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Working with Executive Functioning and Cognitive Control in Individuals with ASD

Joseph Falkner, MST/CCC-SLP

Complexity of Discussion of EF

- Many:
  - Theories
  - Definitions
  - Components
  - Resources
Blind Men and the Elephant

• A metaphor for our understanding of Executive Functions

Definitions: The Handbook of Executive Functions (2014), Goldstein and Naglieri

• Baron (2004): “Executive functioning skills “allow an individual to perceive stimuli from his or her environment, respond adaptively, flexibly change direction, anticipate future goals, consider consequences, and respond in an integrated or commonsense way.” (p. 135)

• Burgess (1997): “a range of poorly defined processes which are putatively involved in activities such as “problem-solving,” “planning” “initiation” of activity, ‘cognitive estimation,’ and ‘prospective memory.’”
Definitions: *The Handbook of Executive Functions* (2014), Goldstein and Naglieri

- Crone (2009): “For example, during childhood and adolescence, children gain increasing capacity for inhibition and mental flexibility, as is evident from, for example, improvements in the ability to switch back and forth between multiple tasks.” (p. 826)

- Dawson and Guare (2010): “Executive skills allow us to organize our behavior over time and override immediate demands in favor of longer-term goals.” (p. 1)

- McCloskey (2011): “It is helpful to think of executive functions as a set of independent but coordinated processes rather than a single trait.” (p. 2)

- McCloskey (2006): “Executive Functions can be thought of as a diverse group of highly specific cognitive processes collected together to direct cognition, emotion, and motor activity, including mental functions associated with the ability to engage in purposeful, organized, strategic, self-regulated, goal directed behavior.” (p. 1)
Simplified Model of Executive Functions

[Goldstein & Naglieri, 2014]

• Diamond (2006) describes three “core” executive functions that provide a base for more complex executive skills to develop. In her model, the prefrontal cortex plays a significant role in the neural circuitry required for mental health, academic achievement, and life success. These three “core” executive functions are inhibitory control, working memory, and cognitive flexibility.

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Impulse Control: Definition

• AKAI: Response inhibition

• The capacity to think before you act—this ability to resist the urge to say or do something allows us the time to evaluate a situation and how our behavior might impact it. (Dawson & Guare, The Smart but Scattered Guide to Success: How to Use Your Brain's Executive Skills to Keep Up, Stay Calm, and Get Organized at Work and at Home, 2016)
Flexibility: Definition

- Cognitive flexibility is defined as the ability to switch one’s thinking (cognition) (or train of thought) as an adaptation to the demands of stimuli. In neuroscience, the term is sometimes referred to as “attention switching” (GLOOM, 2017).

Working Memory: Definition

- In general, WM involves the ability to maintain and manipulate information over brief periods of time without reliance on external aids or cues. (Best & Miller, 2010)
Development of Executive Functions

• Nature vs Nurture
  • Genetics
  • Environment
• Timeline
  • Dawson & Guare, 2010: Developmental Tasks Requiring Executive Skills
  • Peters, 2013: Hierarchy of Social/Pragmatic Skills as Related to the Development of Executive Function

Neural Correlates of Executive Functions
(Hunter, Hinkle, & Edidin, 2012)

• Prefrontal cortex: inhibition, organization, goal-directed behavior, working memory, cognitive flexibility, attention
  • Orbitofrontal-behavioral inhibition, motivation, working memory, cognitive inhibition, integration of emotional information into contextually appropriate behavioral responses
  • Dorsolateral-set shifting, planning, response selection, working memory, impulse control
  • Ventral medial—initiation
Neural Correlates of Executive Functions
(Hunter, Hinkle, & Edidin, 2012)

• Other cortical structures
  • Temporal lobe-inhibition
  • Parietal lobe-flexibility, goal-directed behavior, working memory

Neural Correlates of Executive Functions
(Hunter, Hinkle, & Edidin, 2012)

• Subcortical structures
  • Cerebellum-inhibition, cognitive flexibility
  • Basal ganglia-inhibition, sustained attention
  • Striatum (caudate and putamen)-reward detection, motor and action planning, motivation
Neural Correlates of Executive Functions

- Limbic system—attentional control, inhibition, self-monitoring, working memory
  - Cingulate cortex—inhibition of prepotent response, linking behavioral outcomes to motivation
- Hippocampus—memory
- Insula—self-awareness, salience
- Amygdala—emotional memory, emotional arousal

General Assessment Considerations
(Sparrow, 2012)

- Key Issues with Executive Functioning Assessment
  - Nearly every test involves Executive Functioning
  - Standardization may remove aspects of Executive Functioning
  - It is challenging to isolate a single Executive Functioning Skill
  - Executive Functioning may vary by setting
  - Defining the proper peer comparison can be challenging
General Assessment Considerations
(Suchy, 2016) (Sparrow, 2012)

- Factors Impacting Interpretation of Assessments
  - Alertness/Arousal
  - Sleep Difficulties
  - Emotion Regulation
  - Pain
  - Hunger
  - Stress
  - Mood
  - Lack of Exercise

General Assessment Considerations
(Suchy, 2016)

- Decision-Making Considerations
  - Demographics
  - Personality
  - Intrinsic Resources and Task Complexity
  - Complexity of Daily Life
  - Temperament
Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Suchy, 2016)

- Informal Assessment Measures
  - Case History
    - Demographics
    - Background
    - History of success and struggles with EF
    - History of functioning in different areas

Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Suchy, 2016)

- Informal Assessment Measures
  - Review of Records
    - School Records (report cards, transcripts, attendance, incident reports)
    - Work/personnel file
    - Medical/psychiatric
    - Legal/Criminal
Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Suchy, 2016)

- Informal Assessment Measures
  - Interview
    - Student/Client
    - Parent
    - Teacher
    - Significant Other

Components of a Comprehensive Assessment

- Informal Assessment Measures
  - Interview
    - Concerns of interviewee
    - Values of interviewee
    - Current success and struggles with EF
    - Current functional abilities
    - Level of independence in different environments
Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Suchy, 2016)

• Observation
  • Classroom
  • Interactions with others
  • During “functional” tasks—ADL’s

Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Suchy, 2016)

• Work Samples
  • Tests
  • Writing Assignments
  • Agenda pages
  • Written correspondence: emails
  • Work production: memos, reports
Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Sparrow, 2012)

- Behavior Checklists/Rating Scales
  - Adaptive Behavior Assessment System (ABAS)
  - Barkley Deficits in Executive Functioning Scale (Adult and Child versions)
  - Behavior Assessment System for Children (BASC)
  - Behavior Rating Inventory of Executive Functions (BRIEF)
  - Behavioral Assessment of the Dysexecutive Syndrome

Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Sparrow, 2012)

- Behavior Checklists/Rating Scales
  - Child Behavior Checklist
  - Connor’s Comprehensive Behavior Rating Scale
  - Metacognitive Awareness Inventory
  - Ross Information Processing Assessment
  - School Function Assessment
Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Sparrow, 2012)

• Mental Health Checklists
  • Brown Attention-Deficit Disorder Scales for Children and Adolescents
  • Children’s Depression Inventory
  • Conner’s Third Edition

• Formal Assessment Measures—Comprehensive
  • Cambridge Neuropsychological Tests
  • Clinical Evaluation of Language Fundamentals-5
  • Clinical Evaluation of Language Fundamentals-5-Metalinguistics
  • Cognitive Assessment System
  • Comprehensive Test of Phonological Processing
Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Sparrow, 2012)

• Formal Assessment Measures—Comprehensive
  • Delis-Kaplan Executive Function Scale
  • NEPSY-II
  • Test of Auditory Processing Skills
  • Test of Information Processing Skills
  • Wechsler Adult Intelligence Scale

Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Sparrow, 2012)

• Formal Assessment Measures—Comprehensive
  • Wechsler Individual Achievement Scale
  • Wechsler Intelligence Scale for Children
  • Wide Range Assessment of Memory and Learning
  • Woodcock Johnson Tests of Achievement
  • Woodcock Johnson Tests of Cognitive Ability
Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Sparrow, 2012)

• Formual Assessment Measures-Single Tasks/Laboratory Measures
  • California Verbal Learning Test
  • Children’s Category Test
  • Conner’s Continuous Performance Test
  • Dichotic Listening
  • Porteus Mazes

• Formal Assessment Measures-Single Tasks/Laboratory Measures
  • Rapid Automatic Naming and Rapid Alternating Stimulus
  • Rey-Osterrieth Complex Figure Test
  • Ruff Figural Fluency Test
  • Stroop Color Word Test
  • Tasks of Executive Control
Components of a Comprehensive Assessment
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014) (Sparrow, 2012)

- Formal Assessment Measures-Single Tasks/Laboratory Measures
  - Test of Everyday Attention (Child and Adult Versions)
  - Test of Variables of Attention
  - Tower of Hanoi
  - Trail Making Tests
  - Wisconsin Card Sorting Test

Caveat: Cold vs. Hot Executive Functions

- “Cold” executive functions: the goal-directed, future-oriented skills that are manifested during relatively decontextualized, nonemotional conditions
- “Hot” executive functions: the goal-directed, future-oriented skills that are elicited in contexts that engender emotion, motivation, and tension between immediate gratification and long-term rewards
Clinical Basis for Treatment: Neuroplasticity
(Kleim & Jones, 2008; Elbert & Rockstroh, 2004) (Sparrowhawk, 2016)

- Critical Periods—for Executive Functions
  - Earliest stages occur in the first few months of life
  - Continues development through late 20's+ (myelination continues into fourth to fifth decade of life)
- Experience-related changes in the brain
  - Independent—prenatal
  - Expectant—first few years of life
  - Dependent—after the first few years of life

Clinical Basis for Treatment: Neuroplasticity
(Kleim & Jones, 2008; Elbert & Rockstroh, 2004)

- Principles of Experience-Dependent Brain Plasticity and Treatment of Executive Functions
  - Practice Makes Perfect
  - Use It or Lose It
  - Use It and Improve It
  - Fire Together, Wire Together
  - Specificity
  - Repetition Matters
Clinical Basis for Treatment: Neuroplasticity
(Kleim & Jones, 2008; Elbert & Rockstroh, 2004)

• Principles of Experience-Dependent Brain Plasticity and Treatment of Executive Functions
  • Intensity Matters
  • Timing Matters
  • Salience Matters
  • Transference Matters
  • Interference Matters

General Considerations Related to Treatment
(Haskins, et al., 2014)

• Outcomes of treatment
  • Deficit remediation
  • Functional outcome

**When will treatment end?**
**What will the individual’s performance look like when treatment has concluded?**
General Considerations Related to Treatment
(Haskins, et al., 2014)

• Patient Variables
  • Awareness of impacts of deficits
  • Severity of impairments
  • Emotional reactions and psychiatric issues
  • Motivation for, or resistance to, treatment

General Considerations Related to Treatment
(Haskins, et al., 2014)

• Family Factors
  • Family relationships
  • Family stress
  • Family “buy-in” to treatment
  • Family willingness to collaborate/participate in the treatment process
General Considerations Related to Treatment
(Barkley, 2012)

- Understand that improving Executive Functioning can be hard work
- Address arousal issues first
- Externalize information
  - Executive function prostheses
  - Externally represent or remove gaps in time

General Considerations Related to Treatment
(Barkley, 2012)

- Externalize motivation
  - Address motivational deficits
- Intervene at the point of performance in the natural setting
- Approach Executive Function deficit as a chronic condition
- Intervene at the most disrupted level
Addressing Arousal Issues

• Six Principles of Structure (Ory, 2006)
  • Predictability
  • Concrete
  • Positive Expectations
  • Trust
  • Flexibility within Structured Choices
  • Continuity
• Organize environment
• Priming

Addressing Arousal Issues

• Sensory Integration, Sensory Modulation, and Sensory Regulation
• Mindfulness training
• Relaxation Techniques
• Brain Gym©
Executive Function Prostheses

- Calendars, visual schedules, choice boards, checklists, task organizers, management tools (Hodgdon, 1995)
- Memory Journals, Tape Recorders, Post-It Software for Computers (Dawson & Guare, 2010)
- Comic Strip Conversations (Gray, 1994), Social Stories (Gray, 2010), Power Cards (Gagnon, 2016)
- Smartphones and Smartwatches

Zone of Proximal Development
(Vygotsky, 1978) (Yeager & Yeager, 2013)

- Intervention should take place in the Zone of Proximal Development: the place where the individual is able to complete the task with support
Evidence-Based Practices and Executive Function Interventions

- Cognitive-Behavioral Therapy
  - Cognitive-Behavioral Therapy manuals have been developed for intervening with some Executive Functions
    - Gallagher—Organizational Skills Training for Children with ADHD
    - Ramsay & Rostain—Cognitive-Behavioral Therapy for Adult ADHD: An Integrative Psychosocial and Medical Approach
    - Safran et al—Mastering Your Adult ADHD: A Cognitive-Behavioral Treatment Program Therapist Guide
    - Sibley—Parent-Teen Therapy for Executive Function Deficits and ADHD
    - Solanto—Cognitive-Behavioral Therapy for Adult ADHD
  - Cognitive-Behavioral Therapy is an evidence-based practice for working with individuals with Autism Spectrum Disorders

Evidence-Based Practices and Executive Function Interventions
(Haskins, et al., 2014) (Barkley, 2012) (Dawson & Guare, 2014)

- Skills-training (Dawson & Guare, 2014)
  - Teach deficient skills
  - Consider the individual's developmental level
  - Move from external to internal
  - Use rather than fight the individual's innate drive for mastery and control
  - Modify tasks to match individual's capacity to exert effort
  - Use incentives to augment instruction
  - Fade supports, supervision and incentive gradually
Strategy Framework
(Hutaff & Henry, 2013)

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Modification/Accommodation</th>
<th>Strategy</th>
</tr>
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<tbody>
<tr>
<td>Identify the Target Behavior (include the student)</td>
<td>Determine related classroom and/or home modifications or accommodations</td>
<td>Determine direct strategy to be taught and plan for teaching it.</td>
</tr>
<tr>
<td>Plan for monitoring and reinforcing</td>
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</tbody>
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Evidence-Based Practices and Executive Function Interventions

- Five Stages of Skill/Strategy Instruction (McCloskey, 2016)
  - Explain the purpose of self-regulation strategies in general and describe and discuss the specific steps of the strategy that will be taught.
  - Model the use of the strategy using language and examples that connect with the individuals.
Evidence-Based Practices and Executive Function Interventions

- Five Stages of Skill/Strategy Instruction (McCloskey, 2016)
  - Individuals memorize the steps in the strategy as well as any mnemonics that are used as part of the strategy.
  - Therapist/Teacher/Coach supports the implementation of the strategy by the students, scaffolding as necessary to help the individuals to master the use of the strategy.

- Individuals independently apply the self-regulated strategy covertly (in their own minds). Students and teacher collaboratively evaluate the effectiveness of student self-directed strategy application.
Evidence-Based Practices—Computer Programs

• Effectiveness of computer programs in treating cognitive deficits has not be unequivocally established
  • May not generalize to more functional tasks
• Benefit has been noted for some programs, including the APT-III and CET in addressing in addressing some areas of functioning in some population
  • Including in individuals with ASD for CET

• May be better to see Computerized Cognitive Training as part of an overall package of interventions (as it is in CET or APT-III)
• APT-III references functional activities that may be benefited by work with the program; these may be worked on at the same time as the APT-III
• CET incorporates a social-cognitive group curriculum with the computerized cognitive training to address both social and non-social cognitive impairments
• Good Interventions incorporate “metacognitive” and behavioral interventions (Denys, et al., 2011)
Phases of Treatment
(Haskins, et al., 2014)

- Acquisition Stage
- Application Stage
- Adaptation Stage

Overview of Coaching Process
(Dawson & Guare, 2010)

- Goal-Setting, Reward/Motivation, and Executive Function
  - Develop/set a goal
  - Determine reward/motivation for achieving
  - Determine obstacles to achieving the goal and ways to overcome obstacles
  - Write a plan/contract to achieve the goal
  - Track progress on achieving the goal
Reasons for Lack of Progress in Executive Function Treatment (Livanis, Mertturk, Benvenuto, & Mulligan, 2014)

- Lack of treatment integrity related to...
  - Adherence to the treatment procedures
  - Agent competence
  - Treatment differentiation
  - Problems with operational definition of executive functioning

Interventions for Executive Function Impacts on Specific Academic Areas

- Books with specific interventions related to Math and Reading...
Impulse Control/Response Inhibition

• The capacity to think before you act. This ability to resist the urge to say or do something allows us the time to evaluate a situation and how our behavior might impact it. (Dawson & Guare, 2016)
• Response inhibition refers to one's ability to refrain from doing things that do not contribute to one's intentions or goals. (Yeager & Yeager, 2013)
• Cognitive inhibition: the ability to suppress or ignore irrelevant or distracting information intentionally so that one can focus on the task at hand. (Cartwright, 2015)

Impulse Control/Response Inhibition

( Yeager & Yeager, 2013)

• Three interrelated processes:
  • The ability to refrain from executing one's natural (prepotent) response to a situation
  • The ability to perform "interference control" once a course of action has been initiated, and thus protect the response from disruption by competing events and responses
  • The ability to interrupt a response once it has been initiated
Impulse Control—Developmental Context
(Forgan & Richey, 2015)

4-5 years
"Can delay eating a treat; ... can keep an arbitrary rule in mind and follow it to produce a response that differs from their natural instinct" (Center on the Developing Child, 2014, p. 9)

6-9 years
Are more internal in thinking and more adept at controlling momentary impulses

10-12 years
Become more flexible in thinking and able to switch between a central focus like driving and peripheral stimuli that may need attention, such as pedestrians (Center on the Developing Child, 2014)

Impulse Control—Developmental Context
(Blakemore & Robbins, 2012) (Best & Miller, 2010)

Teens
Increase in risk taking behavior
Increased responsiveness to peer pressure
Increases in “response inhibition” on “cold” EF tasks
Prefrontal cortex and connections to other cortical and subcortical structures involved in inhibition going through significant development

20’s
Decreased risk taking behavior
Better able to inhibit immediate gratification for more long term goals
Increased connections between emotion centers of brain and prefrontal cortex
Increased awareness when making an inhibition error
### Assessing Impulse Control


- Barkley Deficits in Executive Functioning Scale
- Behavior Rating Inventory of Executive Function (BRIEF)
- Conner’s Continuous Performance Test-3rd Edition
- Delis-Kaplan Executive Function System
- NEPSY-II
- Stroop Color Word Test
- Tasks of Executive Control
- Test of Everyday Attention

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### Signs and Symptoms of Impulse Control Difficulties--Elementary Classroom Behavior

(Axelrod, et al., 2012)

<table>
<thead>
<tr>
<th>Difficulty waiting</th>
<th>Perseveration</th>
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<tbody>
<tr>
<td>Interrupts and disrupts group activities</td>
<td>Many false starts</td>
</tr>
<tr>
<td>Student may call out</td>
<td>Dives right into problems without pausing, reflecting, developing a strategy or game plan</td>
</tr>
<tr>
<td>Touching things or people</td>
<td>Excessive talking</td>
</tr>
<tr>
<td>Makes careless mistakes</td>
<td>Unlikely to reflect or self-monitor</td>
</tr>
<tr>
<td>Displays hyperactivity</td>
<td>Misinterprets directions</td>
</tr>
<tr>
<td>Acting on auto-pilot without reflection</td>
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Signs and Symptoms of Impulse Control Difficulties--Middle School Classroom Behaviors
(Axelrod, et al., 2012)
• Calling out
• Touching objects/peers
• Invading others personal space
• Interrupting conversations
• Making careless errors -written & verbal

• Issues with directions:
  • Not reading directions
  • Misreading directions
  • Misinterpreting directions
  • Misinterpreting text
  • Attempting problem solving without planning
  • Starting & stopping tasks repeatedly

Signs and Symptoms of Impulse Control Difficulties--High School Classroom Behaviors
(Axelrod, et al., 2012) (Guare, Dawson & Guare, 2013)
• Calling out
• Not following directions
• Inconsistent test performance
• Touching things/ other people
• Restlessness
• Over active behaviors
• Choice of fun activities over challenging or nonpleasurable ones
Signs and Symptoms of Impulse Control Difficulties-Adulthood

- Road rage
- Drinking
- Gambling
- Internet and gaming addiction
- Risk-taking behaviors
- Angry interactions with significant others
- Distracted driving
- Workplace issues
- Money/financial issues—difficulty delaying gratification

Impulse Control Accommodations in K-12 Classrooms (Gioia & Isquith, 2013)

- Additional structure in environment
- Limit distractions
- Careful placement in the classroom
- Sit near well-controlled peers
- Lower student-teacher ratio
- Reduced homework
- Impose response delay
- Verbalize plan of approach to task
- Develop more than one plan of approach

• Major focus is on developing external controls for behavior
• Individual may not “internalize” strategies, and may be dependent upon “externalizing” of...
  • Information (calendars, visual schedules)
  • Motivation and reinforcement (i.e., token reinforcement systems)
  • Structure and arousal management
• The key is “lending” the intact EF of the teacher/caregiver to the individual


• Modify the environment
• Modify the task
• Positive Behavioral Supports: Functional Behavioral Assessment, Task Analysis, Reinforcement Systems
• Teach routines that are incompatible with the impulsive behavior
  • Backwards chaining
  • Forwards chaining
Working with Individuals with Significant Cognitive Deficits Who Have Impulse Control Difficulties

- Comic Strip Conversations (Gray, 1994), Social Stories (Gray, 2010), Power Cards (Gagnon & Myles, 2016)

Working with Individuals with Mild to No Cognitive Deficits Who Have Impulse Control Difficulties
(Haskins, et al., 2014) (McCloskey, 2016)

- Internal self-management and self-monitoring strategies
  - Self-Monitoring Training: teaching the use of self-monitoring routines
    - i.e., Zones of Regulation, 5-Point Scale
  - Self-Management: modeling and teaching the use of self-administered reward routines
  - Self-Talk: A Think-Aloud & Talk-Aloud Approach to Building Language
    - Use of Mediated Self-Talk on the part of the therapist/teacher to facilitate the development of language including private speech and self-talk
  - Cognitive-Behavioral Therapy
Evidence Based Practices for Working with Individuals with ASD and Commonly Co-occurring Psychiatric Disorders—Cognitive Behavioral Therapy

- (Kreslins, Robertson, & Melville, 2015): psychosocial (CBT) interventions were superior to waitlist and treatment-as-usual control conditions at post-treatment....individual treatment was more effective than group treatment.
- (Spain, Sin, Chalder, Murphy, & Happe, 2015): CBT interventions—including behavioural, cognitive, and mindfulness-based techniques—were moderately effective treatments for co-morbid anxiety and depression symptoms
- (Storch, et al., 2014): Results—Youth randomized to CBT demonstrated superior improvement across primary outcome relative to those receiving treatment as usual.
- Included on the National Autism Center’s National Standards Project Phase 2 as having an Established Evidence Base for its use as an intervention with Individuals with Autism Spectrum Disorders (National Autism Center, 2015).

Considerations in the Use of Cognitive Behavioral Therapy with Individuals with Autism Spectrum Disorders

- Specific Barriers to Treatment (Selles, Ung, Nadeau, & Storch, 2014):
  - Common characteristics of ASD, such as communicative, social, and cognitive deficits, emotion regulation deficits, and inflexible adherence to rules and structure, present unique treatment barriers.
  - Youth with ASD may struggle to accurately report their mental states and daily life experiences, and to separate difficulties associated with core features of autism or comorbid psychiatric disorder.
  - Cognitive deficits such as limited insight (Storch et al., in press), lack of theory of mind, attention difficulties, and restricted interests (Wood et al., 2009) may reduce the efficacy of treatment.
  - Youth with ASD may be unwilling or unmotivated to engage in treatment because they do not believe a problem exists, are uncomfortable with any changes to their routine, or are unable to understand how therapy will help.
- Modifications are needed to use these approaches with individuals with ASD
Cognitive Behavioral Therapy: Skills Required to Engage in CBT

(McLeod, 2013):

- Emotion recognition
- Understanding the link between thoughts, feelings and behaviour
- Cognitive mediation
- Meta-cognitive abilities/Self-reflection
- Perspective-taking
- Verbal ability
- Short and long-term memory

Modifications to Cognitive Behavioral Therapy for Use with Individuals with Autism Spectrum Disorders

(Selles, Ung, Nadeau, & Storch, 2014) (Paxton & Estay, 2007) (Scarpa, Williams, White, & Attwood, 2013)

- Any modification to CBT for children with ASD will primarily be related to the previously mentioned skill deficits, rather than to the presenting comorbid condition (Selles, Ung, Nadeau, & Storch, 2014).
- Cognitive Modifications: significant reduction in reliance upon wholly cognitive tasks, may need to compensate for lack of entry-level emotional and behavioral skills required for CBT, modifying language to understanding of client, increased structure of transitions and sequencing, visual sequencing of steps, shortened individual session time, concrete terminology and activities for cognitive restructuring tasks, use of visual representations and hands-on activities (e.g., comic strip conversations), client may need assistance in generating alternative or coping thoughts, use of special interests as a metaphor, need for family/staff involvement and training to aid in skill transference
Modifications to Cognitive Behavioral Therapy for Use with Individuals with Autism Spectrum Disorders
(Selles, Ung, Nadeau, & Storch, 2014) (Paxton & Estay, 2007) (Scarpa, Williams, White, & Attwood, 2013)

• Cognitive restructuring is not recommended when the client is out of touch with reality or locked into inflexible thinking (Paxton & Estay, 2007)
• Behavioral Modifications: activity and/or pleasant event scheduling, grading task/ homework assignments, exposure with response prevention, relaxation/breathing training, coping cards, rehearsal or application of learned cognitive routines, goal setting, structuring choices for success
Evidence Based Practices for Working with Individuals with ASD-Cognitive Behavioral Therapy
Working with Individuals with Mild to No Cognitive Deficits Who Have Impulse Control Difficulties
(Haskins, et al., 2014) (McCloskey, 2016)

• Teaching problem-solving skills
  • Collaborative Problem Solving—Ross Greene
  • I Can-Problem Solve—Myrna Shure
  • Social Thinking Curriculum—Michelle Garcia Winner
  • Goal-Management Training
  • Social Behavior and Self-Management

Working with Individuals with Mild to No Cognitive Deficits Who Have Impulse Control Difficulties
(Haskins, et al., 2014) (McCloskey, 2016)

• Teaching problem-solving skills
  • Thinking Through Problems in the Community—Holzhauser-Peters, Grizinski, Solazzo
  • Cognitive Rehabilitation of Executive Functions—Dilks, Hutchinson
  • Successful Problem-Solving for High-Functioning Students with Autism-Spectrum Disorders
Working with Individuals with Mild to No Cognitive Deficits Who Have Impulse Control Difficulties (Suchy, 2016)

- Teaching context awareness (may be particularly important when person has difficulty with Threat Sensitivity, Contingency Updating, and Discrepancy Detection)
  - Social Behavior Mapping—Michelle Garcia Winner
  - Comic Sense: A comic book on common sense and social skills for young people with Asperger’s and ADHD—Nancy Mucklow
  - More Comic Sense: More comics and cartoons on common sense and social skills for young people—Nancy Mucklow
  - Perspective-taking training

Working with Individuals with Mild to No Cognitive Deficits Who Have Impulse Control Difficulties (Suchy, 2016)

- Teaching context awareness (may be particularly important when person has difficulty with Threat Sensitivity, Contingency Updating, and Discrepancy Detection)—Sarah Ward, 2013
- Space: Read the room
- Time: Get on the timeline
- Objects: Sense the organization
- People: Read the person
Working with Individuals with Mild to No Cognitive Deficits Who Have Impulse Control Difficulties


- Training Mindfulness/Meditation
  - Improving all forms of self-control, especially Self-Awareness through “quieting of the mind.” (McCloskey, 2016)
  - Benefits found when training/teaching mindfulness strategies to Individuals with ASD, their Parents, and other Caregivers
    - Improvements noted in mood, coping, impulse control, anxiety, aggression, self-awareness, and cognitive flexibility

Potential psychological changes associated with mindfulness training (Perry-Parrish, Copeland-Linder, Webb, Shields, & Sibinga, 2016)

- Improved intentional shifts in attention
- Increased flexibility of attention
- Reduced emotional intensity/duration and secondary emotional responses
- Reduced belief in automatic thoughts
- Enhanced ability for learning
- Enhanced treatment motivation
Evidence Based Practices for Working with Individuals with ASD - Mindfulness

- Emerging evidence base—expanding literature base for use of mindfulness practices in interventions for individuals with Autism Spectrum Disorders
  - (Kiep, Spek, & Hoeben, 2015): early research showed that mindfulness-based therapy for individuals on the autism spectrum is effective in reducing symptoms of depression, anxiety, and rumination.
  - (Hwang & Kearney, 2015): Recent intervention studies have reported the successful application of mindfulness meditation practice for individuals with developmental disability (DD), including ASD, as evidenced by reductions in their behavioural (e.g. Singh et al., 2013), psychological (e.g. Spek et al., 2013) and physical (e.g. Singh et al., 2014a) problems.

Modifications to Mindfulness Practices for Use with Individuals with Autism Spectrum Disorders

- Need to consider factors reviewed on slide related to Considerations in the Use of Cognitive Behavioral Therapy with Individuals with Autism Spectrum Disorders when making modifications to mindfulness practices
- Need to consider similar factors related to the cognitive modifications for Cognitive Behavioral Therapy when making modifications to mindfulness practices.
- Example: Meditation on Soles of Feet
  - Begins with practitioner establishing posture by sitting or standing with feet on floor
  - Then paying attention to breathing, thus grounding the mind
  - Next stage involves reminding herself of specifics of her arousal state
  - The practitioner then directs attention to the soles of the feet until body and mind calm down
Evidence Based Practices for Working with Individuals with ASD and Commonly Co-occurring Psychiatric Disorders--Mindfulness
Flexibility

- Cognitive flexibility: changing perspectives or approaches to a problem, flexibly adjusting to new demands, rules, or priorities (as in switching between tasks) (Diamond, 2013)
- Cognitive flexibility refers to the brain’s ability to transition from thinking about one concept to another. (GLOOM, 2017)
- The ability to revise plans in the face of obstacles, setbacks, new information, or mistakes. It relates to adaptability to changing conditions. (Dawson & Guare, 2016)

Flexible cognition: adapting inference to unfamiliar or unexpected situations, creatively combining concepts, and modifying familiar knowledge and habits to produce novel representational syntheses or action sequences. (Deak, 2003)
Flexibility—Psychological Flexibility

• Psychological flexibility spans a wide range of human abilities to: recognize and adapt to various situational demands; shift mindsets or behavioral repertoires when these strategies compromise personal or social functioning; maintain balance among important life domains; and be aware, open, and committed to behaviors that are congruent with deeply held values. (Kashdan & Rottenberg, 2010)

Flexibility—Developmental Context

(Forgan & Richey, 2015)

<table>
<thead>
<tr>
<th>Age</th>
<th>Skills and Behaviors</th>
</tr>
</thead>
</table>
| 2-5 years | • Can shift actions based on changing rules (e.g. run on the playground but not inside)  
• Begins to understand turn-taking  
• Emerging understanding of time  
• Emotions can still be very intense  
• Difficulty separating "real" from "imaginary"  
• May develop fears |
| 3 years | • "Can direct and re-direct their attention to make deliberate choices," mental flexibility (Center on the Developing Child, 2011, p. 4). |
| 5 years | • Can play cooperatively with several children |
### Flexibility — Developmental Context

*Forgan & Richey, 2015*

#### 6-9 years
- Self-control continues to improve
- Internal thinking or self-talk develops
- Becomes better able to control negative feelings
- Develops awareness of consequences of their actions
- Begins to understand difference between "needs" and "wants"
- More sophisticated understanding of time
- Still egocentric but beginning to understand perspectives of others
- Peer competition in sports and the classroom comes to the forefront

#### 10-12 years
- Becomes more flexible according to changing rules
- Better able to separate actions and feelings and control negative feelings *(Teeter, 1998)*
- Able to take more responsibility for their action
- Wants independence but still needs guidance
- Importance of peer acceptance increasing
Flexibility — Developmental Context

<table>
<thead>
<tr>
<th>Teens</th>
<th>20’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased exploration of “self”</td>
<td>More stable sense of self</td>
</tr>
<tr>
<td>Increased goal flexibility</td>
<td>More defined “set” of goals for life</td>
</tr>
<tr>
<td>Continued increases in ability to take the perspective of others</td>
<td>Increased resilience to life’s stressors</td>
</tr>
<tr>
<td>Ability to carry out more tasks at a single time</td>
<td></td>
</tr>
<tr>
<td>Increases in “hot” executive function development</td>
<td></td>
</tr>
</tbody>
</table>

Cognitive Flexibility Skills

- Seeing the “grays”, being comfortable with “iffy” thinking (vs. more concrete, literal, black and white thinking and need for precision)
- Thinking hypothetically or inferentially/ using hypothesis-testing
- Handling deviation from rules, routine, original plan
- Handling unpredictability, ambiguity, uncertainty, novelty
Cognitive Flexibility Skills

- Shifting from original idea or solution/adapting to changes in plan or new rules/possibly perseverative or obsessive
- Taking into account situational factors that would suggest the need to adjust a plan of action
- Interpreting information accurately/avoiding cognitive distortions or biases in thinking such as over-generalizing or personalizing

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Signs and Symptoms of Difficulties with Flexibility--Elementary Classroom Behavior

(Axelrod, et al., 2012)

- Difficulty making transitions
- Difficulty starting a new task before the first task is complete
- Difficulty switching gears (addition problems/subtraction problems on same page)
- Perseverative behaviors
- Gives the same answers to different questions
- Difficulty switching to a new topic or new subject
- Inflexibility
- Difficulty with problem solving and conflict resolution
- Failure to comply with task instructions
Signs and Symptoms of Difficulties with Flexibility-Middle School Classroom Behaviors
(Axelrod, et al., 2012)

- Perseverating on a topic, idea or activity
- Repeating the same behavior after the task has changed
- Difficulty moving on from an emotional response to a situation
- Difficulty applying different strategies to problems as they arise
- Difficulty attending to differences between two different problems
- Driven by routine and consistency
  - Needing the same seat
  - Wearing the same color
  - Eating the same foods
  - Difficulty transitioning - class to class, weekend to school, one activity to another, etc.
  - Unable to tolerate changes in schedule
  - Difficulty with transitioning within conversation

Signs and Symptoms of Difficulty with Flexibility-High School Classroom Behaviors
(Axelrod, et al., 2012) (Guare, Dawson & Guare, 2013)

- Perseveration on previous and current tasks
- Not being prepared for next activity
- The student may just sit and stare
- Non-participation
- Noncompliance
Signs and Symptoms Difficulty with Flexibility—Adulthood

- Highly emotional—becomes stuck in emotional response
- Perseverative—will perseverate on thoughts, ideas, tasks, etc...
- Ruminative—will ruminate on unhealthy thoughts
- Inflexible need to adhere to specific routines and rituals
- Unable to adapt to changes or life events

Assessing Flexibility

(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014)

- Behavior Rating Inventory of Executive Function (BRIEF)
- Comprehensive Trail-Making Test
- Delis-Kaplan Executive Function System
- NEPSY-II
- Rapid Automatic Naming and Rapid Alternating Stimulus
- Ruff Figural Fluency Test
- Stroop Color Word Test
- Wisconsin Card Sorting Test
Flexibility Accommodations in K-12 Classrooms
(Gioia & Isquith, 2013)

• Remain consistent in environment and teaching
• Gradually and incrementally introduce minor changes one at a time
• Develop the use of visual organizers, such as pictures, schedules, planners, and calendar boards
• Make child feel secure by maintaining a set of basic routines

Working with Individuals with Significant Cognitive Deficits Who Have Flexibility Difficulties

• The strategies listed in the section on Working with Individuals with Significant Cognitive Deficits Who Have Impulse Control Difficulties all would benefit individuals with difficulties with flexibility.
• Remember to address any issues with arousal and anxiety
  • Remember there is an inverse relationship between an individual’s level of arousal and how flexible they are going to be able to be
Working with Individuals with Significant Cognitive Deficits Who Have Flexibility Difficulties


• Related to Structure...
  • Signal changes well in advance to allow individual to “prepare” for change
  • Utilize visual schedules and teach routines. Teach changes to routines ahead of time.
  • Teach individual cognitive script for dealing with change
  • Using Wait Cards

• Related to Structure...
  • Change one thing at a time when making changes
  • Reduce novelty
  • Increase level of support around the task
Working with Individuals with Significant Cognitive Deficits Who Have Flexibility Difficulties

• Dealing with individuals when they get stuck...
  • Remember that getting “stuck” is a neurological state not a willful behavior
  • Stuck behavior is different than resistant behavior
  • When someone is “stuck” their arousal level has risen to the level where they are no longer able to adequately cope

• Do not take “stuck” behavior personally
• We won’t “reward” or “reinforce” someone out of “stuck” behavior
• We won’t “consequence” or “punish” someone out of “stuck” behavior
• One key to dealing with stuck behavior is the understanding that we are working to return control to the individual
Working with Individuals with Significant Cognitive Deficits Who Have Flexibility Difficulties

- Dealing with individuals when they get stuck...
  - Priming
  - Give the person an “out”
  - Provide a safe space
  - “Inoculate” them against the rigidity and inflexibility of others
  - Utilize trust, attunement and relationship

- Nathan Ory, 2007
  - Key to Prevention: the Six A’s: Accepting Attitude; Accommodate the person’s needs and deficiencies
  - Return to routine or schedule (create a routine for these types of situations)
  - Prop-Rule-Role
  - The key is to stop any perseverative movement is to first capture the person’s attention, then focusing his attention on what you expect.
• General Guidelines:
  • Provide opportunities for individual to experience flexibility and to acquire knowledge flexibly
  • Demonstrate flexible approaches to solving problems/flexible strategies for approaching school work
  • Make the individual a full partner in design of routines, selection of rewards, and troubleshooting.
  • Teach self-monitoring and self-awareness skills
  • Model and teach reflection on own behavior: teach self-talk
  • Be willing to negotiate rather than dictate

• General Guidelines:
  • Introduce and define the concept of shifting strategies.
  • Model shifting strategies and explain what, when, and how to do this.
  • Provide opportunities for active student learning.
  • Reinforce shifting strategies by embedding opportunities for doing this into the curriculum.
  • Reflect on students' use of specific strategies.
  • Challenge students and extend flexible strategy use to other academic areas and tasks.
Working with Individuals with Mild to No Cognitive Deficits Who Have Flexibility Difficulties

(Diamond & Lee, 2011) (van de Ven, et al., 2015)

• Activities that may increase flexibility:
  • Computerized Training
  • Non-computerized games (cooperative games are especially beneficial)
  • Aerobics
  • Martial Arts
  • Yoga

Working with Individuals with Mild to No Cognitive Deficits Who Have Flexibility Difficulties

• Both Cognitive-Behavioral Therapy and Mindfulness have been found to be beneficial for addressing issues with flexibility
  • See sections under impulse control for each of these areas
Working with Individuals with Mild to No Cognitive Deficits Who Have Flexibility Difficulties

- Materials/Approaches developed for Individuals with ASD that are based on Cognitive Behavioral Therapy
  - Michelle Garcia Winner’s Social Thinking Materials
  - Kenworthy, et al., 2011: *Unstuck & On Target! An Executive Function Curriculum to Improve Flexibility for Children with Autism Spectrum Disorders*
  - Kerstein, 2014: *A Week of Switching, Shifting, and Stretching: How to Make My Thinking More Flexible*

  **may need to be adapted for different ability levels or ages

Working with Individuals with Mild to No Cognitive Deficits Who Have Flexibility Difficulties

- Approaches/Materials based on Applied Behavior Analysis
  - Miller, 2013: *Developing Flexibility Skills in Children and Teens with Autism: The 5P Approach to Thinking, Learning and Behavior*
  - Najdowski, 2017: *Flexible and Focused: Teaching Executive Function Skills to Individuals with Autism and Attention Disorders*
  - Granpeesheh, et al., 2014: *Evidence-Based Treatment for Children with Autism: The CARD Model (Practical Resources for the Mental Health Professional)*
Working with Individuals with Mild to No Cognitive Deficits Who Have Flexibility Difficulties

- Develop Resilience Skills
    - Has been researched in individuals with ASD

- Cognitive Flexibility Training (Canas, Fajardo, & Salmeron, 2006)
  - First Type of Training: The main idea behind these programs consists of emphasizing irregularity and variation in training over a fixed repetition of steps. This variability can be obtained by means of different training scenarios with different demands or by increasing the training of different behavioral strategies in different sequence orders.
Working with Individuals with Mild to No Cognitive Deficits Who Have Flexibility Difficulties

- Cognitive Flexibility Training (Canas, Fajardo, & Salmeron, 2006)
  - In a second set of programs, learners are instructed to vary the amount of attention (i.e. effort) dedicated to different tasks features during the training session. For example, in a task consisting of several sub-tasks involving the continued exploration of several displays, operators are told to switch their priorities from display to display through different training blocks.

Working Memory

- The ability to hold information in mind while performing complex tasks. It incorporates the ability to draw on past learning or experience to apply to the situation at hand or to project into the future. (Dawson & Guare, 2010)
- Working memory is the limited cognitive capacity to retain information in the short term while simultaneously manipulating the same or other information. (Dehn, 2014)
- Working memory is the term used to refer to a system responsible for temporarily storing and manipulating information. It functions as a mental workspace that can be flexibly used to support everyday cognitive activities that require both processing and storage such as, mental arithmetic. (Alloway, 2006)
Working Memory (Baddeley)

(Henry, 2012)

- Phonological Loop
  - Phonological store
  - Articulatory rehearsal mechanism
- Visuospatial Sketchpad
- Episodic Buffer
- Central Executive

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Working Memory — Developmental Context

(Forgan & Richey, 2015)

<table>
<thead>
<tr>
<th>Age</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 years</td>
<td>Can keep two rules in mind and act on them</td>
</tr>
<tr>
<td>3.5 years</td>
<td>Can use past knowledge to help them remember (Wellman, Somerville, &amp; Haake,</td>
</tr>
<tr>
<td></td>
<td>1979)</td>
</tr>
<tr>
<td>5 years</td>
<td>Begin to recall location of items, such as in a memory game or by finding</td>
</tr>
<tr>
<td></td>
<td>items in a room</td>
</tr>
<tr>
<td>7 years</td>
<td>Can begin to use simple memory strategies, like organization of material,</td>
</tr>
<tr>
<td></td>
<td>but usually need prompting (Teeter, 1998)</td>
</tr>
<tr>
<td>10-11 years</td>
<td>May use organizational strategies when instructed to remember information</td>
</tr>
<tr>
<td></td>
<td>without prompting (Chance &amp; Fischman, 1987)</td>
</tr>
<tr>
<td></td>
<td>Begin using rehearsal strategies, such as grouping items together or repeating</td>
</tr>
<tr>
<td></td>
<td>them in a certain sequence</td>
</tr>
<tr>
<td>12 years</td>
<td>Use more spontaneous elaboration and strategies independently</td>
</tr>
</tbody>
</table>
Signs and Symptoms of Difficulties with Working Memory--Elementary Classroom Behavior
(Axelrod, et al., 2012)

- Student gets confused when too much information is presented
- Has trouble remembering things (i.e., phone numbers)
- Student may lose track of what they are doing as they work
- Student may forget what they need to retrieve when sent on an errand
- May frequently switch tasks or fail to complete tasks
- Difficulty keeping up with classroom lessons
- Difficulty remaining attentive and focused for appropriate length of time

- Difficulty sequencing math word problems
- Extreme difficulty solving problems mentally (i.e., mental math)
- Poor reading comprehension
- Difficulty summarizing
- Inconsistent performance
- Difficulty following directions
- Difficulty keeping track of a lot of information

Signs and Symptoms of Difficulties with Working Memory--Middle School Classroom Behaviors
(Axelrod, et al., 2012)

- Difficulty keeping up with information to complete a task
  - may look like poor attention
  - misses important pieces of information
  - gets confused when too much information is presented at once or too quickly (i.e. information overload)
  - poor note taking from lectures

- Extreme difficulty solving problems mentally (i.e. mental math)
- Difficulty keeping up with and maintaining conversation
- Frequently asking questions
- Difficulty sequencing
Signs and Symptoms of Difficulty with Working Memory—High School Classroom Behaviors (Axelrod, et al., 2012)

• May appear as poor attention
• Only obtains part of the information and gets confused when too much information is presented in quick manner
• Has significant difficulty solving problems mentally
• Poor reading comprehension
• Has difficulty sequencing information

Signs and Symptoms Difficulty with Working Memory—Adulthood

• Forgetful of, or misses, appointments
• Misses deadlines
• Overdue bills
• Misses components of projects/work tasks
• Requires repeated explanations to be able to complete tasks
• Does not complete basic hygiene routines
• Does not complete home living routines
Assessing Working Memory
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014)

- Behavior Rating Inventory of Executive Function
- Brown ADD Scales
- California Verbal Learning Test
- Children’s Category Test
- Children’s Memory Scale

Assessing Working Memory
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014)

- Delis-Kaplan Executive Function System
- NEPSY-II
- Rey-Osterrieth Complex Figure Test
- Ross Information Processing Assessment
- Tasks of Executive Control
- Test of Auditory Processing Skills
Assessing Working Memory
(Dawson & Guare, 2010) (Goldstein & Naglieri, 2014)

- Test of Everyday Attention
- Test of Information Processing Skills
- Wechsler Intelligence Scale for Children—Fifth Edition
- Wide Range Assessment of Memory and Learning—Second Edition
- Woodcock Johnson Tests of Cognitive Ability

Working Memory Accommodations in K-12 Classrooms
(Gioia & Isquith, 2013)

- Preteach framework of new information. Could meet with Resource Teacher or Aide at the beginning of the day
- Establish eye contact and alert child that something is important
- Break tasks into smaller chunks or steps
- Change tasks frequently, maybe every ten minutes
- Provide short breaks (maybe only one to two minutes
- Provide attentional breaks with a motor activity, running an errand, getting a drink, or bringing work to the teacher
Working with Individuals with Significant Cognitive Deficits Who Have Working Memory Difficulties

--See strategies under Impulse Control and Flexibility
--The key is externalizing motivation/reinforcement and memory functions
--Use visuals—Hodgdon Books
--Support for rules/boundaries: Social Stories, Comic Strip Conversations, 5 point scale, Zones of Regulation, etc...
--Need to reduce cognitive load for the individual

Working with Individuals with Mild to No Cognitive Deficits Who Have Working Memory Difficulties

(Dehn, 2014) (Gathercole, Lamont & Alloway, 2006) (Alloway, 2006)

• General Guidelines—Reduce cognitive load
  • Learning is based on success
  • Begin with a few elements that can be learned in isolation and then add more
  • Arrange and integrate information so that there is only one source
  • Present math problems vertically rather than horizontally
  • Provide materials that allow the individual to focus on processing without the need to maintain task-relevant information
  • Guide the individual through schema construction and modification
  • Working with individual to acquire automaticity
  • Use external memory aids
  • Break down problems into steps
Working with Individuals with Mild to No Cognitive Deficits Who Have Working Memory Difficulties
(Dehn, 2014) (Dehn, 2008)

- Conduct training during one-on-one brief, focused sessions, held at least a couple times weekly over a period of several weeks.
- Precede memory strategy training by informing the student of her or his memory strengths and weakness so that the student acquires metamemory and begins to recognize the personal need for adopting strategies.
- Teach only one memory strategy at a time, at least until the student is familiar with the idea of strategy use.
- Inform the student about the purpose and rationale for the strategy, including when, where, why, and how to use the strategy. Explain the benefits and how use will result in better memory performance. Without this knowledge, the student will have difficulty selecting the most appropriate strategy for the task at hand.

- When introducing a strategy, model all steps and components of the strategy while thinking aloud. Use different examples when modeling and demonstrate how your thinking progresses while implementing a strategy.
- Explain, demonstrate, and teach in detail each step in the strategy procedures, with special attention paid to aspects of strategy use that generally are not well understood.
- Provide plenty of relevant practice, first with external guidance, then with the student thinking aloud, and finally while encouraging the student to internalize the strategy, such as having the student whisper the steps while enacting them.
- Provide multiple practice sessions that permit the strategy to be learned, over-learned, and automatized. During practice provide corrective feedback on strategy usage.
Working with Individuals with Mild to No Cognitive Deficits Who Have Working Memory Difficulties
(Dehn, 2014) (Dehn, 2008)

• To facilitate recall of strategy procedures, it is helpful to teach students a cuing system, such as an acronym.
• Give the student positive reinforcement for using the new strategy. Also, provide data on the success of the strategy so that the student understands the personal efficacy of strategy use.
• Encourage the student to monitor and evaluate strategy use and to attribute his or her success to strategy use.
• Encourage generalization by discussing applications of the strategy and practicing the strategy with different materials and under different situations.

Working memory strategies:
• Rehearsal—semantic, elaborative, paraphrasing
• Chunking
• Metamemory
• Mnemonics
Working with Individuals with Mild to No Cognitive Deficits Who Have Working Memory Difficulties

(Dehn, 2014) (Dehn, 2008)

- Working memory strategies:
  - Metacognitive Training
  - Visualization and Imagery
    - Warren, 2014: Mindful Visualization for Education
  - Working Memory Exercises
    - Benegas, Brush, Elliot, 2016: Spaced Retrieval Step by Step
    - Dehn, 2011: Helping Students Remember: Exercises to Strengthen Memory

- Computerized:
  - N-Back
  - Counting Span
  - Arithmetic Flash Cards
  - Visual-Spatial Recall
  - Remembering Directions
  - Mental Rotation
Factors Which May De-Motivate
(Jensen, 1998)

- Past associations
- Unsuitable learning styles
- Lack of resources
- Language barriers
- Cultural taboos
- Fear of embarrassment/fear of failure
- Lack of respect
- Lack of feedback

Factors Which May De-Motivate
(Jensen, 1998)

- Poor nutrition
- Prejudice
- Perceptual factors
  - Poor lighting
  - Bad seating
  - Wrong temperature
- Relationship with the future
  - Presence of clear, well-defined goals
  - Beliefs about the content, and context, of learning
Motivational Approaches (to intervention) are based on the following assumptions:
(Treatment, 1999)

- Motivation is a key to change.
- Motivation is multidimensional.
- Motivation is a dynamic and fluctuating state.
- Motivation is interactive.
- Motivation can be modified.
- The clinician’s style influences client motivation.

Responding to Resistance

- Build rapport, relationship and trust
- Do not take resistance personally, reframe resistance
- Understand where the individual is in the cycle of change
  - Normalize ambivalence
Responding to Resistance


• Demonstrate empathy and attunement with the individual
• Avoid becoming the individual’s “friend”
• “Roll with” the resistance
• Utilize “priming” to enhance future participation in change/treatment

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Primming

• “Primming refers to activating particular representations or associations in memory just before carrying out an action or task.” (http://psychology.wikia.com/wiki/Priming)
• “Primming refers to a increased sensitivity to certain stimuli due to prior experience.” (http://psychology.about.com/od/pindex/g/def_priming.htm)
• “Primming is the incidental activation of knowledge structures, such as trait concepts and stereotypes, by the current situational context. “(Turner, Forrester, Mulhern, & Crisp, 2005)
• Preparing the brain ahead of time for stimuli (experience) that is coming

Primming Benefits

• Optimize arousal
• Decrease anxiety
• Increase attention/concentration
• Activate memory
• Focus perceptual strengths
• Reduce perceptual confusion
• Get individual “ready” for the activity, transition, etc...
Inverse Relationship Between Arousal (Anxiety) and Executive Function Skills

• As arousal increases (beyond an optimal level) our ability to use executive skills to control behavior decreases.
• As we use our executive skills to control behavior, arousal decreases (toward an optimal level)
• Circuitry between amygdala and prefrontal cortex

Responding to Resistance


• Elicit ideas regarding the individual’s perceived self-efficacy and expectations regarding treatment
• Summarize self-motivational statements
• Further development of Helping Relationships: these may take the forms of peer mentoring groups, self-help groups, social support, or a therapeutic relationship
Responding to Resistance

• Find ways to “leverage” the individual’s own interests/motivations in therapy
• Clarify the individual’s own goals and strategies for change
• Identify functional impact of changes in executive functions
• Offer a menu of options for change or treatment

• With permission, offer expertise and advice
• Negotiate a change—or treatment-plan and behavior contract
• Consider and lower barriers to change/treatment
• Acknowledge the difficulties the individual may experience in early stages of change/treatment
Responding to Resistance

• Help the individual identify methods to continue gains established in treatment. This may include the use of executive function prostheses, as well as the continued identification of self-administered reinforcements

• Support changes the individual has made in executive functions and their functional impact on academics, life skills, work, etc...

• Help individual to practice coping skills for times when context or emotion may threaten the individual’s resilience

Additional Reading on Motivational Interviewing
## Appendix 1: Hierarchy of Social/Pragmatic Skills as Related to the Development of Executive Function

created by Kimberly Peters, Ph.D.

<table>
<thead>
<tr>
<th>Age</th>
<th>Pragmatic Skills</th>
<th>EF Development/Tasks requiring EF</th>
<th>Treatment Ideas/Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3 months</td>
<td>Illocutionary—caregiver attributes intent to child actions</td>
<td>Development:</td>
<td>- face to face interaction</td>
</tr>
<tr>
<td></td>
<td>- smiles/coos in response</td>
<td>- behavior is designed to meet immediate needs</td>
<td>- vocal-turn-taking with care-providers</td>
</tr>
<tr>
<td></td>
<td>- attends to eyes and mouth</td>
<td>- cognitive flexibility not emerged</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- has preference for faces</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- exhibits turn-taking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-6 months</td>
<td>- laughs while socializing</td>
<td></td>
<td>- vocal turn-taking with care-providers</td>
</tr>
<tr>
<td></td>
<td>- maintains eye contact appropriately</td>
<td></td>
<td>- facial expressions: tongue protrusion, “oh”, raspberries.</td>
</tr>
<tr>
<td></td>
<td>- takes turns by vocalizing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- maintains topic by following gaze</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- copies facial expressions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-9 months</td>
<td>- calls to get attention</td>
<td>Development:</td>
<td>- peek-a-boo</td>
</tr>
<tr>
<td></td>
<td>- demonstrates attachment</td>
<td>- Early inhibitory control emerges</td>
<td>- place toys slightly out of reach</td>
</tr>
<tr>
<td></td>
<td>- shows self/acts coy to Peek-a-boo (first true communicative intent)</td>
<td>- tolerates longer delays and still maintains simple, focused attention</td>
<td>- imitative babbling</td>
</tr>
<tr>
<td></td>
<td>- reaches/points to request</td>
<td></td>
<td>- imitating actions (waving, covering eyes with hands).</td>
</tr>
<tr>
<td>9-12 months</td>
<td>Development:</td>
<td>12-18 months</td>
<td>Development:</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>begins directing others</td>
<td><em>Early inhibitory control emerges</em></td>
<td>imitate routines</td>
<td><em>model single words for age-appropriate functions</em></td>
</tr>
<tr>
<td>- participates in verbal routines</td>
<td>tolerates longer delays and still maintain simple, focused attention</td>
<td>- imitates other children</td>
<td>- play routines (playing with a doll, pretending to talk on the phone, pushing trucks)</td>
</tr>
<tr>
<td>- repeats actions that are laughed at</td>
<td></td>
<td>uses words to protest/reject, greet/call, respond to others</td>
<td>- put toys out of reach but in sight for child to point/request with voice</td>
</tr>
<tr>
<td>- tries to restart play</td>
<td></td>
<td>request to others (age-appropriate functions)</td>
<td>- “ignore” child and wait for child to vocalize to get attention</td>
</tr>
<tr>
<td>uses play routines to give &amp; take, build &amp; bash</td>
<td></td>
<td>impulsive behaviors reflect immature attentional system, distractibility, and undeveloped inhibitory control</td>
<td>- waving “hi”, modeling “please” and “thank you” (speech or sign).</td>
</tr>
<tr>
<td>vocalizes with gesture to protest, reject, request objects or action, call, express feelings, notice/comment, respond to others, refuse</td>
<td></td>
<td><em>Frequency of communicative acts: 5/min of free play</em></td>
<td>- using “no” to reject</td>
</tr>
<tr>
<td>* frequency of communicative acts = 2.5/min of free play</td>
<td></td>
<td><em>Frequency of communicative acts: 5/min of free play</em></td>
<td>joint attention activities— commenting on what the child is looking at. Modeling pointing/commenting</td>
</tr>
<tr>
<td>12-18 months</td>
<td></td>
<td>closer to 18 months, uses words to request information, initiate pretend play, comment/tell info, acknowledge/answer.</td>
<td>asking “wh” questions (“where are your shoes?” “what’s that?” “where’s daddy/sister/brother/mommy?”)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Frequency of communicative acts: 5/min of free play</td>
<td></td>
</tr>
</tbody>
</table>
| 18-24 months | Uses longer utterance (2-3 words) to express intentions: protest/reject, greet/call, respond to others, label/notice, request object/action, express feelings, request information, initiate pretend play, comment/tell info, acknowledge/answer. Practices familiar conversational frames and schema (book reading routine, go to restaurant schema).  
* Frequency of communicative acts: 7.5/min |
|  | Development:  
- can inhibit certain behaviors and shift to new response sets  
- some self-monitoring and early ability to identify errors (inconsistent)  
- impulsive behaviors reflect immature attentional system, distractibility, and undeveloped inhibitory control  
- Begins to identify correct vs. incorrect block constructions (compared to designs) but unable to “fix” incorrect version. |
|  | - two- and three-term semantic relations  
- words for emotions  
- shared reading activities  
- “what’s that?”  
- put toys out of reach, in front of others, for child to label.  
- verbal turn-taking |

| 24-30 months | “please” used for polite requests  
- New intents include: symbolic play, talk about absent objects, misrepresenting reality (lies, teases)  
- Narratives are “heap stories”, primarily labels and descriptions  
- Uses speech to announce intentions  
- takes two turns in conversation  
- verbally introduces and changes topics  
- uses words to express emotion  
- begins to give descriptions to aid listener  
- clarifies by repeating  
- requests clarification |
|  | - 2 ½ year olds demonstrate knowledge of rules but unable to shift or alter behaviors, demonstrating perseveration  
- target emotion words  
- use of imaginative language (think, feel, wonder)  
- teasing (“that’s silly”)  
- requests for clarification  
- feign lack of understanding: strategies for repairing communication breakdown (ex: providing more information).  
- “experience books” for talking about past experiences.  
- “drama” activities (dropping things, breaking things, getting hurt, making a mess)  
- early pronouns |

| 30-36 months | Convenes in sentences  
- attempts to control situations verbally |
|  | Development:  
- most choices are made by chance are |
<p>|  | same as 24-30 months |</p>
<table>
<thead>
<tr>
<th>Uses polite “nice” intonation patterns</th>
<th>Disadvantageous</th>
</tr>
</thead>
<tbody>
<tr>
<td>- responds to requests to clarify</td>
<td>- Unable to delay gratification</td>
</tr>
<tr>
<td>- apologizes by saying “I’m sorry”</td>
<td></td>
</tr>
<tr>
<td>- topic continuation near 50%</td>
<td></td>
</tr>
<tr>
<td>- topics are continued by adding new information</td>
<td></td>
</tr>
<tr>
<td>- use of language in play increases</td>
<td></td>
</tr>
<tr>
<td>- narratives are “sequences,” with theme, but no plot</td>
<td></td>
</tr>
<tr>
<td><strong>ToM:</strong> understands that others can want different things (passes a “diverse desires” task at about 3 ½ years of age).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>36-42 months</th>
<th>Development:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- takes 4 to 5 conversational turns</td>
<td>increased attention, self-control, concentration, and inhibition, but not mature.</td>
</tr>
<tr>
<td>- uses fillers to acknowledge</td>
<td>gradual decline in impulsivity, although still present</td>
</tr>
<tr>
<td>- begins to shift register with younger children</td>
<td>- occasional perseverative behavior</td>
</tr>
<tr>
<td>- requests permission</td>
<td>incremental improvements in verbal fluency</td>
</tr>
<tr>
<td>- uses language for teasing/jokes/fantasies</td>
<td>gradual improvements in processing speed</td>
</tr>
<tr>
<td>- consistently uses descriptions to clarify</td>
<td>accuracy on impulse control tasks</td>
</tr>
<tr>
<td>- corrects others</td>
<td>3-year-olds demonstrate knowledge of rules</td>
</tr>
<tr>
<td>- uses pronouns to mark old information</td>
<td>and emerging ability to shift behaviors, but only for one rule necessary for task success.</td>
</tr>
<tr>
<td>- requests using “yes/no” questions</td>
<td>- “What’s missing” game</td>
</tr>
<tr>
<td>- more flexibility in requesting, including: permission directives (“can you...?”), and indirect requests (“would you...?”).</td>
<td>elaborated conversations (“tell me about what happened at school today”—may need to model this type of conversation).</td>
</tr>
<tr>
<td>- Direct requests decrease and indirect</td>
<td>modeling “baby talk” with younger kids</td>
</tr>
<tr>
<td>- requests for information and clarification (deliberately obscure input to child/”practice” requests for info/clarification).</td>
<td>- retelling simple stories</td>
</tr>
<tr>
<td>- retelling simple stories</td>
<td>- pronouns</td>
</tr>
<tr>
<td>Age Range</td>
<td>Abilities and Development</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
</tr>
</tbody>
</table>
| 42-48 months | - has long, detailed conversations
- tells two events in correct order
- tells story mixing real and unreal
- uses pronouns across sentences to mark object
- New functions emerge: \textbf{reporting on past events, reasoning, predicting, expressing empathy, creating imaginary roles and props, maintaining interactions.}
\textbf{ToM:} understands that others can have different beliefs (passes a “diverse belief” task by 4 years of age). | - Skills:
- Runs simple errands (“get your shoes from the bedroom”)
- Tidies bedroom with some assistance
- Performs simple chores and self-help tasks with reminders
- Inhibits behaviors (don’t touch a hot stove, don’t run in the street, don’t hit, bite, etc.)
- Understanding sentences with 2-, 3- and 4-critical elements
- Simple games (go fish, bingo, lotto)
- Understanding simple riddles (“This is an animal that lives on a farm”). This is the beginning of inferential reasoning.
- Retelling stories
- Taking the perspective of others during story retelling |
| 4-5 years | - uses hints that do not mention the intention in the request
- Ability to address specific requests for clarification increase
- Narratives are “chains” with some plot, but no high point or resolution
- Correctly changes reference with \textbf{this/that, here/there, go/come}
- Ends conversations abruptly
- Changes topics appropriately | - Following one- and two-step directions
- Retelling simple stories in correct order
- Sequencing three to four pictures and then describing the events
- Determining which “step” is missing in a three- to four-step event (“What comes next?” “What do you do before you cut the sandwich?”)
- Reporting to parent what happened in therapy/school/activity (child needs support for this—experience book).
- Predicting what comes next in a story
- Practicing empathy for a toy/doll that falls and gets hurt.
- Self-talk |
<table>
<thead>
<tr>
<th>5-6 years</th>
<th>Development:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- uses focused chains for narratives</td>
<td></td>
</tr>
<tr>
<td>- gives threats/insults</td>
<td></td>
</tr>
<tr>
<td>- issues promises</td>
<td></td>
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<tr>
<td>- may give praise</td>
<td></td>
</tr>
<tr>
<td>- stays on topic for 10 turns</td>
<td></td>
</tr>
<tr>
<td>- uses pronoun reference as a cohesive device</td>
<td></td>
</tr>
<tr>
<td>- self-monitors speech for errors</td>
<td></td>
</tr>
<tr>
<td>- negotiates play roles, turns, and ending of play</td>
<td></td>
</tr>
<tr>
<td>ToM: child understands that a person can feel one thing but those feelings can be hidden or not apparent on the face (passes a “hidden emotion” task between about 5 and 5 ½ years of age).</td>
<td></td>
</tr>
<tr>
<td>- 4-year-olds begin to have more successful task completion due to increase in mental flexibility and rapid switching between two simple response sets.</td>
<td></td>
</tr>
<tr>
<td>- 4-year-olds begin to make more advantageous choices</td>
<td></td>
</tr>
<tr>
<td>- 4-year-olds capable of generating new concepts and ideas</td>
<td></td>
</tr>
<tr>
<td><strong>Skills:</strong></td>
<td></td>
</tr>
<tr>
<td>- same as above</td>
<td></td>
</tr>
<tr>
<td>- 5-6 years: ability to resist distractions and maintain attention begins to increase.</td>
<td></td>
</tr>
<tr>
<td>- begin to use silent, verbal mediation as language becomes more complex</td>
<td></td>
</tr>
<tr>
<td>- 6-year-olds able to process up to 5-step “moves” in simple problem-solving</td>
<td></td>
</tr>
<tr>
<td>- 5-year-olds demonstrate difficulty switching between multiple rules, even when verbal cues are given.</td>
<td></td>
</tr>
<tr>
<td>- spurt of development in mental flexibility around 6 years</td>
<td></td>
</tr>
<tr>
<td>- decline in perseverative behavior emerging capacity to learn from mistakes and create alternative</td>
<td></td>
</tr>
</tbody>
</table>

- 5-year-olds demonstrate difficulty switching between multiple rules, even when verbal cues are given.
- spurt of development in mental flexibility around 6 years
- decline in perseverative behavior emerging capacity to learn from mistakes and create alternative

- barrier games (following directions, providing specific directions)
- 20 questions (who am I?)
- “Headbandz” game
- written language (draw a picture, write the story that goes with it).
- similarities and differences (“how are a bike and tricycle the same? How are they different?”)
- higher level inferential tasks (“he came downstairs early in the morning and saw the tree.” What is happening?).
- address multiple meaning words as they come up.
- inferring meaning from context (“I’m going to put this word in a sentence”)
strategies for simple problems
4- to 5-year-olds begin to delay initial choices for behavior, selecting goals that lead to “better” rewards later on.
simple strategic planning skills emerge
- make better choices

**Skills:**
- follows two- to three-step directions
- tidies bedroom or playroom
- Performs simple chores, self-help tasks; may need reminders
- Brings papers to and from school
- Completes a 20 minute homework assignment
decides how to spend money (allowance)
- Inhibits behaviors (follows safety rules, doesn’t swear, raises hand before speaking in class, keeps hands to self).

and you try to figure out what it means?
- infer feelings of characters in a story.
- negotiating roles in games: “Who do you want to be?” “Who will you be?”
- Blanks Level IV questions: “how do you know?” “What could you have done differently?” “What should he have done instead to avoid that problem?”
- giving clues that include function (“This is used for…”)

| 6-8 years | can give multiple step directions
- uses well-formed narrative language (creates riddles, describes characters)
- makes and responds appropriately to evaluative comments/correction
- check’s listener’s comprehension
- produces full explanations
- responds appropriately to compliments |
|-----------|----------------------------------|
| **Development:** | Selective attention begins to develop and mature
7-year-olds struggle with switching behavior sets that are contingent on multiple demands
8-year-olds demonstrate increase in focus, sustained and shifting attention
demonstrate more frequent strategic and planned goal choices and behaviors, but not yet mastered |
|-----------------|----------------------------------|
| **Development:** | expressive narrative skills/story grammar
- describing character motives and feelings
- formulating complex sentences given clauses without using coordinating conjunctions (and, but, so, then).
- descriptive language: describing pictures in detail so that the listener can select the correct picture
- role playing challenging social |
<table>
<thead>
<tr>
<th>Skills:</th>
<th>Development:</th>
<th>8-9 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same as above</td>
<td>9-year-olds begin to have more success switching rules/sets between multiple or changing demands.</td>
<td>Language is used to establish and maintain social status</td>
</tr>
<tr>
<td>apologized and responds to apologies appropriately.</td>
<td>Rapid surge in development of planning and organizational skills that reflect consideration of task parameters more so than personal or impulsive desires.</td>
<td>increased perspective-taking allows for more successful persuasion</td>
</tr>
<tr>
<td>- word attack skills: “How can you turn this adjective into an adverb?” “What part of speech is that?”</td>
<td>strategic behavior and efficient reasoning become more obvious.</td>
<td>provides conversational repairs by defining terms or giving background information</td>
</tr>
<tr>
<td>- practice taking the perspective of others</td>
<td>- runs errands that may involve a time delay or a greater distance—going to the store, remembering to do something after school (“prospective memory”)</td>
<td>begins to understand jokes and riddles based on sound similarities</td>
</tr>
<tr>
<td>- multiple meaning words, jokes, riddles.</td>
<td>- tidies bedroom or playroom (may include vacuuming or dusting)</td>
<td>can perform successfully on simple referential communication tasks.</td>
</tr>
<tr>
<td>- mad-libs</td>
<td>- performs chores that take 15 to 20 minutes</td>
<td></td>
</tr>
<tr>
<td>- games such as: Scattergories (working memory), Taboo (inhibitory control), Stare (visual memory).</td>
<td>- brings books, papers, assignments home and takes them back to school.</td>
<td></td>
</tr>
<tr>
<td>- high-level categories (ex: things that can be rolled).</td>
<td>- keeps track of belongings when away from home</td>
<td></td>
</tr>
<tr>
<td>- inferential reasoning skills (higher level).</td>
<td>- visualizing activities (“What will it look like when you’re done?”)</td>
<td></td>
</tr>
<tr>
<td>- visualizing activities (“What will it look like when you’re done?”)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9-12 years</td>
<td>Development:</td>
</tr>
<tr>
<td>---</td>
<td>------------</td>
<td>--------------</td>
</tr>
<tr>
<td></td>
<td>Stories include complex, embedded, and interactive episodes</td>
<td>Significant improvement in ability to inhibit impulsive actions.</td>
</tr>
<tr>
<td></td>
<td>understands jokes and riddles based on lexical ambiguity</td>
<td>Selective attention nears maturity; better ability to selectively attend to relevant and necessary information in the environment.</td>
</tr>
<tr>
<td></td>
<td>completes homework assignments (1- hour maximum)</td>
<td>Able to monitor and regulate actions well.</td>
</tr>
<tr>
<td></td>
<td>plans simple school projects such as book reports (selects the book, reads the book, writes a report)</td>
<td>Relatively mature attentional functions.</td>
</tr>
<tr>
<td></td>
<td>Keeps track of a daily changing schedule</td>
<td>Able to limit preservative errors at adult level.</td>
</tr>
<tr>
<td></td>
<td>- Saves money for desired objects</td>
<td>Temporary increase in impulsivity for short periods.</td>
</tr>
<tr>
<td></td>
<td>inhibits/self-regulates (behaves when the teacher is out of the classroom; refrains from rude comments, temper tantrums, bad manners)</td>
<td>- Verbal fluency near maturity.</td>
</tr>
<tr>
<td></td>
<td>- stories include complex, embedded, and interactive episodes</td>
<td>- significant gains in processing speed.</td>
</tr>
<tr>
<td></td>
<td>- understands jokes and riddles based on lexical ambiguity</td>
<td>ability to switch between multiple tasks demands continues to improve.</td>
</tr>
<tr>
<td></td>
<td>- multiple meaning words</td>
<td>- games like Balderdash, Apples to Apples.</td>
</tr>
<tr>
<td></td>
<td>- idiomatic expressions/figurative language</td>
<td>- assign personality traits to characters in books based on actions (address high-level vocabulary)</td>
</tr>
<tr>
<td></td>
<td>- riddles</td>
<td>- identify character beliefs based on actions (address high-level vocabulary)</td>
</tr>
<tr>
<td></td>
<td>- written narratives: Story Grammar Marker (as an example).</td>
<td>- identify motives for actions in books</td>
</tr>
<tr>
<td></td>
<td>- assign personality traits to characters in books based on actions (address high-level vocabulary)</td>
<td>- games like Balderdash, Apples to Apples.</td>
</tr>
</tbody>
</table>
### Executive Functioning and Cognitive Control

**Skills:**
- Same as above

**Development:**
- Relative maturity of cognitive flexibility
- Perseverative behaviors are rare
- Improved flexibility to switch between changing performance demands and initiate deliberate behaviors
- Developmental spurt for goal-setting skills, around age 12
- Increased ability to use strategies for problem-solving
- Complex planning skills near maturity
- 12-year-old may demonstrate adult-levels of planning abilities and
- Practice empathetic response to peers
- Self-evaluation of social interactions
- Strategies for identifying figurative language in literature (identify unfamiliar language; keep a written record; practice practice practice).
- Organizational strategies (Cornell notes, planners, color-coding homework, timelines, working backwards from deadline in step)
- Assistive technology (iPads, iPod Touch).
- Break assignments into chunks with time frames for completions
- “To do” lists with timelines

<table>
<thead>
<tr>
<th>12-14 years</th>
<th>Expository texts used in school-sponsored writing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Most academic information is presented in expository format</td>
</tr>
<tr>
<td></td>
<td>Understands jokes and riddles based on deep structure ambiguity</td>
</tr>
</tbody>
</table>

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### Executive Functioning and Cognitive Control

**Skills:**
- Same as above

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- Relative maturity of cognitive flexibility
- Perseverative behaviors are rare
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<table>
<thead>
<tr>
<th><strong>Performance</strong></th>
<th><strong>Skills:</strong></th>
<th><strong>Development:</strong></th>
<th><strong>Paper writing:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Helps out with chores around the home, including daily responsibilities and occasional tasks (emptying dishwasher, raking leaves, shoveling snow). Tasks may take 60-90 minutes.</td>
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<td>Perseverative errors are rare</td>
<td>“Outline to paper” method (outline headings: five main points of the paper; slowly add supporting details/evidence until paper)</td>
</tr>
<tr>
<td>Babysits younger siblings or other kids for pay uses system for organizing school work, including assignment books, notebooks, etc.</td>
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<td>Working memory increases significantly.</td>
<td></td>
</tr>
<tr>
<td>Follows complex school schedule involving changing teachers and changing schedules plans and carries out long-term projects, including tasks to be accomplished and reasonable timeline to follow; may require planning multiple large projects simultaneously plans time, including after-school activities, homework, family responsibilities; estimates how long it takes to complete individual tasks and adjusts schedule to fit.</td>
<td>Follows complex school schedule involving changing teachers and changing schedules plans and carries out long-term projects, including tasks to be accomplished and reasonable timeline to follow; may require planning multiple large projects simultaneously plans time, including after-school activities, homework, family responsibilities; estimates how long it takes to complete individual tasks and adjusts schedule to fit.</td>
<td>inhibits rule-breaking in the absence of visible authority.</td>
<td></td>
</tr>
<tr>
<td>Uses large, color-coded, erasable calendars for long-term assignments and projects</td>
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<td>- vocabulary apps!</td>
<td></td>
</tr>
<tr>
<td>- use a “date stamp”: <strong>due on</strong> and <strong>received on</strong></td>
<td>- use a “date stamp”: <strong>due on</strong> and <strong>received on</strong></td>
<td>- keep a vocabulary notebook</td>
<td></td>
</tr>
<tr>
<td>- identify the main idea (color code); identify supporting details (color code) or supporting evidence (color code).</td>
<td>- identify the main idea (color code); identify supporting details (color code) or supporting evidence (color code).</td>
<td>- identifying relevant vs. irrelevant information in writing (own/others’).</td>
<td></td>
</tr>
<tr>
<td>- keep a vocabulary notebook</td>
<td>- keep a vocabulary notebook</td>
<td>- identifying relevant vs. irrelevant information in writing (own/others’).</td>
<td></td>
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</tr>
<tr>
<td>- essay writing: “outline to paper” method (outline headings: five main points of the paper; slowly add supporting details/evidence until paper)</td>
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<table>
<thead>
<tr>
<th><strong>Language</strong></th>
<th><strong>15-18 years</strong></th>
</tr>
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<tr>
<td>Language is used to maintain social bonds (“just talking”)</td>
<td>Language is used to maintain social bonds (“just talking”)</td>
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<td>Persuasive and argumentative skills reach near-adult levels.</td>
<td>Persuasive and argumentative skills reach near-adult levels.</td>
</tr>
</tbody>
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increased verbal fluency and sequencing
more complex planning and organizational skills
strategy development and its use in complex, multidimensional goal-oriented behavior continues to improve
overall skills in decision-making, goal selection, and capacity to orchestrate efforts necessary to attain goals continue to improve

Skills:
manages school work effectively on a day-to-day basis, including completing and handing in assignments on time, studying for tests, creating and following timelines for long-term projects, and making adjustments in effort and quality of work in response to feedback.
establishes and refines a long-term goal and make plans for meeting that goal.
makes good use of leisure time, including obtaining employment or pursuing recreational activities during the summer.
inhibits reckless and dangerous behaviors.
is complete).
*Focus on cognitive language, memory, prediction, and reasoning during all interactions.* Examples: “What do you think?” “Do you remember what happened?” “Can you tell mom that story?” “We have a problem. What is a good solution for this?” “What are some alternative solutions?” “What is the main point of the lecture?” (color code) “What are the details that support the main point?” (color code). “What are the most important things to remember?” (color code).

References:


Appendix 2: Assessments

**Adaptive Behavior Assessment System (ABAS):** The ABAS-3 covers three broad adaptive domains: Conceptual, Social, and Practical. Within these domains, it assesses 11 adaptive skill areas (each form assesses 9 or 10 skill areas based on age range). Items focus on practical, everyday activities required to function, meet environmental demands, care for oneself, and interact with others effectively and independently. On a four-point response scale, raters indicate whether the individual can perform each activity, and if so, how frequently they perform it when needed. (from: https://www.wpspublish.com/store/p/3234/adaptive-behavior-assessment-system-third-edition-abas-3)

**A-not-B Task:** This is a cognitive flexibility test typically administered to children. During this test, children are visually presented with an object that is hidden at “Location A.” The children are then allowed to look for the object at the hidden “Location A” – which is generally within arm’s reach. The hiding of the object at Location A is repeated a few times until the child becomes focused on how to find it. Next, the same object is hidden in a new area called “Location B” – a distinct location separate from Location A (also within arm’s reach). Individuals under 1 years of age will typically look again in Location A. Children over 1 years of age are able to display “cognitive flexibility” and learn to find the object at the novel Location B. This is a cognitive flexibility task reserved for infants and would be far too simplistic for older children, teens, and adults. (GLOOM, 2017)

**Barkley Deficits in Executive Functioning Scale:** The Barkley Deficits in Executive Functioning Scale (BDEFS for Adults) is an empirically based tool for evaluating dimensions of adult executive functioning in daily life. The BDEFS offers an ecologically valid snapshot of the capacities involved in time management, organization and problem-solving, self-restraint, self-motivation, and self-regulation of emotions. Scores are presented in raw scores and percentiles.

**Beery-Buktenica Developmental Test of Visual Motor Integration:** measures visual motor integration in children adults. Backed by decades of research and clinical use, the Berry VMI offers a convenient and economical way to screen for visual-motor deficits that can lead to learning, behavior, and neuropsychological problems. http://www.therapro.com/Browse-Category/Visual-Perception-and-Visual-Skills/6th-Ed-Starter-Kit.html

**Behavior Assessment System for Children:** The Behavior Assessment System For Children consists of rating scales and forms, such as the Parent Rating Scales (PRS), the Teacher Rating Scales (TRS), the Self-Report of Personality (SRP), Student Observation System (SOS), and the Structured Developmental History (SDH). The TRS, PRS, and SOS measure the child’s behavior patterns. The SRP can be used to assess the child’s emotions and feelings. The SDH is useful for obtaining the child’s background information. http://txautism.net/evaluations/behavior-assessment-system-for-children-second-edition-basc-2
**Behavior Rating Inventory of Executive Function:** Assess executive function behaviors in the school and home environments with the BRIEF, a questionnaire developed for parents and teachers of school-age children. Designed to assess the abilities of a broad range of children and adolescents, the BRIEF is useful when working with children who have learning disabilities and attention disorders, traumatic brain injuries, lead exposure, pervasive developmental disorders, depression, and other developmental, neurological, psychiatric, and medical conditions. Eight clinical scales (Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, Monitor) and two validity scales (Inconsistency and Negativity) give the clinician a well-rounded picture of the behavior of the child or adolescent being rated. [http://www4.parinc.com/Products/Product.aspx?ProductID=BRIEF](http://www4.parinc.com/Products/Product.aspx?ProductID=BRIEF)

**Behavioral Assessment of the Dysexecutive Syndrome:** The assessment battery includes a 20 item Dysexecutive Questionnaire (DEX) that samples the range of problems in four broad areas of likely change: emotional or personality changes, motivational, behaviour or cognitive. Disorders of planning, organization, problem solving, setting priorities, and attention and can measure improvements over time. Can predict everyday problems associated with dysexecutive syndrome following traumatic brain injury. [http://www.emrehab.com/assessment-bads.htm](http://www.emrehab.com/assessment-bads.htm)

**Brown ADD Scales:** The *Brown ADD Scales* help to assess a wide range of symptoms of executive function impairments associated with ADHD/ADD. These normed rating scales are available to elicit parent report and teacher report for children ages 3 to 7 yrs and 8 to 12 yrs. For 8 to 12 year olds, a normed self-report version is also available. For adolescents (12-18 yrs) and for adults, normed rating scales elicit self-report and collateral report on a single form. [http://www.drthomasebrown.com/assessment-tools/](http://www.drthomasebrown.com/assessment-tools/)

**California Verbal Learning Test:** The California Verbal Learning Test (CVLT) is a neuropsychological test which can be used to assess an individual's verbal memory abilities. The tester reads aloud a list, called "Monday's shopping list". The list contains sixteen common words, each of which belongs to one of four categories: thus, there are four fruits, four herbs and spices, etc. The subject is then asked to recall as many of these items as possible. [http://www.memorylossonline.com/glossary/californiaverballearningtest.html](http://www.memorylossonline.com/glossary/californiaverballearningtest.html)

**Cambridge Neuropsychological Tests Automated Battery:** CANTAB technology contains a suite of the world's most validated and sensitive touchscreen neuropsychological tests of cognition, specifically designed to assess central nervous system disorders and cognitive function across a range of domains, including: memory, executive function, attention, decision making, and social cognition. [http://www.cambridgecognition.com/technology#sthash.Um7r1JGvF.dpuf](http://www.cambridgecognition.com/technology#sthash.Um7r1JGvF.dpuf)

**Children’s Category Test:** The Children’s Category Test (CCT) is an abbreviated version of the original Halstead Category Test (HCT; Reitan & Wolfson, 1992). The CCT is an individually administered instrument designed to measure nonverbal learning and memory, concept formation, and problem-solving abilities. [http://www.pearsonclinical.com/psychology/products/10000169/childrens-category-test-cct.html](http://www.pearsonclinical.com/psychology/products/10000169/childrens-category-test-cct.html)

**Children’s Depression Inventory 2:** The CDI 2 is a revision of the Children's Depression Inventory (CDI™). The CDI 2 can be used in both educational and clinical settings to evaluate depressive symptoms in children and adolescents. [http://www.mhs.com/product.aspx?gr=edu&id=overview&prod=cdi2](http://www.mhs.com/product.aspx?gr=edu&id=overview&prod=cdi2)
Children’s Memory Scale: The CMS helps fill the need for a comprehensive learning and memory test for children, measuring learning in a variety of memory dimensions including attention and working memory, verbal and visual memory, short- and long-delay memory, recall and recognition, and learning characteristics. http://www.helloq.com/overview/the-q-interactive-library/CMS.html

Clinical Evaluation of Language Fundamentals-5: The Clinical Evaluation of Language Fundamentals (CELF-5) was designed to assess a student’s language and communication skills in a variety of contexts, determine the presence of a language disorder, describe the nature of the language disorder and plan for intervention or treatment. The CELF-5 is a comprehensive and flexible assessment procedure. The test identifies a student’s language strengths and weaknesses and can be used to determine eligibility for services, plan “curriculum relevant treatment,” recommend classroom language adaptations or accommodations and provide performance-based assessment that corresponds to educational objectives. http://www.leadersproject.org/2014/02/17/test-review-celf-5/

Clock-Drawing: The clock-drawing test is used for screening for cognitive impairment and dementia and as a measure of spatial dysfunction and neglect. It was originally used to assess visuo-constructive abilities but we know that abnormal clock drawing occurs in other cognitive impairments. Doing the test requires verbal understanding, memory and spatially coded knowledge in addition to constructive skills. (Agrell & Dehlin, 1998)


Color Trails Test: Developed to be free from the influence of language and cultural bias, the CTT assesses sustained attention in adults. Numbered circles are printed with vivid pink or yellow backgrounds that are perceptible to color-blind individuals. For Part 1, the respondent uses a pencil to rapidly connect circles numbered 1-25 in sequence. For Part 2, the respondent rapidly connects numbered circles in sequence, but alternates between pink and yellow. The length of time to complete each trial is recorded, along with qualitative features of performance indicative of brain dysfunction, such as near-misses, prompts, number sequence errors, and color sequence errors. Retains the sensitivity and specificity of the original Trail Making Test but substitutes color for letters, making it more suitable in cross-cultural and special needs contexts. http://www4.parinc.com/Products/Product.aspx?ProductID=CTT


Conner’s Comprehensive Behavior Rating Scale: Conner’s Comprehensive Behavior Rating Scales (Conner’s CBRS™) is designed to provide a complete overview of child and adolescent concerns and disorders. Those working in the field of child and youth psychology can use the

**Conner’s CPT-3rd Edition:** The *Conner’s Continuous Performance Test 3rd Edition™ (Conner’s CPT 3™)* is a task-oriented computerized assessment of attention-related problems in individuals aged 8 years and older. By indexing the respondent’s performance in areas of inattentiveness, impulsivity, sustained attention, and vigilance, the Conner’s CPT 3 can be useful to the process of diagnosing Attention-Deficit/Hyperactive Disorder (ADHD) and other neurological conditions related to attention.

**Conner’s K-CPT:** The Conner’s Kiddie Continuous Performance Test 2nd Edition™ (Conner’s K–CPT 2™) assesses attention deficits in children ages 4 to 7 years old. Based on the well-established Conner’s CPT paradigm, the Conner’s K–CPT 2™ takes half the time to complete, making it more appropriate for younger children. The 7.5 minute performance-based assessment uses pictures of objects (e.g. boat, soccer ball, train) that are familiar to young children. The child is asked to respond to targets (all objects except soccer ball) and refrain from responding to non-targets (soccer ball) that appear on the computer screen. http://www.mhs.com/product.aspx?gr=edu&prod=kcpt2&id=overview

**Continuous Performance Tests:** A continuous performance task, continuous performance test, or CPT, is any of several kinds of neuropsychological test that measures a person's sustained and selective attention. Clients are presented with a repetitive, boring task and must maintain their focus over a period of time in order to respond to targets or inhibit response to foils. Tests may use numbers, symbols, or even sounds, but the basic task has the same concept.  https://en.wikipedia.org/wiki/Continuous_performance_task

**Delis-Kaplan Executive Function System:** The *Delis-Kaplan Executive Function System (D-KEFS)* is the first nationally standardized set of tests to evaluate higher level cognitive functions in both children and adults. With nine stand-alone tests, comprehensively assess the key components of executive functions believed to be mediated primarily by the frontal lobe. Tests are in the areas of: Trail Making, Verbal Fluency, Design Fluency, Color-Word Interference, Sorting, Twenty Questions, Word Context, Tower, and Proverb.

- The *Trail Making Test* measures flexibility of thinking on a visual-motor sequencing task
- The *Verbal Fluency Test* measures letter fluency, category fluency, and category switching
- The *Design Fluency Test* measures one’s initiation of problem-solving behavior, fluency in generating visual patterns, creativity in drawing new designs, simultaneous processing in drawing the designs while observing the rules and restrictions of the task, and inhibiting previously drawn responses
- The *Color-Word Interference Test* measures ability to inhibit a dominant and automatic verbal response
- The *Sorting Test* measures concept-formation skills, modality-specific problem-solving skills (verbal/nonverbal), and the ability to explain sorting concepts abstractly
- The *Twenty Questions Test* measures the ability to categorize, formulate abstract, yes/no questions, and incorporate the examiner’s feedback to formulate more efficient yes/no questions
- The *Word Context Test* measures verbal modality, deductive reasoning, integration of multiple bits of information, hypothesis testing, and flexibility of thinking
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- The Tower Test measures spatial planning, rule learning, inhibition of impulsive and perseverative responding, and the ability to establish and maintain instructional set.
- The Proverb Test measures one’s ability to form novel, verbal abstractions.


**Design Fluency:** Design Fluency (DF) is typically assumed to assess planning, cognitive flexibility, and fluency in generation of visual patterns, above and beyond contributions from motor speed. (Suchy, Kraybill, & Gidley Larson, 2010)

**Dichotic Listening:** The Dichotic listening test is a psychological test commonly used to investigate selective attention within the auditory system and is a sub-topic of cognitive psychology and neuroscience. Specifically, it is “used as a behavioral test for hemispheric lateralization of speech sound perception.” During a standard dichotic listening test, a participant is presented with two different auditory stimuli simultaneously (usually speech). The different stimuli are directed into different ears over headphones. https://en.wikipedia.org/wiki/Dichotic_listening_test

**Digit Symbol Substitution Test:** Digit Symbol Substitution asks you to match symbols with their corresponding digit. It consists of 9 digit symbols matched with their corresponding numerical digit. At first this seems simple, but the time limit on the test makes it quite challenging. You have a very small amount of time to enter the correct symbol for each digit. The most obvious application of digit symbol substitution is to memory. The test requires you to remember where each symbol matches a digit. There is also a speed of processing component, since you have a very small amount of time to enter the correct symbol. In the clinical setting, this test is used to test brain injury, especially for athletes suffering concussions. https://www.brainbaseline.com/assessments/symbol-substitution

**Dimensional Change Card Sorting Tasks:** The dimensional change card sort (DCCS) is an easily administered and widely used measure of executive function that is suitable for use with participants across a wide range of ages. In the standard version, children are required to sort a series of bivalent test cards, first according to one dimension (e.g., color), and then according to the other (e.g., shape). Most 3-year-olds perseverate during the post-switch phase, exhibiting a pattern of inflexibility similar to that seen in patients with prefrontal cortical damage. By 5 years of age, most children switch when instructed to do so. Performance on the DCCS provides an index of the development of executive function, and it is impaired in children with disorders such as attention-deficit/hyperactivity disorder (ADHD) and autism. (Zelazo P. D., 2006)

**Go/No-go Task:** A task in which stimuli are presented in a continuous stream and participants perform a binary decision on each stimulus. One of the outcomes requires participants to make a motor response (go), whereas the other requires participants to withhold a response (no-go). Accuracy and reaction time are measured for each event. Go events typically occur with higher frequency than no-go events. http://www.cognitiveatlas.org/task/go/no-go_task

**Matching Familiar Figures Test:** An instrument designed to measure reflection-impulsivity by requiring the respondent to select repeatedly from several alternative figures the one that matches a standard. The number of errors and the time required to complete the test are recorded, and people with below-median errors and above-median response times are classified as *reflective*; people with above-median errors and below-
median response times *impulsive*; people with below-median errors and below-median response times *quick*; and people with above-median errors and above-median response times *slow*.  http://oxfordindex.oup.com/view/10.1093/oi/authority.20110810105346925

**Metacognitive Awareness Inventory:** The Metacognitive Awareness Inventory (MAI) consists of 52-items which measure an individual’s knowledge of cognition and regulation of cognition (Schraw & Dennison, 1994). Within these two constructs, the MAI also examines individuals’ monitoring, evaluation of learning, debugging strategies, conditional knowledge, planning, declarative knowledge, information management strategies, and procedural knowledge (Schraw & Dennison, 1994).

**n-back task:** The *n*-back task is a continuous performance task that is commonly used as an assessment in cognitive neuroscience to measure a part of working memory and working memory capacity. The subject is presented with a sequence of stimuli, and the task consists of indicating when the current stimulus matches the one from *n* steps earlier in the sequence. The load factor *n* can be adjusted to make the task more or less difficult.  https://en.wikipedia.org/wiki/N-back

**NEPSY-II:** NEPSY-II is a comprehensive instrument designed to assess neuropsychological development and provide insights regarding academic, social, and behavioral difficulties in preschool and school-age children. It enables clinicians to assess across six functional domains, including Attention and Executive Functioning, Language, Memory and Learning, Sensorimotor, Social Perception, and Visuospatial Processing.  http://www.helloq.com/tests/test-library/nepsy-ii.html

**Porteus Maze Test:** designed to measure psychological planning capacity and foresight in children, adolescents, and adults. Maze test consists of a set of paper forms in which the subject is required to trace a path through a drawn maze of varying complexity with a limit of 15–60 minutes to perform this test. The subject must avoid blind alleys and dead ends; no back-tracking is allowed.  https://en.wikipedia.org/wiki/Porteus_Maze_Test

**Posner Task:** also known as the Posner paradigm, is a neuropsychological test often used to assess attention. The task assesses an individual’s ability to perform an attentional shift. It has been used and modified to assess disorders, focal brain injury, and the effects of both on spatial attention.  https://en.wikipedia.org/wiki/Posner_cueing_task

**Rapid Automatic Naming and Rapid Alternating Stimulus:** The tests consist of rapid automatized naming tests (i.e., letters, numbers, objects, colors) and two rapid alternating stimulus tests (i.e., two-set letters and numbers; three-set letters, numbers, and colors). The examinee is asked to accurately name each stimulus item as quickly as possible. The tests consist of rapid automatized naming tests (i.e., letters, numbers, objects, colors) and two rapid alternating stimulus tests (i.e., two-set letters and numbers; three-set letters, numbers, and colors). The examinee is asked to accurately name each stimulus item as quickly as possible. The RAN/RAS tests assess children’s and adolescents’ ability to perceive a visual symbol and name it accurately and rapidly, effectively aiding in the identification of children who have reading disabilities.  http://www4.parinc.com/Products/Product.aspx?ProductID=RAN/RAS

**Raven’s Progressive Matrices:** The Progressive Matrices usefully provide an assessment of non-verbal ability, an important feature for our ethnically diverse population. A measure of educative ability – the ability to make sense and meaning out of complex or confusing data; the ability to perceive new patterns and relationships, and to forge (largely non-verbal) constructs which make it easy to handle complexity.
Rey–Osterrieth complex figure test: The RCFT standardizes the materials and procedures for administering the Rey complex figure, measures recognition memory for the elements of the Rey complex figure, and assesses the respondent's ability to use cues to retrieve information. Appropriate for use with children and adults, the instrument enables you to gather information on major aspects of neuropsychological functioning. [http://www4.parinc.com/Products/Product.aspx?ProductID=RCFT](http://www4.parinc.com/Products/Product.aspx?ProductID=RCFT)

Ross Information Processing Assessment: The RIPA-2 can be used to quantify cognitive-linguistic deficits, determine severity levels for skills, and develop rehabilitation goals. The RIPA-2 profiles 10 key areas in communicative and cognitive functioning: Immediate Memory, Recent Memory, Temporal Orientation (Recent Memory), Temporal Orientation (Remote Memory), Spatial Orientation, Orientation to Environment, Recall of General Information, Problem Solving and Abstract Reasoning, Organization, and Auditory Processing and Retention. [http://www.academictherapy.com/detailATP.tpl?action=search&cart=14497730121667175&eqskudatarq=DDD-2113&eqTitledatarq=Ross%20Information%20Processing%20Assessment-2%20(RIPA-2)&eqvendordatarq=ATP&bobby=%5Bbobby%5D&bob=%5BBob%5D](http://www.academictherapy.com/detailATP.tpl?action=search&cart=14497730121667175&eqskudatarq=DDD-2113&eqTitledatarq=Ross%20Information%20Processing%20Assessment-2%20(RIPA-2)&eqvendordatarq=ATP&bobby=%5Bbobby%5D&bob=%5BBob%5D)

Ruff Figural Fluency Test: The RFFT was developed to provide clinical information regarding nonverbal capacity for fluid and divergent thinking, ability to flexibly shift cognitive set, planning strategies, and executive ability to coordinate this process. The RFFT was designed as a nonverbal analog to popular verbal fluency tests that require respondents ages 16–70 years to generate as many words as possible starting with a specific letter. [http://www.ronruff.com/tests/ruff-figural-fluency-test-rfft/](http://www.ronruff.com/tests/ruff-figural-fluency-test-rfft/)

School Function Assessment: The School Function Assessment measures a student's performance of functional tasks that support participation in the academic and social aspects of an elementary school program (grades K-6). It was designed to facilitate collaborative program planning for students with a variety of physical and cognitive disabilities. [http://www.proedinc.com/customer/productView.aspx?ID=3160](http://www.proedinc.com/customer/productView.aspx?ID=3160)

Span tasks (digits, words, spatial): In psychology and neuroscience, memory span is the longest list of items that a person can repeat back in correct order immediately after presentation on 50% of all trials. Items may include words, numbers, or letters. The task is known as digit span when numbers are used. Memory span is a common measure of short-term memory. It is also a component of cognitive ability tests such as the WAIS. Backward memory span is a more challenging variation which involves recalling items in reverse order. [https://en.wikipedia.org/wiki/Memory_span](https://en.wikipedia.org/wiki/Memory_span)

Stop-signal task: In a stop-signal task, you are asked to respond quickly, except when a stop signal arrives. Once you have initiated a movement, even when just “in the brain” as a plan, it is hard to stop. Stop-signal tasks are a variation on go/no-go. Introduced by Lappin and Eriksen in 1966,
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and further developed by Gordon Logan and colleagues, the tasks measure how good a person is in withholding a response.
http://www.psytoolkit.org/experiment-library/stopsignal.html

**Stroop Color-Word Test:** The Stroop Color and Word Test consists of a Word Page with color words printed in black ink, a Color Page with ‘Xs’ printed in color, and a color-Word Page with words from the first page printed in colors from the second page (the color and the word do not match). The respondent goes down each sheet reading words or naming the ink colors as quickly as possible within a time limit. The test yields three scores based on the number of items completed on each of the three stimulus sheets. An Interference score, which is useful in determining the individual’s cognitive flexibility, creativity, and reaction to cognitive pressures also can be calculated.

**Tasks of Executive Control:** The TEC is a standardized computer-administered measure of two fundamental aspects of executive control processes: working memory and inhibitory control. It provides four sequential tasks for 5- to 7-year old children and six tasks for children and adolescents ages 8-18 years. The tasks involved consist of on-screen instructions, a set of practice trials with feedback, and 100 timed-interval stimuli that require responses. It was determined that this assessment would be administered to determine whether difficulties with working memory or inhibition may be influencing or contributing to the client’s struggles.

**Test of Auditory Processing Skills 3:** The TAPS-3 measures what a person does with what is heard. It provides a way to identify particular auditory processes that the individual may be having difficulties with, allowing appropriate remediation strategies to be planned. The nine TAPS-3 subtests provide information for four main areas (reflected as Index scores), confirmed by factor analysis. In addition, there is one optional subtest presented on CD. The indices and subtests are:

- **Basic Phonological Skills:**
  - Subtest 1: Word Discrimination
  - Subtest 2: Phonological Segmentation
  - Subtest 3: Phonological Blending
- **Auditory Memory**
  - Subtest 4: Number Memory Forward
  - Subtest 5: Number Memory Reversed
  - Subtest 6: Word Memory
  - Subtest 7: Sentence Memory
- **Auditory Cohesion:**
  - Subtest 8: Auditory Comprehension
  - Subtest 9: Auditory Reasoning


**Test of Everyday Attention:** The Test of Everyday Attention (TEA) is designed to measure attention in adults age 18 through 80 years. The test comprises 8 subsets that represent everyday tasks and has three parallel forms. It assess three aspects of attentional functioning: selective attention, sustained attention, and mental shifting. The subtests include the following:
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- Map Search: looking at a large map of Philadelphia, patients search for symbols (selective attention)
- Elevator Counting
- Visual Elevator
- Telephone Search
- Lottery: patient are asked to listen for their 'winning number' presented on audio tape, then write down the two letters preceding a specified number

https://en.wikipedia.org/wiki/Test_of_everyday_attention

**Test of Everyday Attention for Children:** There is also a version available for children and adolescents aged 6 to 15 years and 11 months, called the Test of Everyday Attention for Children (TEA-Ch). The TEA-Ch has 9 subsets and two parallel forms. Administration time is 55 to 60 minutes.

  - Selective attention is measured by two tasks requiring the ability to detect targets from distractors:
    - Sky Search
    - Map Mission
  - Sustained attention is measured by four tasks:
    - Score
    - Score DT
    - Code Transmission
    - Walk/Don't Walk

https://en.wikipedia.org/wiki/Test_of_everyday_attention

**Test of Information Processing Skills:** The TIPS provides clinicians with quick and reliable measures of how well a person processes information (letter strings) presented visually and auditorily. TIPS assesses: executive function, working memory, auditory and visual processing, semantic fluency, and the effects of interference on recall. Designed for individuals from aged 5-90+.

http://www.academictherapy.com/detailATP.tpl?qskudatarq=8468-0

**Test of Language Competence:** Now revised and called the CELF-5: Metalinguistics-- A revision of the Test of Language Competence-Expanded, the CELF-5 Metalinguistics assessment includes four tests of higher-level language skills that are embedded in upper-grade curricula and are critical to classroom success. Use it to measure a student’s ability to think about and use language to make inferences, manipulate conversational speech given a context, use words in multiple ways, and use language in a non-literal manner. Administer the four tests individually or as a battery to obtain information about an individual’s language skills in: Making Inferences, Conversation Skills, Multiple Meanings, and Figurative Language.


**Test of Variables of Attention:** The T.O.V.A. uses geometric stimuli (to minimize the effects of cultural differences and learning problems), and contains two test conditions: target infrequent and target frequent. In the first half of the test (the target infrequent half), the target: nontarget ratio is 1:3.5, i.e.: a target is presented (randomly) only once every 3.5 nontarget presentations. In this half which is similar to most of the other Continuous Performance Tests (CPTs), the task is boring and fatiguing, and the subject must pay close attention to respond to the infrequent target
correctly. When a subject does not respond to the target, it is called an error of omission and is a measure of inattention. In the second half of the test (target frequent half), the target: nontarget ratio is 3.5:1, i.e. 3.5 targets are presented for every 1 nontarget. In this half of the test, the subject expects to respond most of the time but occasionally must inhibit the tendency to respond. T.O.V.A. measures include variability of response time (consistency), response time, commission (impulsivity), errors of omission (inattention), post-commission response times, multiple and anticipatory responses, and an ADHD score, which is a comparison to an age/gender specific ADHD group. http://www.tovatest.com/about-the-t-o-v-a/

**Thematic Apperception Test:** A projective psychological test. Proponents of the technique assert that subjects' responses, in the narratives they make up about ambiguous pictures of people, reveal their underlying motives, concerns, and the way they see the social world. [https://en.wikipedia.org/wiki/Thematic_apperception_test](https://en.wikipedia.org/wiki/Thematic_apperception_test)

**Tinker toy Task:** The Tinker toy Test is a self-structured task used to evaluate executive functioning, which include initiating, planning, and structuring of behaviors. This test is used often to assess executive dysfunction in patients with neurodegenerative diseases. [http://link.springer.com/referenceworkentry/10.1007%2F978-0-387-79948-3_1911](http://link.springer.com/referenceworkentry/10.1007%2F978-0-387-79948-3_1911)

**Tower of Hanoi:** The Tower of Hanoi (also called the Tower of Brahma or Lucas' Tower,[1] and sometimes pluralized) is a mathematical game or puzzle. It consists of three rods, and a number of disks of different sizes which can slide onto any rod. The puzzle starts with the disks in a neat stack in ascending order of size on one rod, the smallest at the top, thus making a conical shape. The Tower of Hanoi is frequently used in psychological research on problem solving. There also exists a variant of this task called Tower of London for neuropsychological diagnosis and treatment of executive functions.

The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules:

1. Only one disk can be moved at a time.
2. Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack.
3. No disk may be placed on top of a smaller disk.


**Tower of London:** Children with acquired and developmental problems often exhibit impairment in executive planning. The TOL²⁰ 2nd Edition measures higher order problem-solving ability. The information it provides is not only useful when assessing frontal lobe damage, but also when evaluating attention disorders and executive functioning difficulties. [http://www.mhs.com/product.aspx?gr=edu&id=overview&prod=toldx](http://www.mhs.com/product.aspx?gr=edu&id=overview&prod=toldx)

**Trail Making Test:** *(from the Comprehensive Trail-Making Test)* The CTMT is a standardized set of five visual search and sequencing tasks. Attention, concentration, resistance to distraction, and cognitive flexibility (or set-shifting) heavily influence performance on these tasks.
The CTMT can be used to determine challenges with processing speed, visual search and sequencing, visual attention, and impairments in set-shifting (flexibility).


Verbal Fluency Tasks (first letter, phonemic, semantic): The verbal fluency test is a short test of verbal functioning (e.g., Lezak et al., 2012). It typically consists of two tasks: category fluency (sometimes called semantic fluency; Benton, 1968) and letter fluency (sometimes called phonemic fluency; Newcombe, 1969). (Shao, Janse, Visser, & Meyer, 2014)

Visual Search and Attention Test: The VSAT consists of four visual cancellation tasks that require the respondent to cross out letters and symbols that are identical to a target. It yields an overall attention score and provides separate scores for left- and right-side performance to assess visual field defects, unilateral spatial neglect, or syndromes that affect the perception of portions of the visual space.  http://www4.parinc.com/Products/Product.aspx?ProductID=VSAT

Wechsler Adult Intelligence Scale—Fourth Edition: The Wechsler Adult Intelligence Scale (WAIS) is an IQ test designed to measure intelligence and cognitive ability in adults and older adolescents. There are four index scores representing major components of intelligence:

- Verbal Comprehension Index (VCI): Similarities, Vocabulary, Information, Comprehension
- Perceptual Reasoning Index (PRI): Block Design, Matrix Reasoning, Visual Puzzles, Picture Completion, Figure Weights
- Working Memory Index (WMI): Digit Span, Arithmetic, Letter-Number Sequencing
- Processing Speed Index (PSI): Symbol Search, Coding, Cancellation

  https://en.wikipedia.org/wiki/Wechsler_Adult_Intelligence_Scale#WAIS-IV

Wechsler Individual Achievement Scale—Third Edition: The WIAT-III is suitable for use in a variety of clinical, educational, and research settings, including schools, clinics, private practices, and residential treatment facilities. Use WIAT-III results to:

- Identify the academic strengths and weaknesses of a student
- Inform decisions regarding eligibility for educational services, educational placement, or diagnosis of a specific learning disability
- Design instructional objectives and plan interventions
Sixteen subtests include: Listening Comprehension, Early Reading Skills, Reading Comprehension, Math Problem Solving, Alphabet Writing Fluency, Sentence Composition, Word Reading, Essay Composition, Pseudoword Decoding, Numerical Operations, Oral Expression, Oral Reading Fluency, Spelling, Math Fluency-Addition, Math Fluency-Subtraction, Math Fluency-Multiplication


**Wechsler Intelligence Scale for Children—Fifth Edition:** The Wechsler Intelligence Scale for Children (WISC), developed by David Wechsler, is an individually administered intelligence test for children between the ages of 6 and 16. The Fifth Edition (WISC-V; Wechsler, 2014) is the most current version. There are five scale scores representing major components of intelligence:

- **Verbal Comprehension:** Similarities, Vocabulary, Information, Comprehension
- **Visual Spatial:** Block Design, Visual Puzzles
- **Fluid Reasoning:** Matrix Reasoning, Figure Weights, Picture Concepts, Arithmetic
- **Working Memory:** Digit Span, Picture Span, Letter-Number Sequencing
- **Processing Speed:** Coding, Symbol Search, Cancellation


**Wide Range Assessment of Memory and Learning—Second Edition:** This test makes it easier to assess memory functions in children, adolescents, and—with this edition—adults as well. The WRAML2 gives clinicians a single, integrated collection of relevant memory tests that can be used across the life span. Appropriate for individuals from 5 to 90 years of age, the WRAML2 core battery produces a General Memory Index, plus three more specific index scores and six subtest scores:

- **Verbal Memory Index**
  - Verbal Learning Subtest
  - Story Memory Subtest

- **Visual Memory Index**
  - Design Memory Subtest
  - Picture Memory Subtest

- **Attention and Concentration Index**
  - Number/Letter Subtest
  - Finger/Windows Subtest

Wide Range Assessment of Visual Motor Abilities:  The WRAVMA lets you assess and compare visual–spatial, fine motor, and integrated visual–motor skills using norms gathered from the same sample. Designed for 3- to 17-year-olds, WRAVMA includes three subtests, which can be used individually or in combination:

- **The Drawing Test** measures visual–motor integration by asking the child to copy designs that are arranged in order of increasing difficulty.
- **The Matching Test** assesses visual–spatial skills by asking the child to look at a visual “standard” and select the option that “goes best” with it. Again, items are arranged in order of increasing difficulty.
- **The Pegboard Test** evaluates fine motor skills by asking the child to insert as many pegs as possible, within 90 seconds, into a waffled pegboard. Norms are provided for both dominant and nondominant hands.

Each test requires just 4 to 10 minutes, and each provides a scaled score, standard score, age equivalent, and percentile score. Norms are based on a nationally representative sample of more than 2,600 children.


Wisconsin Card Sorting Task:  Used primarily to assess perseveration and abstract thinking, the WCST is also considered a measure of executive function because of its reported sensitivity to frontal lobe dysfunction. As such, the WCST allows you to assess your client’s strategic planning; organized searching; and ability to utilize environmental feedback to shift cognitive sets, direct behavior toward achieving a goal, and modulate impulsive responding. Four stimulus cards incorporate three stimulus parameters (color, form, and number). Respondents are required to sort numbered response cards according to different principles and to alter their approach during test administration. To complete the task, clients should have normal or corrected vision and hearing sufficient to adequately comprehend the instructions and to visually discriminate the stimulus parameters.

http://www4.parinc.com/Products/Product.aspx?ProductID=WCST

Woodcock Johnson Tests of Achievement:  The WJ IV Tests of Achievement are ideal for accurately screening, diagnosing, and monitoring progress in reading, writing, and mathematics achievement areas. The Achievement battery is available in three forms (A, B, C) with parallel content, providing the means to monitor progress two to three times per year once a proficiency level is established and interventions are implemented with a student. The parallel forms also provide flexibility to examiners who wish to alternate the three forms to reduce examinees’ familiarity with test content.


Woodcock Johnson Tests of Cognitive Ability:  Supporting a new era of CHC theory, the WJ IV Tests of Cognitive Abilities contain the greatest breadth of cognitive abilities of any standardized body of tests. New tests and clusters have been designed to place emphasis on the most useful measures for identifying individuals’ patterns of strengths and weaknesses through seven different broad CHC abilities. The WJ IV Tests of
Cognitive Abilities also offer a new Gf-Gc Composite for comparison with other cognitive abilities, oral language, and achievement. Understanding relative strengths and weaknesses in comparison to the Gf-Gc Composite can lead to individualized instruction designed to target identified learning needs.

- **Tests**

- **Clusters**
  - Short-Term Working Memory-Extended—NEW; Brief Intellectual Ability; Gf-Gc Composite—NEW; Cognitive Processing Speed (Gs); Number Facility (N)—NEW; Perceptual Speed (P); General Intellectual Ability; Auditory Processing (Ga); Comprehension-Knowledge (Gc); Auditory Memory Span (MS)*; Comprehension-Knowledge-Extended; Long-Term Retrieval (Glr); Fluid Reasoning (Gf); Visual Processing (Gv); Fluid Reasoning-Extended; Cognitive Efficiency; Short-Term Working Memory (Gwm); Cognitive Efficiency-Extended Clusters

* Obtained when used with the WJ IV Tests of Oral Language.

Appendix 3: Forms and Checklists

**Dawson and Guare:** Executive Skills in Children and Adolescents Second Edition
A Practical Guide to Assessment and Intervention (2010)

- Executive Skills Semistructured Interview—Parent Version
- Executive Skills Semistructured Interview—Teacher Version
- Executive Skills Semistructured Interview—Student Version
- Executive Skills Questionnaire for Parents/Teachers
- Executive Skills Questionnaire for Students
- Executive Skills Questionnaire-Teen Version
- Executive Skills: Planning Interventions
- Forms for Developing Behavior Plans/Incentive Systems
- Executive Skills Self-Management Checklist

**McCloskey:** Assessment and Intervention for Executive Function Difficulties (School-Based Practice in Action)

- Executive Function Student Observation Form (EFSO)
- Executive Function Structured Interview (EFSI)
- Executive Function Structured Interview for Children (EFSI-C)
- Self-Regulation Abbreviated Version (MEFS-SRAV)—Self-Rating Inventory
- McCloskey Executive Functions Scale (MEFS) – School Age Teacher Form


**Elementary School Executive Function (EF) Checklist:** [http://schoolslp.blogspot.com/2014/12/friday-freebee.html#more](http://schoolslp.blogspot.com/2014/12/friday-freebee.html#more)

**Adult College Symptoms Checklist:**
Appendix 4: Resources for Addressing Executive Function Deficits

Impulse Control

Therapeutic Manuals

- Miller, D. (2004). *The Stop...Think...Do...Program: A Workbook for Children with ADD or ADHD*. Xulon Press.

Games

- Therapy Games: Creative Ways to Turn Popular Games Into Activities That Build Self-Esteem, Teamwork, Communication Skills, Anger Management, Self-Discovery, and Coping Skills; Jones, Alanna—also has activities that can be adapted for flexibility and working memory
- The Impulse Control Board Game: [https://www.amazon.com/Impulse-Control-Board-Franklin-Learning/dp/B002P8LK90](https://www.amazon.com/Impulse-Control-Board-Franklin-Learning/dp/B002P8LK90)
- Stop, Relax & Think: A Game to Help Impulsive Children Think Before They Act: [https://www.amazon.com/Stop-Relax-Think-Impulsive-Children/dp/B002V7456A/ref=pd_sim_21_4?_encoding=UTF8&pd_rd_i=B002V7456A&pd_rd_r=1QRr62QD5J6MAEJHJJ2F&pd_rd_wg=YVXus&pd_rd_w=BU9MW&psc=1&refRID=1QRr62QD5J6MAEJHJJ2F](https://www.amazon.com/Stop-Relax-Think-Impulsive-Children/dp/B002V7456A/ref=pd_sim_21_4?_encoding=UTF8&pd_rd_i=B002V7456A&pd_rd_r=1QRr62QD5J6MAEJHJJ2F&pd_rd_wg=YVXus&pd_rd_w=BU9MW&psc=1&refRID=1QRr62QD5J6MAEJHJJ2F)
Executive Functioning and Cognitive Control – Joseph Falkner, MST/CCC-SLP

- The Talking, Feeling and Doing Game:  https://www.amazon.com/Talking-Feeling-Doing-Game/dp/B000MBE3S2/ref=pd_sim_21_10?_encoding=UTF8&pd_rd_i=B000MBE3S2&pd_rd_r=CDPWEMV9VZYRKZGEV411
  &pd_rd_w=EzFtT&pd_rd_wg=OdvCK&psc=1&refRID=CDPWEMV9VZYRKZGEV411

**Flexibility**

**Manuals**


Working Memory


General Executive Function


Related to ASD

- A 5 Is Against the Law! Social Boundaries: Straight Up! An honest guide for teens and young adults; Buron, Kari Dunn
- Colour Coding for Learners with Autism: A Resource Book for Creating Meaning through Colour at Home and School; Devine, Adele
- Comic Strip Conversations: Illustrated interactions that teach conversation skills to students with autism and related disorders; Gray, Carol
- FBA to Z: Functional Behavior and Intervention Plans for Individuals with ASD; Aspy, Ruth, Grossman, Barry G, Myles, Brenda Smith, Henry, Shawn A
- The Hidden Curriculum for Understanding Unstated Rules in Social Situations for Adolescents and Young Adults; Myles, Brenda Smith, Trautman, Melissa L, Schelvan, Ronda L
- The Incredible 5-Point Scale: The Significantly Improved and Expanded Second Edition; Buron, Kari Dunn, Curtis, Mitzi
- Lights! Camera! Autism! 2: Using Video Technology to Support New Behavior; McGinnity, Kate, Hammer, Sharon, Ladson, Lisa
- The New Social Story Book: Gray, Carol
- The Power Card Strategy 2.0: An Evidence Based Practice Using Special Interests to Motivate Children and Youth with Autism Spectrum Disorder; Gagnon, Elisa, Myles, Brenda Smith
- Seeing is Believing: Video Self-Modeling for People with Autism and Other Developmental Disabilities; Buggey, Tom
- Social Behavior and Self-Management: 5-Point Scales for Adolescents and Adults; Buron, Kari Dunn, Curtis, Mitzi
- Social Thinking: Michelle Garcia Winner
  - Inside Out
  - Should I? or Shouldn’t I?
  - Social Behavior Mapping
  - Social Fortune, Social Fate
  - Social Thinking and Me
  - Social Thinking Worksheets for Teens and Tweens
  - Social Town Citizens Discover 82 New Unthinkables for Superflex to Outsmart
  - Superflex Curriculum
Executive Functioning and Cognitive Control ~ Joseph Falkner, MST/CCC-SLP

- Superflex: My Hero Inside Music CD
- Superflex Superdecks
- Superflex: A Superhero Social Thinking Curriculum
- Superflex Takes on Brain Eater and the Team of Unthinkables
- Superflex Takes on Glassman and the Team of Unthinkables
- Superflex Takes on One-Sided Sid, Un-Wonderer and the Team of Unthinkables
- Thinking About You, Thinking About Me
- Think Social
- We Thinkers

- Stuck! Strategies: What to Do When Students Get STUCK” How to Turn “No!” Into “Let’s Go!”; Carroll, Janice, Izrelevitz, Terry Ellis
- Visual Support for Visual Thinkers: Practical Ideas for Students with Autism Spectrum Disorders and Other Special Educational Needs; Rogers, Lisa
- Writing Social Stories with Carol Gray; Gray, Carol
## Appendix 5: STRUCTURED REVIEW OF COMPUTER-BASED PROGRAMS FOR EXECUTIVE FUNCTION TRAINING

Obtained from: [http://www.strokengine.ca/pdf/REVIEW_OF_COMPUTER-BASED_PROGRAMS.pdf](http://www.strokengine.ca/pdf/REVIEW_OF_COMPUTER-BASED_PROGRAMS.pdf) on 1/30/17,

adaptations January 31, 2017 by Joseph Falkner, MST/CCC-SLP

<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Effectiveness</th>
<th>Clinical utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquired Brain Injury Memory Exercises</td>
<td>Planning</td>
<td>X</td>
<td>ABIME has six key components with exercises across a range of visual, verbal and spatial memory functions: 1) memory for numbers; 2) working visual memory; 3) short term visual memory; 4) visuospatial memory; 5) immediate verbal recall; and 6) delayed visual/verbal memory.</td>
<td>Developed by a clinical neuropsychologist specializing in brain injury rehabilitation and cognitive communication.</td>
<td>No published studies on the effectiveness of the ABIME program were found.</td>
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<td></td>
<td>Problem-Solving</td>
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<td></td>
<td>Inhibition</td>
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<tr>
<td></td>
<td>Working Memory</td>
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<tr>
<td></td>
<td>Divided Attention</td>
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<tr>
<td></td>
<td>Flexibility</td>
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</tr>
</tbody>
</table>

### Target clientele:
- Using a mouse to point and click
- Other pre-requisites: understanding written instructions and basic attention skills.

### Language:
English

### System requirements:
XP SP2, Vista or Windows 7 - 32 or 64 bit platforms
***does run on Windows 10

### Contact information:

### Cost:
$120.00
## Executive Functioning and Cognitive Control ~ Joseph Falkner, MST/CCC-SLP

<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Effectiveness</th>
<th>Clinical utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention Processing Training III</td>
<td>X X X X</td>
<td>Over 100 tasks with parameters that can be modified to increase or decrease the number of stimuli and the speed of presentation. The program is designed to be used with a wide range of people including those who have severe attention deficits to those with concussion symptoms</td>
<td>Developed by a Clinical Psychologist and a Speech-Language Pathologist</td>
<td>The research base developed for the APT is in the area of direct attention training.</td>
<td>Target clientele: Adolescent and adults with acquired brain injury from mild (concussive) to more severe injuries.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ The attention framework used to organize the tasks has been updated to reflect the expanded attention research and includes tasks targeting: Basic Sustained Attention as well as Executive Control Processes related to Working Memory, Selective Attention, Suppression and Alternating Attention</td>
<td>Included in the Cognitive Rehabilitation Manual: Translating Evidence-Based Recommendations into Practice as an evidence-based approach for working on attention</td>
<td></td>
<td>Pre-requisite abilities:</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Ability to press space bar</td>
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<td></td>
<td></td>
<td>Language: English</td>
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<td></td>
<td>System requirements:</td>
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<td></td>
<td>The APT 3 uses a USB drive which contains the complete program</td>
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<td></td>
<td>APT-3 will work with computers and laptops running Mac OS 10.5 or newer and Windows XP or newer. The computer or laptop will need an available USB port for connecting the APT-3 USB drive. All of the software necessary to run the tool is contained on the drive. The clinician runs the program from the drive; thus, no software needs to be installed on the computer and any computer can be used to run the therapy program.</td>
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<td>Contact information:</td>
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<td></td>
<td><a href="https://www.lapublishing.com/attention-process-training-apt3/">https://www.lapublishing.com/attention-process-training-apt3/</a> or 919-556-0300</td>
</tr>
<tr>
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<td></td>
<td>Cost: $850 for the complete program</td>
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</tbody>
</table>

### Clinical utility

- **Target clientele:** Adolescent and adults with acquired brain injury from mild (concussive) to more severe injuries.
- **Pre-requisite abilities:** Ability to press space bar
- **Language:** English
- **System requirements:**
- The APT 3 uses a USB drive which contains the complete program
- APT-3 will work with computers and laptops running Mac OS 10.5 or newer and Windows XP or newer. The computer or laptop will need an available USB port for connecting the APT-3 USB drive. All of the software necessary to run the tool is contained on the drive. The clinician runs the program from the drive; thus, no software needs to be installed on the computer and any computer can be used to run the therapy program.

### Contact information:

[https://www.lapublishing.com/attention-process-training-apt3/](https://www.lapublishing.com/attention-process-training-apt3/) or 919-556-0300

### Cost:

$850 for the complete program
<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Characteristics of the cognitive training</th>
<th>Effectiveness</th>
<th>Clinical utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainbuilder</td>
<td></td>
<td>Broken up into the following areas: Brain Coach, Brain Exercises, Brain Music and Brain Games</td>
<td>No specific information provided on website concerning development of software</td>
<td>20 diverse visual, auditory and focus exercises with varying degree of difficulty</td>
<td>No published studies on the effectiveness of the BrainBuilder program were found.</td>
<td>Target clientele: Healthy children and adults 7 years of age or older or those with various neurological disorders, learning disabilities or attention disorders</td>
</tr>
</tbody>
</table>

- Planning
- Problem-Solving
- Inhibition
- Working Memory
- Divided Attention
- Flexibility

- Tasks become more difficult as the person progresses through an exercise
- Can track up to five people on one computer

Clinical utility:
- Target clientele
- Pre-requisite abilities
- Language
- System requirements
- Ordering information
- Cost

Pre-requisite abilities:
- No specific pre-requisite abilities noted.
- Using a mouse/keyboard
- Other pre-requisites: understanding verbal and/or written instructions, and basic attention skills

Language: English

System requirements:
- 1.6 GHz Pentium III (2.8 GHz or Greater Recommended)
- XP SP2, Vista or Windows 7 - 32 or 64 bit platforms
- 512 MB RAM or Greater
- Minimum 300 MB Free Disk Space
- CD/DVD Drive
- Screen Resolution 1024 x 768 or Greater
- Sound Card
- Speakers or Headphones

Contact information:
http://l.advancedbrain.com/brainbuilder/brainbuilder.html

Cost:
## Software

<table>
<thead>
<tr>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Clinical utility</th>
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</thead>
<tbody>
<tr>
<td>Planning</td>
<td>➢ Characteristic of the cognitive training</td>
<td>➢ Effectiveness</td>
<td>➢ Target clientele</td>
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<tr>
<td>Problem-Solving</td>
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<td>Inhibition</td>
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<td>Working Memory</td>
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<td>Divided Attention</td>
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### Brain Train: Captain’s Log MindPower Trainer

- Comprehensive mental gym offering over 2000 different challenging brain training exercises targeting 20 different cognitive skills.
- Uses visual and/or auditory stimuli
  - Tasks become more difficult as the person progresses through an exercise
  - Exercises can be adapted for any level of ability
  - Client’s performance is recorded and presented in summary tables
  - Provides auditory and visual feedback on performance
  - Can incorporate optional biofeedback training
- Developed in collaboration with medical specialists and neuropsychologists
  - Studies in children with Attention Deficit Hyperactivity Disorder (ADHD) and in adults with traumatic brain injury and psychiatric disorders support the effectiveness of the Captain’s Log software for improving cognitive skills.

**Target clientele**: Children and adults (aged 5 years and over) with brain injuries, ADHD, learning disabilities, psychiatric disorders or other cognitive problems.

**Pre-requisite abilities**:
- Using a mouse/keyboard or touch screen
- Other pre-requisites: understanding verbal and/or written instructions, and basic attention skills.

**Language**: English

**System requirements**:
- Pentium IV 2.0 GHz or faster processor
- 1 GB free hard drive space
- 2 GB of RAM or more
- Windows Win 7 / Win 8.1 / Win 10
- DirectX 10 Compatible Video Card
- 256 MB video memory
- Color monitor
<table>
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<tr>
<th>Sound card</th>
<th>External speakers or headphones</th>
<th>USB Mouse required</th>
<th>Internet access is required for activation and updates.</th>
</tr>
</thead>
</table>

**Contact information:**
www.braintrain.com or 1-800-822-0538

**Cost (prices subject to change)**

**Free trial:**
http://www.braintrain.com/software-trial-registration-form/

**Player Licensing:**
1 Player, 1 Year: $395; 5 Players, 1 year: $995; 10 players, 1 year: $1295

**Station Licensing:**
1 Year Station Licenses: 1 station, unlimited Players: $1495
5 Year Station Licenses: 1 station, unlimited Players: $5495
<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Clinical utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAMSART: Concentration-Attention-and-Mental-Speed-Rehabilitation-Task</td>
<td>X X X</td>
<td>CAMSART combines structured tasks with performance measurement. It requires the user to memorize a set of instructions in short term memory and then undertake a task that demands selective, divided and sustained attention as well as decision making and information processing.</td>
<td>Developed by a clinical neuropsychologist specializing in brain injury rehabilitation and cognitive communication. No published studies on the effectiveness of the CAMSART program were found.</td>
<td>Target clientele: Developed for adolescents and adults with traumatic brain injury. Pre-requisite abilities: - Using a mouse to point and click - Other pre-requisites: understanding written instructions and basic attention skills. Language: English System requirements: XP SP2, Vista or Windows 7 - 32 or 64 bit platforms ***does run on Windows 10 Contact information: <a href="https://www.lapublishing.com/CAMSART-cognitive-rehab/">https://www.lapublishing.com/CAMSART-cognitive-rehab/</a> or 919-556-0300 Cost: $120.00</td>
</tr>
</tbody>
</table>

- **Planning**
- **Problem Solving**
- **Inhibition**
- **Working Memory**
- **Divided Attention**
- **Flexibility**
| processing between pertinent and irrelevant information. |

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### DASAT: Divided and Sustained Attention Task

<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Clinical utility</th>
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<tr>
<td></td>
<td>Planning</td>
<td>X X X</td>
<td>DASAT has been designed as an early intervention tool to develop the cognitive recovery of divided and sustained attention, information processing and working memory following an acquired brain injury or to help delay cognitive decline in neurological degenerative conditions such as Alzheimer’s. DASAT is a clinical tool for use in hospitals, rehabilitation programs or can easily be set up to be used at home. DASAT is designed to minimize information overload which is a common problem for people with neurological impairments and to steadily build up cognitive ability.</td>
<td>Target clientele: Developed for persons with challenges in divided and sustained attention, information processing, and working memory following acquired brain injury or a neurological degenerative condition. Pre-requisite abilities: - Using a mouse to point and click - Other pre-requisites: understanding written instructions and basic attention skills. Language: English System requirements: XP SP2, Vista or Windows 7 - 32 or 64 bit platforms ***does run on Windows 10 Contact information: <a href="https://www.lapublishing.com/DASAT-attention-cognitive-rehab/">https://www.lapublishing.com/DASAT-attention-cognitive-rehab/</a> or 919-556-0300 Cost: $120.00</td>
</tr>
<tr>
<td></td>
<td>Problem-Solving</td>
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<td>Inhibition</td>
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**DASAT** has been designed as an early intervention tool to develop the cognitive recovery of divided and sustained attention, information processing and working memory following an acquired brain injury or to help delay cognitive decline in neurological degenerative conditions such as Alzheimer’s.

- Developed by a clinical neuropsychologist specializing in brain injury rehabilitation and cognitive communication.
- No published studies on the effectiveness of the DASAT program were found.

Target clientele: Developed for persons with challenges in divided and sustained attention, information processing, and working memory following acquired brain injury or a neurological degenerative condition.

Pre-requisite abilities:
- Using a mouse to point and click
- Other pre-requisites: understanding written instructions and basic attention skills.

Language: English

System requirements: XP SP2, Vista or Windows 7 - 32 or 64 bit platforms

***does run on Windows 10

Contact information: https://www.lapublishing.com/DASAT-attention-cognitive-rehab/ or 919-556-0300

Cost: $120.00
| Graded exposure to the task, an intelligent system which automatically adjusts to the user's ability level, on screen user feedback within a user friendly system, and a comprehensive performance history which can be printed or electronically transferred to the medical record make this a useful tool for any practitioner or researcher in neurological impairment. |  |  |
### CogniFit

<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Clinical utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>CogniFit</td>
<td>Planning</td>
<td>Problem-Solving</td>
<td>Inhibition</td>
<td>Working Memory</td>
</tr>
<tr>
<td>progress by monitoring the client’s performance</td>
<td>✓ Client’s performance is recorded during each training session and presented in a graph; also each cognitive skill is recorded individually.</td>
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<tr>
<td>Uses auditory and visual feedback</td>
<td>✓ iOS and Android Apps are also available.</td>
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</tr>
<tr>
<td>Software</td>
<td>Executive Function Components</td>
<td>Description of the software</td>
<td>Characteristics of the cognitive training</td>
<td>Development and scientific validity</td>
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</tbody>
</table>
| Constant Therapy | X X X X X X                  | 65 evidence-based tasks, with 60,000+ stimuli that are continuously updated and expanded. | - Clients access activities through an app on either an iOS or Android device  
- Constant Therapy has activities impacting on: auditory skills, naming, phonological skills, reading, writing, production, attention, visual skills, memory, problem solving and everyday skills | Designed by neuroscientists and game developers. Based on principles of neuroplasticity.  
- The research base developed for the Constant Therapy is in the area of computer-mediated cognitive-communication interventions.  
- No specific outcome research was found on the Constant Therapy Website. |                         | Target clientele: Designed for individuals with stroke, traumatic brain injury, and other cognitive, language, or learning disabilities. |
|                |                               |                             |                                        |                                   |              | Pre-requisite abilities: |
|                |                               |                             |                                        |                                   |              | - Using a touchscreen tablet device  
- Other pre-requisites: understanding written instructions and basic attention skills. |
|                |                               |                             |                                        |                                   |              | Language: English |
|                |                               |                             |                                        |                                   |              | System requirements: |
|                |                               |                             |                                        |                                   |              | App-based  
Utilizes either an iPad or Android Tablet |
|                |                               |                             |                                        |                                   |              | Contact information: |
|                |                               |                             |                                        |                                   |              | https://constanttherapy.com/ or |
|                |                               |                             |                                        |                                   |              | Cost: |
|                |                               |                             |                                        |                                   |              | Free for clinicians  
For patient:  
Monthly: 19.99  
Yearly 199.99  
3 year: 299.99 |
<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Clinical utility</th>
</tr>
</thead>
</table>
| Lumosity | Planning Problem-Solving Inhibition Working Memory Divided Attention Flexibility | ➢ Includes over 50 games and exercises to enhance brain functions  
➢ 5 types of game categories available: Speed, memory, attention, flexibility and problem-solving  
➢ Uses visual and/or auditory stimuli  
➢ Training level of difficulty is automatically adjusted by monitoring the users performance  
➢ Training may be customized according to the user’s goals  
➢ exercise varies depending on the exercise; each training session lasts approximately 15 minutes.  
➢ Has both iOS and Android apps for use on tablets | ➢ Designed by neuroscientists and game developers. Based on principles of neuroplasticity.  
➢ Some studies on Lumosity showed improvements in cognitive and executive function performance after training in survivors of childhood cancer, healthy young adults and persons with mild cognitive impairment. | ➢ Target clientele: All individuals.  
➢ Pre-requisite abilities:  
- Using a mouse to point and click  
- Other pre-requisites: understanding written instructions and basic attention skills.  
- Some exercises require typing on a keyboard  
➢ Language: English  
➢ System requirements: Internet  
➢ Contact information: [www.lumosity.com](http://www.lumosity.com)  
➢ Cost: (as of 2013)  
Free trial and registration online Monthly: 14.95/month  
Yearly: 6.95/month  
Two Year: 4.99/ month  
Lifetime cost: 299.95  
30-day money back guarantee |
## Software

<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Clinical utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posit Science: BrainHQ Program</td>
<td>X X X</td>
<td>Includes 29 online exercises that work on attention, brain speed, memory, people skills, navigation and intelligence. Uses auditory and visual stimuli. The program automatically customizes the training progress/level of difficulty according to the client’s performance during the exercise. The client is able to design own program, choosing exercises and workouts that meet their personal interests, mood, and/or schedule.</td>
<td>Developed by neuro-scientists, clinical collaborators and university partners. Some studies support the effectiveness of the BrainHQ exercises and assessment in outcomes such as memory and auditory processing speed particularly in the healthy aging population.</td>
<td>Target clientele: More extensively studied in the healthy aging population but can also be used with persons with various clinical conditions (e.g. mild cognitive impairment, traumatic brain injury, Alzheimer’s Disease, schizophrenia, however not specifically studied in the stroke population). Pre-requisite abilities: - All tasks require the use of a mouse to point and click; - Other pre-requisites: understanding written instructions, functional hearing ability (can be used with hearing aids), and basic attention skills. Language: English System requirements: - Internet access Contact information: <a href="http://www.positscience.com/">http://www.positscience.com/</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planning</th>
<th>Problem-Solving</th>
<th>Inhibition</th>
<th>Working Memory</th>
<th>Divided Attention</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</table>
### Software

<table>
<thead>
<tr>
<th>Executive Function Components</th>
<th>Description of the software</th>
<th>Development and scientific validity</th>
<th>Effectiveness</th>
<th>Clinical utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
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<td></td>
<td></td>
<td>Target clientele</td>
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<tr>
<td>Problem-solving</td>
<td></td>
<td></td>
<td></td>
<td>Pre-requisite abilities</td>
</tr>
<tr>
<td>Inhibition</td>
<td></td>
<td></td>
<td></td>
<td>Language</td>
</tr>
<tr>
<td>Working Memory</td>
<td></td>
<td></td>
<td></td>
<td>System requirements</td>
</tr>
<tr>
<td>Divided Attention</td>
<td></td>
<td></td>
<td></td>
<td>Ordering information</td>
</tr>
<tr>
<td>Flexibility</td>
<td></td>
<td></td>
<td></td>
<td>Cost</td>
</tr>
</tbody>
</table>

#### Psychological Software Services

<table>
<thead>
<tr>
<th>Cognitive Enhancement Training</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
</table>

**The Cognitive Enhancement Therapy collection includes 14 therapy exercises that focus on Attention, Memory and Problem Solving skills.**

- Each of the exercises contains a parameter setup panel so that the difficulty of the exercise can be adjusted.
- If working with an individual exhibiting greater than a mild cognitive impairment, the authors recommend using either their Neuropsychonline or PSSCogRehab software products.

**Developed by clinical neuropsychologists and psychologists as a part of the overall Cognitive Enhancement Therapy program.**

- CET is a performance based, comprehensive, developmental approach to the rehabilitation of social cognitive and neurocognitive deficits.
- Participants work at recovery through structured group and computer exercises. CET is designed as a recovery phase intervention for symptomatically stable persons with severe mental disorders.

**Target clientele:** developed for individuals with cognitive and mental health difficulties. Was specifically developed for individuals with Schizophrenia, but has been used more recently with individuals with other neuropsychiatric disorders including: Autism Spectrum Disorders.

**Pre-requisite abilities:**
- Using a mouse to point and click
- Other pre-requisites: understanding written instructions and basic attention skills.

**Language:** English

**System requirements:**
USB with password

**Contact information:**
[https://www.psychological-software.com/products.html](https://www.psychological-software.com/products.html) or 317/257-9672

**Cost:**
250.00
### Neuropsychonline

<p>| | | | | | | | |</p>
<table>
<thead>
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</table>

- Published (peer-reviewed) research evidence clearly shows the effectiveness of this tool when used properly in a well formulated treatment program for individuals with Schizophrenia. A growing research base has begun demonstrating its efficacy for individuals with Autism Spectrum Disorders.

- **Target clientele**: developed for individuals with cognitive and mental health difficulties.

- **Pre-requisite abilities**:
  - Using a mouse to point and click
  - Other pre-requisites: understanding written instructions and basic attention skills.

- **Language**: English

- **System requirements**:
  - Internet
  - Neuropsychonline should run on any up-to-date computer or tablet that can run HTML5 and javascript through a Google Chrome web browser.
<table>
<thead>
<tr>
<th>PSSCogRehab</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
</tr>
</thead>
</table>

- The eight software modules in the PSSCogRehab 2012 system include some sixty-seven computerized therapy tasks, most of which contain User modifiable parameters that extend the utility of each program to fit nearly any requirement presented by your patient or student. The focus of the individual exercises extends from simple attention and executive skills, through multiple avenues and modalities of visuospatial and memory skills, all the way up to problem solving skills ranging from the simple to extremely complex.
- The Eight Modules are: Foundations I; Foundations II; Memory I; Memory II; Problem Solving I; Problem Solving II; Visuospatial I; and Visuospatial II.
- This compendium of programs was 30+ years in the making and has been used in over 5000 treatment facilities from around the world.
- Published (peer-reviewed) research evidence clearly shows the effectiveness of this tool when used properly in a well formulated treatment program.

**Target clientele:** developed for individuals with cognitive and mental health difficulties.

**Pre-requisite abilities:**
- Using a mouse to point and click
- Other pre-requisites: understanding written instructions and basic attention skills.

**Language:** English, Spanish, and Korean

**System requirements:**
- USB Drive
- Windows XP or higher or Apple Mac OSX

**Contact information:**
https://www.psychological-software.com/products.html or 317/257-9672

**Cost:**
$2500 1st purchase
$800.00 each for same facility
### Executive Functioning and Cognitive Control

**RehaCom**

<table>
<thead>
<tr>
<th>Software</th>
<th>Executive Function Components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Planning</td>
</tr>
<tr>
<td>RehaCom</td>
<td>X</td>
</tr>
</tbody>
</table>

- **Description of the software**
  - RehaCom is a computerized therapy tool developed by experts and therapists that focuses on the rehabilitation of cognitive impairments. No specific information was provided about the developers on the website.

- **Development and scientific validity**
  - No published studies on the effectiveness of this software were found.

- **Characteristics of the cognitive training**
  - More than 20 computerized therapy modules are available to help your clients improve cognitive function and compensatory skills in attention, memory, executive functions, and visual field.
  - Screening—Choose from nine screening modules to test cognitive impairment
  - Specialized modules—Choose appropriate therapy modules, each with hundreds of tasks

- **Effectiveness**

**Clinical utility**

- **Target clientele:** Developed for individuals 8 years to adult who have had a stroke, traumatic brain injury, or who have a degenerative neurological disorder.

- **Pre-requisite abilities:**
  - Using a mouse to point and click
  - Other pre-requisites: understanding written instructions and basic attention skills.

- **Language:** Available in 20+ language at no extra cost including English

- **System requirements:**
  - Utilizes a propriety interface panel for responses

**Contact information:**

http://www.pearsonclinical.com/psychology/products/100001914/rehacom-for-cognitive-therapy-after-stroke-or-tbi.html#tab-details or 1-888-783-6363

**Cost:**

- **Annual Licenses:**
  - 1 year license with panel: 1495.00
  - 2 year license with panel: 2495.00
  - 3 year license with panel: 3495.00
<table>
<thead>
<tr>
<th>feature</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom settings</td>
<td>Individualize the therapy with parameters that can be adjusted to control duration, number of tasks, working speed, feedback, etc.</td>
</tr>
<tr>
<td>Client workflow</td>
<td>Introduce therapy tasks and allow the client to work independently for 15 to 60 minutes as the computer provides monitoring and feedback</td>
</tr>
</tbody>
</table>
Appendix 6: Speech Therapy Software Companies Whose Programs May Benefit Individuals with Executive Functioning Deficits

Bungalow Software:  http://bungalowsoftware.com/

- Direction Following +Outloud: Patient hears and/or reads directions and follows them by moving shapes on the screen with the mouse or keyboard. If the patient answers incorrectly, program provides helpful suggestions in a human voice, like "that's the wrong shape. You should be moving the large red triangle". Improves ability to understand, remember, and execute instructions, both written and verbal (out loud in a human voice).
- Categories and Words: Teaches patient which words or concepts belong together (apple, orange, banana: all fruit). At the higher level, the patient just deduce what several objects have in common and what other objects might belong in that group.
- Moriarity Mystery Dinner: This is a challenging program for cognitive therapy. Provides a nearly unlimited selection of puzzles in wide variety of difficulty settings. If the puzzle is too difficult the user can get unlimited hints and even have the puzzles solved automatically. Exercises cognitive/logical/ deductive reasoning skills

Parrot Software:  http://www.parrotsoftware.com/

- Cause and Effect: A situation is presented: There is a rip in a feather pillow, what will probably happen? The user chooses between 4 options that could happen: “The pillowcase cover will fade; The pillowcase will shrink; The feathers will come out; and The feathers will smell.” The user must choose the most likely option given the circumstances.
- Category Discrimination and Reasoning: In the 1st step, a list of words is presented in which all but one belong to the same category and the user must identify the one that does not belong. In the 2nd step the user finds the reason the word does not belong. In the 3rd step, the user finds a word that belongs in the first list.
The stimuli are graded from simple to complex vocabulary and degree of abstractness. 20 informative lessons are provided.

- **Conditional Statements:** This program presents a challenging language task. A hierarchy of conditional statements is presented either visually or auditorily. A simple instruction would be: If sun is in box 12 click rain. Otherwise click clouds. A complex instruction would be: If sun is not in box 3 or rain is in box 20, click clock. Otherwise click car. The program provides stimuli within the following five different lesson types: Simple Conditional, Negative Conditional, Conditional Conjunctive and, Conditional Conjunctive or, Negative/Positive Conditional Conjunctive

- **Deductive Reasoning:** Deductive Reasoning was designed to facilitate reasoning skills in relatively high level cognitively impaired people. Each problem has a set of rules that describe a class of words. The user is presented with words and asked to determine whether each is a member of the class. For example, in one class, lion and dog belong but desk and tree do not belong. (Obviously the class is animals) The user is asked: Does elephant belong? What about flower? Finally, the user is asked to identify the class.

- **Logical Thinking:** Users are asked to move a picture to a certain location. Lesson types include: Put baseball on a red square that is not even numbered; Put baseball on a red, even numbered square; If 10 is an odd number then put baseball below box 10. Otherwise put baseball above box 10; If box 18 is blue or box 4 is green than put baseball in the upper-right hand corner. Otherwise put baseball in box 4.; If box 19 is yellow put baseball in the upper right hand corner. Otherwise put baseball in box 19.; If box 19 is not yellow put baseball in the upper right hand corner. Otherwise put baseball in box 19.

- **Problem Solving:** A problem is presented like ‘A couple with three children wants to have a quiet weekend together. What is the best way to ensure that?’ The user chooses between a list of four options that could theoretically all be solutions like: Tranquilize the children; Send the children outside to play; Tell the children to watch TV all weekend; and Send the children to a relative’s home. The user chooses the most likely and solution.

- **Situational Reasoning:** A real-life situation is presented like ‘You burn your hand. What is the first thing to do?’ The user chooses between a list of 4 alternatives like: Put on a mitten; Put on a Band-Aid; Put your hand under cold water; and Put your hand under hot water. The user is instructed to choose the best alternative.

- **Auditory and Visual Instructions:** Four geometric forms are displayed. Then, a description of one of the geometric forms is presented using the attributes of size, color, and shape, e.g. large, yellow, and square. The user must identify the geometric form that fits the description. Four levels of lessons of varying degrees of
difficulty are included. Problems are generated randomly. The difficulty of the task is related to the similarity between the geometric forms displayed. The more similar the form, the fewer the distinguishing features between geometric forms and therefore, the easier the task. For example, if all four geometric forms are large circles, the only difference between them can be a color difference.

- **Concentration:** Users are presented with a grid of randomly placed picture pairs. Users try to remember where each pair is located. The pictures in the grid are then hidden and the user must identify the location of each pair, one at a time.
- **Inhibiting Repetitive Behaviors:** A word is presented and the user is given a short time to respond to the question ‘Does this word belong to the category?’ Users respond by clicking on the word if it belongs to the category or doing nothing if the word does not belong to the category. Users learn to inhibit the clicking response for words that do not belong to the category.
- **Multi-Tasking:** Multitasking is a program that requires users to keep track of from 2 to 5 different events. Users select the number of events and then geometric shapes are presented one at a time. Users must keep track of how many times each shape was presented.
- **Remembering Auditory Patterns:** A 16 item grid is displayed. Users then hear a sound while one of the squares in the grid moves side to side. Another item is presented in the same manner. Then the user is asked to identify the square associated with the first sound and then the square associated with the second sound. In lesson 2, 3 sounds are presented, lesson 3 has 4 sounds and so on.
- **Remembering Written Directions:** Written directions are given requesting the user to move small pictures to special locations on the screen. The pictures are moved with a mouse. If a picture is moved to the correct screen location, a positive reinforcement is provided. The number of different directions can be set between one and five to increase the difficulty of the task
- **Remembering Spoken Directions:** Written directions are given requesting the user to move small pictures to special locations on the screen. The pictures are moved with a mouse. If a picture is moved to the correct screen location, a positive reinforcement is provided. The number of different directions can be set between one and five to increase the difficulty of the task
- **Remembering Sounds:** Between 2 and 6 sounds are presented and the user is instructed to remember this list of sounds. Next, a new sound is presented and the user must determine whether this sound was in the list of sounds to be remembered.
Executive Functioning and Cognitive Control – Joseph Falkner, MST/CCC-SLP

- Remembering Spoken Letters: This program is designed to test and exercise short-term memory skills. A list of between 1 and 7 letters is spoken and the user must recall the entire list in the correct order.
- Remembering Spoken Numbers: This program is designed to test and exercise short-term memory skills. A list of between 1 and 7 numbers is spoken and the user must recall the entire list in the correct order.
- Remembering Visual Patterns: The format is to present a picture grid of 16 pictures and then to temporarily remove some of the pictures revealing a pattern comprised of between 1 and 9 pictures. The user is asked to remember the pattern displayed. The original 16 pictures are then displayed again to hide the pattern. The user is asked to click the pictures that formed the pattern.
- Remembering Written Letters: This program is designed to test and exercise short-term memory skills. A list of between 1 and 7 letters is displayed and the user must recall the entire list in the correct order.
- Remembering Written Numbers: This program is designed to test and exercise short-term memory skills. A list of between 1 and 7 numbers is displayed and the user must recall the entire list in the correct order.
- Two Letter Cancellation: Letter cancellation tasks are widely used in clinical and research to combat dysfunction of attention/concentration, visual-spatial scanning, and spatial neglect. User are shown a large grid of random letters and asked to click on every occurrence of two different letters.
- Visual Attention Training: Visual Attention and Training was designed to provide support for individuals with attention deficits. Three types of visual attention training are provided representing varying degrees of difficulty. The attention conditions from simplest to most difficult are: Focused Attention, Selective Attention, and Alternating Attention. Focused Attention requires watching for one event to occur and responding only when it does. Selective Attention is similar to Focused Attention except that an element of visual distraction is added. Alternating Attention requires attending to one stimulus for a period of time and then switching attention to another stimulus.
- Visual Distraction: In this activity the user is shown 5 colored rectangles with incorrect color labels. For example the blue square may be labeled “green”. The instruction to the user is to click on the box with a specific color. The labels are distractions and force the user to inhibit the natural tendency to click on the label rather than the actual color.
## Appendix 7: Games/Apps for Working on Selected Executive Functioning Skills

http://learningworksforkids.com/

<table>
<thead>
<tr>
<th>Executive Function</th>
<th>Games</th>
<th>Apps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flexibility</strong></td>
<td>Ticket to Ride</td>
<td>iMaschine</td>
</tr>
<tr>
<td></td>
<td>Minecraft-Story Mode</td>
<td>Inspire</td>
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<tr>
<td></td>
<td>Lifeline</td>
<td>Photoblend</td>
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<td></td>
<td>Evoland</td>
<td>Snapchat</td>
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<tr>
<td></td>
<td>Pokemon Go</td>
<td>PicLab</td>
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<tr>
<td></td>
<td>Never Alone</td>
<td>Vivoom</td>
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<td></td>
<td>Lightbot: Code Hour</td>
<td>CodeAcademy</td>
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<td></td>
<td>Thomas Was Alone</td>
<td>Pixlpl</td>
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<td>Social Chess</td>
<td>Seene</td>
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<td></td>
<td>Brain Rush</td>
<td>Keezy</td>
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<td>Flow Free</td>
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<td>Versu</td>
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<td></td>
<td>Mazement</td>
<td>Xtranormal</td>
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<td></td>
<td>TinkerBox</td>
<td>Hologram</td>
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<td><strong>Working Memory</strong></td>
<td>Whispering Willows</td>
<td>StudyBlue</td>
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<tr>
<td></td>
<td>Trivia Crack</td>
<td>Pines to Vines</td>
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<tr>
<td></td>
<td>Back to Bed</td>
<td>Elevate</td>
</tr>
<tr>
<td></td>
<td>Icomania</td>
<td>City Guides by National Geographic</td>
</tr>
<tr>
<td></td>
<td>The Room</td>
<td>Roblox</td>
</tr>
<tr>
<td></td>
<td>Stealth Inc</td>
<td>Quizlet</td>
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<td></td>
<td>Cordy</td>
<td>Musyc</td>
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<tr>
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<td>QuizUp</td>
<td>Graphs</td>
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<td>Pivot</td>
<td>Poems by Heart</td>
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<tr>
<td></td>
<td>Hidden Chronicles</td>
<td>Dyscalculator</td>
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<td></td>
<td>Layton Brothers: Mystery Room</td>
<td>Bitsboard</td>
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<tr>
<td></td>
<td>Letris and Friends</td>
<td>Vocabulary</td>
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<tr>
<td></td>
<td>Tap Tap Revenge Tour</td>
<td>SkyView</td>
</tr>
<tr>
<td></td>
<td>Super Hexagon</td>
<td>SpacePaint</td>
</tr>
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## Appendix 8: Apps that Can be Used in Therapy

<table>
<thead>
<tr>
<th>App</th>
<th>Impulse Control</th>
<th>Flexibility</th>
<th>Working Memory</th>
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<tr>
<td><strong>Tactus Apps</strong></td>
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<tr>
<td>• Number therapy</td>
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<td>X</td>
</tr>
<tr>
<td>• Category therapy</td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Visual attention</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>• Spaced retrieval</td>
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<td>• Auditory workout</td>
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<tr>
<td>• Comprehension</td>
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<td>• Aphasia</td>
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<td>• Functional listening</td>
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<td><strong>Let’s Talk About Self-Control</strong></td>
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# Appendix 9: Board and Card Games

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<td>Create-a-Maze</td>
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<td>Emotes Rescue Quest</td>
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<td>Forbidden Island</td>
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<td>iTrax</td>
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<td>X</td>
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<tr>
<td>Kimochi</td>
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<td>Mad Dragon</td>
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<td>Mandala Coloring Books</td>
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<td>On the Dot</td>
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<td>Pixy Cubes</td>
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<td>Rush Hour</td>
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<td>Games</td>
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<td>Sequence</td>
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<td>Shape by Shape</td>
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<td>Simon</td>
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<td>Square by Square</td>
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<td>Stare</td>
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<td>Stop, Relax, and Think</td>
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<tr>
<td>Swish</td>
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<td>Telestrations</td>
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<td>Visual Brainstorms</td>
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<td>Ryuu Cards</td>
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Appendix 10: Examples of Assistive Technology Tools

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<tr>
<td>• Apple Watch</td>
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<td></td>
<td></td>
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<tr>
<td>• Samsung Gear</td>
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<tr>
<td>• Casio Smart Outdoor Watch</td>
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<tr>
<td>Talking Photo Albums</td>
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<td>Livescribe Pens</td>
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<td>White Noise Machine</td>
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<tr>
<td>FM System</td>
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<tr>
<td>iLS/Listening Program</td>
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<td>Voice Recorder</td>
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<td>Post-It Notes</td>
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<tr>
<td>Vibrating Alarm Watch</td>
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<td>Noise-canceling headphones</td>
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<td>Endeavor Mobile Independence</td>
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<td>Biofeedback</td>
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<td>Neuropage</td>
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<td>Tool</td>
<td>Impulse Control</td>
<td>Flexibility</td>
<td>Working Memory</td>
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<tr>
<td>Planning and Execution Assistant and Trainer</td>
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<td>Micro-prompting technologies</td>
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<td>Word Prediction Software</td>
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<td>Mind/Concept Mapping</td>
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<tr>
<td>Smartphone/Electronic Organizer</td>
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</table>

Adapted from: (Scherer, 2012), (Dewar, Kobelman, Kapur, & Wilson, 2015), (Jamieson & Evans, 2015), (LoPresti, Bodine, & Lewis, 2008) and (O’Neill & Manly, 2015)
## Appendix 11: Complementary and Alternative Medical Approaches that May Benefit Individuals with Deficits in Executive Functions

<table>
<thead>
<tr>
<th>CAM Approach</th>
<th>Description of the CAM Approach</th>
<th>Target clientele</th>
<th>Contact information</th>
</tr>
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| **Forbrain** (information from the Forbrain website) | FORBRAIN® headphones leverage high frequency vibration to help the user create and process sound. The patented electronic dynamic filter blocks out environmental noise—isolating and amplifying the user’s voice, giving the nervous system a solid sensory workout. It also enhances long vowels and other sounds critical to the construction of language. The resulting sound is delivered through the bones and bone conduction, not the ears or air conduction, to the nervous system and brain. Forbrain is suitable from 3 years old to adult (with some exceptions – please see details in this section). The voice and the ear plays an important role in our ability to communicate. Forbrain is used in a personal developmental approach (public speaking, improvement of the spoken and singing voice) and also as a therapeutic approach to help people with more severe disorders. Forbrain is a painless and noninvasive sensory stimulation apparatus. Like any stimulation, Forbrain can excite and tire the user during the sessions. Forbrain is not suitable for: | • Children under 3 years  
• For people with Parkinson's disease  
• People with hearing loss in both ears of 80%  
• People carrying a Cochlear Implant  
• People with epilepsy (except on advice of a specialist) | https://www.forbrain.com |
| **Integrated Listening System (iLs)** (information from the Integrated Listening System website) | iLs is a complementary approach which can be integrated into a broad variety of practices such as occupational therapy, speech therapy, physical therapy, ADHD coaching, Autism specialties, psychology/counseling, neurofeedback, sports coaching, chiropractic care and others. iLs programs are based on the principle of neuroplasticity, providing gentle and specific stimulation (music and movement) in order to activate the neural pathways used in the processing of sensory information. iLs trains for brain/body integration through a staged approach, starting with the fundamentals of sensory integration and then extending through more | Integrated Listening may benefit a wide variety of individuals of various ages who might exhibit difficulties with:  
• Attention  
• Regulation  
• Auditory Processing  
• Learning  
• Reading  
• Sensory Processing  
• Speech | Contact Information:  
https://www.forbrain.com |
### Interactive Metronome (IM)

**Interactive Metronome® (IM)** is an evidence-based assessment and training tool that helps strengthen the brain’s ability to synchronize thought and movement to a steady metronome beat. IM responds to a client’s physical performance by providing real-time auditory and visual millisecond feedback indicating whether they are hitting before, after or in sync with the beat. The overall goal of IM training is to improve timing in the brain, or Neurotiming, through rhythm and repetition.

Interactive Metronome may benefit a wide variety of individuals of various ages who might exhibit:

- ADHD
- Autism Spectrum Disorder
- Sensory Processing Disorder
- Learning Disabilities
- Developmental Delays
- Cerebral Palsy
- Auditory Processing Disorder
- Dyslexia
- Brain Injury and Concussion
- Stroke
- Parkinson’s
- Dementia

**Contact Information:**

https://www.interactivemetronome.com or (877) 994-6776

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### The Listening Program

**The Listening Program® (TLP)** is a music listening method, personalized to improve brain fitness at any age or level of ability. Used and trusted by hundreds of thousands of people in over 35 countries, TLP is offered through our international network of trained providers.

TLP has global effects on the brain, and is commonly used to support changes in a wide range of brain performance areas:

- Executive Function
- Communication
- Auditory Processing
- Social & Emotional Function
- Stress Response
- Motor Coordination
- Creativity

**Contact Information:**

http://a.advancedbrain.com/tlp/the_listening_program.jsp or 888-228-1798

---

### Therapeutic Listening

**Therapeutic Listening** is a specific sound-based intervention that is embedded in a developmental and sensory integration perspective. The music in Therapeutic Listening gives the listener unique and precisely

**Therapeutic Listening** may benefit a wide variety of individuals of various ages who might exhibit:

- poor attention
- difficulties interacting with peers and limited play skills
controlled sensory information. The music is electronically modified to highlight the parts of the sound spectrum that naturally capture attention and activate body movement, synchronizing it with the environment. Therapeutic Listening uses electronic modifications, along with the organized, rhythmical sound patterns inherent in music, to trigger the self-organizing capacities of the nervous system.

- challenges with transitions or changes in routine
- difficulty communicating (both verbal and non-verbal)
- struggles with sleep, bowel and bladder control, and eating
- trouble following directions
- challenges perceiving and navigating space
- poor timing and sequencing of motor skills
- difficulties with irritability, mood
- difficulties with regulating their energy level (i.e. too low arousal or hyperactive)
- postural insecurity (fear of heights, playing on playground equipment)
- abnormal responses to various sensory stimuli (sounds, touch, taste, pain)
- poor praxis and motor planning: coming up with an idea, planning, and completing the task
- difficulty responding to sounds and verbal directions

**Contact Information:**
https://vitallinks.com/ or (608) 270-5424

<table>
<thead>
<tr>
<th>Tomatis Method</th>
<th>The Tomatis® Method is a pedagogical method used to improve the listening of a person whose hearing functions correctly. It works thanks to a device that causes musical contrasts by suddenly and unpredictably changing the timbre and intensity of the music.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>The Tomatis Method may benefit a wide variety of individuals of various ages who might exhibit:</td>
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</tbody>
</table>
|                |  - Learning Difficulties and Language Disorders  
|                |  - Attention Disorders  
|                |  - Affective and Emotional Disorders  
|                |  - Communication Disorders  
|                |  - Psychomotor Difficulties  
|                |  - Pervasive Developmental Disorder  
|                |  - Need for improvement of the voice and of musicality  
|                |  - Need to integrate foreign languages                                                                                                                                                                                                                                                                                                                                                     |

**Contact Information:**
http://www.tomatis.com/
Appendix 12: Websites

1. http://cognitiveconnectionstherapy.com/ -- Sarah Ward's website for her innovative Executive Functioning training and approach. Includes links to executive function websites, materials, and products that will benefit anyone working with individuals struggling with executive functioning skills.
Bibliography


Notes: