapid shifting, color naming speed, organiztion.
C. There is also evidence for improved motor control

III. Direct training of executive skills

A. Training working memory: *Cogmed Working Memory Training*

1. At home, computer-based program
2. Well researched; significantly helps about 80 percent who do the training.
3. Improvement is seen in attention, working memory, inhibition.

B. Tools from Fable Vison (www.fablevision.com)

1. *BrainCog Strategies* (developed by Lynne Meltzer et al.)
2. *Smart Moves*

C. Activities that involve sequences of movement, timing, balance, and coordination.

1. The cerebellum shows the same developmental trajectory as the PFC.
2. Activities could include:

a. Martial arts (recent study on Tai Chi and ADHD)
b. Yoga
c. Fine-motor, eye-hand activities.
d Dance (see National Dance Institute promotional video)

IV. Cognitive strategy training for emotional and behavioral regulation (for younger kids)

A. ALERT program ("How Does Your Engine Run")

1. Developed and implemented by occupational therapists.
2. Very useful in the classroom.

B. Tools of the Mind (Metro State College of Denver: www.mscd.edu/extendedcampus)

1. Based on developmental theories of Vygotsky.
2. Teaches cognitive and social/emotional self-regulation/executive skills.
3. Combines child-initiated activities, cooperative paired learning, teacher-directed.
4. Leading Activity: the activity during which the most development occurs.
5. For preschoolers, the leading activity is mature, intentional make-believe play.

6. For kindergarterners, it's the transition between play and learning activities.

V. Teaching study, organizational, and time management skills

A. Structured formulas for planning, goal setting, and monitoring **(do every day!)**

1. Goal, Plan, Do Review

2. What is my problem?
   What is my plan?
   How am I doing,
   How did I do?

B. Learning to learn strategies

1. Teach strategies for organizing materials (e.g., assignment book, binder).

2. Teach strategies for organizing and remembering information

   a. Mnemonic and other strategies for organizing material to be learned
   b. Strategies for organizing and sequencing ideas in writing

C. The importance of modeling

1. Model self-talk re: planning strategizing, organizing, problem-solving
2. Model self-talk for 20 Questions, verbal fluency, memory strategies

D. The power of attributions

1. Attributions can help to shape executive system.
2. "I've noticed that you can really organize when you put your mind to it".
3. Encourage children to teach others.

VI. Mind-body interventions for executive functioning and self-regulation

A. Promoting sleep: the importance of resting the nervous system

1. In "typical" children, sufficient sleep contributes to optimal executive function.

2. Treatment of insomnia with chronotherapy and sleep movement disorders with dopamine enhancing drugs leads to big improvement in attention and behavior.

B. Studies on Transcendental Meditation and ADHD (see davidlynchfoundation.com)

1. Pilot study found 43 percent reduction in student-reported stress/anxiety and 28 percent reduction in ADHD symptoms in three months. Teacher reports were similar.

2. Larger (presently unpublished) study found significant improvement in brain wave activity, including greatly increased EEG coherence, along with improvements in verbal fluency.

C. Recent study of Tai Chi (Lawrence Greenberg)

D. Benefits of exercise for students with ADHD (5-12 year olds) - study at S.U.N.Y 2001

1. Participated in 40 minutes of intense exercise five days per week, leading to significant improvement in behavior over six-week period of study.

2. Behavioral changes were generally noticeable two to four weeks after starting; children with oppositional behavior made greatest improvement (flexibility).

VII. To promote EF and self-regulation we must remember that children are part of nature.

A. The brain functions best when well rested and not highly stressed (relaxed alertness).

B. A primary goal of virtually any school should thus be: Help students sculpt brains that function at high efficiency and low stress.

C. Students need to feel safe in school in order to learn.

1. A top priority should be creating environments in which students feel safe.

2. Another top priority should be teaching students to handle stress and to normalize their own stress response.

D. Attachment (the secure bond between infant and care giver) is a key construct.

1. Attachment is the foundation for resilience.

2. Longitudinal research has found that the security of the attachment relationships with mother is the best predictor of retention in college (Alan Sroufe).

3. Students become “attached to school” when they feel safe, included, accepted, connected. Schools should be a “safe base” for students.

E. The brain functions at low efficiency when tired.

1. Brain activation patterns in children are very different with an hour less sleep.
2. Sleep is crucial for memory consolidation and information integration.

F. Stress and sleep deprivation greatly increase the risk for mental health problems.

1. No amount of achievement is worth the price of unnecessary depression.
2. A significant portion of mental health problems are preventable.
3. Preventing mental health problems in young people should be top political goal.

G. While technology and the new economy are important, we are still part of nature.

1. We still have the same need for sleep, community, relationships.
2. We still develop on the same neurological timetable despite technical changes.
3. Attachment, which can’t be rushed, depends on attunement to baby’s rhythms.

H. Young mammals play.

SUGGESTED READING

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APPENDIX

I. Strategies for getting started (initiate)

A. Strategies for activating the brain in order to "get going"

1. Use movement to facilitate neurological readiness to act.

    a. "Rag doll" or shoulder stands to increase blood flow to brain
    b. *Brain Gym* strategies such as "brain buttons" and "cross crawl"
    c. Push-ups, exercise trampoline, stationary bike, or light weights

2. Use humor: Jokes can help kids get started.

3. Teach students to model the breathing, posture, and self-talk of students who know how to get started (see the *Neuro-Linguistic Programming* [*NLP*] strategies in Thom Hartman's book, including strategies for planning the future).

4. Use music and aromas to modify brain states.
5. Encourage kids to read and write in their areas of interest
6. Encourage work on computer for kids who are activated by technology.
7. Encourage kids to set their own goals.

B. Esther Minskoff's *CHECK:* A research-based generic strategy for getting started on tasks

1. **C**hange environments (Rob Chase: don't do homework at home).
2. **H**ave all equipment nearby.
3. **E**stablish rewards for yourself.
4. **C**reate a checklist of tasks to be done.
5. **K**eep a worry pad.

C. Teach children strategies for "sizing up" new tasks.

1. Teach left hemisphere self-talk strategy ("What am I being asked to do?").
2. Teach right hemisphere visualization strategy ("See myself doing it").
3. Teach to segment, sequence, and prioritize steps in tasks.
4. Provide examples or work samples for students to model (e.g. a math manual).
5. Guide them through the first problem or step.

D. Teach prioritizing and sequencing of steps in time.

1. Use predict and compare strategy (which can greatly reduce procrastination). This involves estimating the time a task will take or how much work can be accomplished in a given time period – and then comparing performance to prediction.

2. Teach student to use various means of marking the passage of time.
3. Always map time left to right.

E. Teach strategies to combat procrastination.

1. Break tasks into small chunks
2. Work in short periods
3. Set time limits to avoid hyper-focusing
4. Teach brainstorming strategies

F. Don't allow students to sit for an hour and accomplish nothing.

1. Emphasize that is better to spend an hour deliberately fooling around than to spend the time avoiding what is ultimately in his or her best interest.

2. With some children, it is useful to encourage them to waste time before starting.

G. Set independent task initiation as a goal.

1. Help kids understand directions only they have read them outline twice.
2. Pay kids for getting started independently; their brain knows how to do it.

H. Increase external structure

1. Establish routines for getting started.
2. Find cues that work (e.g., a touch on the arm, a beeper, a watch that vibrates)
3. Write out steps to be completed on a card, on the board, etc.
4. Give children choices.

I. Use peer mentors to model and encourage.

II. Strategies for sustaining attention and effort (Sustain)

A Goal setting

1. Help students track improvement in their ability to sustain attention to task.
2. Set goals and celebrate improvement. This can be in form of a contract.
3. Celebrate attention and effort expended on enjoyable activities (e.g., sports, music, art, drama, hobbies).

B. Minskoff's **S2TOP** strategy:

1. **S**et a timer.
2. **S**ee if you are off task.
3. **T**ouch the circle (make a mark inside a circle when aware you're daydreaming.
4. **O**rganize your thoughts.
5. **P**roceed again.

C. Use ear plugs or head phones during work time to reduce distractions.
D. Encourage reading and writing about topics of interest.
E. Have students use a watch with a vibrator to remind them to stay on task.
F. Encourage students to take breaks while working (even those with short spans).
G. Allow kids to work in groups.
H. Encourage self-talk to keep on task.

III. Strategies for shifting

A. Minimize transitions; move from unstructured to structured to formal.

1. Provide warnings (e.g, 10 minutes, 5 minutes, 1 minute)
2. Use verbal instructions to guide kids through transitions.

B. Use a transition clock (from *The Difficult Child*)

C. Practice transitions (visualize and/or role play)

D. Use of paradox (e.g., have child pretend to freak out, fall apart when role playing a transition).

E. Practice flexible shifting exercises (Sally Ozonoff)

1. Figure-ground pictures; prompt child to switch back and forth, describe details.
2. Practice classifying things by color, then shape, number, size, etc.
3. Cancellation tasks with odd and even numbers: Cross out even, then odd, etc.
4. Stroop-like tasks

F. Mistake training (for perfectionistic students)
G. Adults must be more flexible than inflexible students (don't get into power struggles).
H. Use Ross Greene's Collaborative Problem Solving with inflexible students.

IV. Strategies for inhibiting

A. Teach response delay strategies ("Count to 5"; "Stop and think")

B. Teach students to think ahead

1. Verbalize a plan or approach before starting a task (including alternate plans)
2. Color code or highlight important aspects of assignments (e.g., in math).

C. Teach students to engage in motor activity when required to wait.

1. Doodle with clay, paper clips, pipe cleaners, etc.
2. Squeeze a Koosh ball
3. Chew gum

D. Increase classroom structure

1. Post classroom rules in clear view; point to rules when violating.
2. Reduce distractions in classroom.

E. Allow student to listen to music with headphones while working.
F. Encourage stretching, breathing, visualizing, relaxation tapes.

V. Strategies for Improving working memory

A.. Teach paraphrasing

1. Have kids put what they hear and read in their own words.
2. Do it every day. Make it a habit.

B. Teach visualization

1. Have kids make pictures in their head of what they hear and read.
2. Do it every day.

C. Teach memory strategies

1. Link names/objects/events to rooms in the house and "walk around".
2. Teach one-bun, two-shoe, etc.
3. Make acronyms
4. Draw cartoons or use clip art to make mnemonics.

D. Emphasize verbal mediation (tell stories without pictures)

E. Prompt students for desired behavior

F. Accommodations for weak working memory (Tannock)

1. Give one direction at a time.
2. Make directions clear, specific, brief.
3. Demonstrate (model) each step of what is to be done
4, Provide visual support (e.g., checklist of items to do)
5. Always check for understanding (ask child to paraphrase)
6. Monitor progress often