EXECUTIVE FUNCTION AND BRAIN INJURY

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NEUROPHYSIOLOGY

Structure of a Typical Neuron

(Figure 1.2) depicts a basic neuron and its components. (Wkeducaator, 2008)

Common Causes of TBI

INFANTS: PHYSICAL ABUSE

TODDLERS: FALLS AND ABUSE

YOUNG CHILDREN: PASSENGERS IN VEHICLES

SCHOOL-AGED CHILDREN: BICYCLE AND PEDESTRIAN COLLISIONS WITH VEHICLES

ADOLESCENTS: DRIVERS AND PASSENGERS IN MOTOR VEHICLE ACCIDENTS

NOTE: CONSIDER HOW THE MECHANISM OF INJURY WILL UNIQUELY AFFECT THE GRIEVING PROCESS.
WHAT MAKES ABI/TBI UNIQUE?

TIME

Grief Hope

DOMAIN AREAS – SENSITIVE TO A TBI

- New Learning
- Language:
  - Receptive Language
  - Expressive Language
  - Social Pragmatics
- Visual-Spatial
- Social/Emotional/Behavioral
- Executive Functioning
  - Initiation
  - Reasoning
  - Planning
  - Mental Flexibility

ATTENTION

Attention: The ability to sustain focus on the information necessary for learning or completing tasks.
- There are numerous types of attention: selective, sustained, shifting and divided attention. Being able to attend to a task, to shift from task to task and to ignore competing distractions so that one can stay focused on the original task at hand, explains why attention is a fundamental skill necessary for all levels of learning.
- The inability to inhibit an impulse is a problem with attention and is often the underlying issue with Attention Deficit Hyperactivity Disorder (“hyperactivity” is often more about the inability to stop acting upon every impulse that comes to mind).
### Memory

The mental ability to store and retrieve words, facts, procedures, skills, concepts and experiences.

- The general memory process is complex and entails memory creation, storage of information and retrieval. Additionally, there are several types of memory. For example, some primary types of memory are short-term, working, visual, auditory, procedural and declarative memory.
- Damage to any brain area that assists in the formation, storage or retrieval of information can degrade overall memory performance. Due to the number of areas associated with the memory system, it is important to emphasize there are also numerous ways to impair or damage this process.
- The inability to remember the steps of appropriate behavior and social skills leads to “inappropriate” events.

### Processing Speed

How quickly information is received, processed, and/or outputted.

- A common consequence of a brain injury is the slowing of information processing. Slowed information processing impacts a person’s ability to think efficiently and may hinder the effectiveness of other abilities such as memory. Although there are different reasons for slowed processing after an injury, one major reason is that the “wires” of the brain (neurons) can no longer communicate with each other efficiently.
- Another reason for slowed processing speed is that the brain might have to re-route signals around the damaged area (takes longer).

### Sensory Motor

Perceiving and responding to what is seen, heard, smelled, tasted, felt and touched.

- Generally speaking, the parietal lobe of the brain (top brain area) processes most sensory information and integrates it to construct a picture of one’s environment. Damage to the parietal lobe may interfere with body awareness, cause attention problems, and degrade the accurate processing of auditory, olfactory, taste, tactile, and visual information.
- Fine Motor: Involves the use of small muscles of the hands to make smooth, coordinated or fine motions.
- Gross Motor: Involves the coordinated use of the large muscles of the body.
- “Not comfortable in my skin”

### Learning Processes

The ability to learn new concepts and information.

- Receiving and processing new information to create learning is a remarkably complex neurological phenomenon. A novel academic task requires several brain areas working in concert to produce understanding. Once new information is processed, the new information is sent to other areas of the brain so the information can be comprehended on a deeper level.
- The inability to benefit from new learning, and to build on that learning – especially in social situations and behaviorally.

### Learning Processes: Unevenness

A hallmark of a brain injury on a person’s performance is an “unevenness” in abilities across different settings, over time, and across different content areas.

- Examples:
  - Across domains - a 31 year old may have typical abilities of in fine and gross motor areas but have the social-emotional regulation of an 11 yr old.
  - Within domains - Average abilities in expressive language and difficulties with receptive language
  - Across time – a client knows the rules on Tuesday but cannot retrieve the same information later that same week.

### Visual-Spatial

The ability to generate, retain, retrieve and transform well-structured visual images.

- Visual-spatial processes are largely associated with the occipital lobe of the brain, which is located at the back of the brain. Damage to the back and left side of the brain can degrade a person’s ability to process images of known objects. Injury to the back to upper regions of the brain may cause problems with spatial and location tasks.
- Inability to recognize social cues.
Language-Receptive: The ability to understand language.
• Understanding spoken language is typically associated with the left hemisphere of the brain. Young children typically understand what is told to them (receptive language) before they can express themselves, but damage to the left side of the brain hinders their ability to understand language.

Language-Expressive: The ability to express one’s thoughts and feelings into words and sentences.
• The ability to speak logically and express oneself using language involves the left hemisphere of the brain.

Social Pragmatics: Pragmatics are the verbal and nonverbal rules of social language and interactions.

Social and Emotional: The awareness of social issues and one’s emotional status. Behavioral self-regulation, control and self-monitoring are also part of this domain.
• The ability to interact successfully with other people and control one’s emotions involves a higher order cognitive skill set. There are two primary areas associated behavioral and emotional regulation.
  1) The frontal cortex, is implicated in pro-social behaviors. Specifically, the front part of the brain, near the eyes, assists with impulse control.
  2) The limbic system. The limbic system is made of several smaller parts that are associated with creating all emotions. When these deep brain structures are damaged, it is common that the person develops severe emotional difficulties.

Executive Functions: Reasoning
Reasoning: The use of deliberate and controlled mental operations to solve novel and on the spot problems
• Many aspects of reasoning are similar to the process of new learning. Reasoning is the foundation for problem solving and ultimately overall intelligence. Higher order reasoning involves the effective integration and processes of the entire cerebral (brain) structure. Since the frontal cortex is considered the “manager” of the brain, this region is typically needed in reasoning as it orchestrates how information is processed. However, many areas of the brain are needed for deep thinking.

Executive Functions: Mental Flexibility
Mental Flexibility: The ability to easily shift from one idea, train of thought, activity or way of looking at things.
• Controlling the thoughts and actions of the brain falls under the function of the frontal lobe. Although there are different brain areas that also help with initiation, organization, planning and flexibility, these four “executive functions” are primarily regulated by the upper brain areas located behind the forehead. People with damage to the frontal lobe may become more rigid in their thinking and less adaptable to change.

Executive Functions: Planning
Planning: The ability to set a goal, identify a sequence of actions to reach the goal and carry out that sequence of steps.
• Planning is a future oriented process requiring forethought, estimation and problem solving similar to the same neurological structures involved with regulation, organization, and problem solving, the upper frontal lobe is intimately tied to planning.

Executive Functions: Organization
Organization: The ability to create and maintain orderliness in thoughts, activities, materials and the physical environment.
• The upper frontal region of the brain, behind the forehead, controls planning and organization of thoughts and activities. The ability to sequence thoughts in a logical fashion and translate those thoughts into action to organize a person’s environment involves communication between the frontal cortex and left hemisphere of the brain. Damage to the front and/or the left hemisphere of the brain may cause disorganized thinking and ordering of materials.
FUNCTIONING

**Executive Functions**: Initiative

*Initiation:* The ability to independently start an action or activity.

- Since the frontal regions of the brain are largely responsible for action and movement, it is not surprising these same areas are responsible for initiation. It is also not surprising that emotions help start actions, so the deeper emotional centers of the brain are implicated in initiation. A child’s inability to get tasks completed may be related to problems with initiation within the brain.

COGNITIVE ABILITY

**Adaptive Living Skills**

Adaptive living skills, including but not limited to with Activities of Daily Living (ADL).

Some Examples:
- Personal hygiene and grooming
- Housework
- Managing money
- Use of telephone or other form of communication
- Community mobility
- Care of pets
- Meal preparation and cleanup
- Safety procedures and emergency responses

INFANCY STAGE: BIRTH TO 3 YEARS

**Developmental Characteristics:** Birth to 3 years

- Language acquisition
- Regulation of motor and affect systems
- Development of problem-solving skills
- Begin to develop sense of self
- Develop relationships
- Initiate social relations with caregivers

Developmental Disruptions Following Brain Injury: Skills to 3 years:

- Loss of understanding of cause and effect relationships
- Lack of understanding of social affect relationships
- Inability to develop sense of self-esteem and independence
- Impulsivity
- Difficulty moving from emotionally and socially extended "fantasy" to reality

Jeanne Dike Lewis, Ph.D.,
Colorado Children’s Hospital
Denver, Colorado

PRESCHOOL STAGE: 3 YEARS TO 6 YEARS

Developmental Characteristics: 3 to 6 Years

- Very basic understanding of cause and effect relationships
- Developing ability to think before acting
- Focus on on-going aspects of the situation at large
- Development of a basic understanding of “the invisible lens”

Developmental Disruptions Following Brain Injury: 3 to 6 Years

- Disruption in the organization among thinking and motor functions
- Emotional and behavioral frustration
- "Executive function" difficulties
- Poor regulation of behavior
- Inability to express feelings
- Inability to learn and anticipate
- Poor acquisition of abstract concepts (same different); inability to understand shapes, sizes, colors (perceptual-motor skills)
- Dissociation of internal structure and organization provided by adults

ELEMENARY SCHOOL STAGE: 6 YEARS TO 12 YEARS

Developmental Characteristics: 6 to 12 years

- Better understanding of cause and effect relationships
- Read to learn academic skills
- Focus on self as important
- Recognize intention of act as important

Developmental Disruptions Following Brain Injury: 6 to 12 Years

- Disruption in reading, spelling, math skills
- Poor performance in academic areas
- School performance breakdown
- Anxiety problems during academic areas
- Depression, social isolation or withdrawal
- Sleep disturbance
- Fatigue
EARLY ADOLESCENCE: 12 YEARS TO 16 YEARS

Developmental Characteristics: 12 to 16 Years
- Capacity for abstract thought
- Ability to plan and execute complex projects over time
- Interest in peer relationships
- Difficulties learning new information
- Reduced cognitive processing
- Increased self-confidence
- Decreased self-esteem

Developmental Disruptions Following Brain Injury: 12 to 16 Years
- Sensations to impact profile
- New learning difficulties
- Difficulty with normal processing
- Difficulty regaining complex skills
- Difficulty and managing difficult situations
- Increased "frustration" responses
- Depression
- Anger

AGE OF BRAIN INJURY?
- What age was the brain injury?
- What "typical" skills were already in place?
- What developed skills might have been lost?
- What skills might never develop now?
- Will they return?
- Splintered skills
- Off-track developmentally

LATE ADOLESCENCE: 16 YEARS TO 19 YEARS

Developmental Stage Characteristics: 16 to 19 Years
- Complex reasoning and judgment
- Ability to achieve complex goals
- Solid personal identity based on positive self-esteem
- Solid relationships
- Multiple interests

Developmental Disruptions Following Brain Injury: 16 to 19 Years
- Reasoning problems (e.g., memory for numbers)
- Difficulties with normal actions
- Difficulties in organizing complex tasks
- Difficulty in making specific choices and secure plans
- Difficulty in maintaining self-esteem and independence
- Emotional problems
- Social problems
- Friends
- Behavior regarding personal health problems
- Difficulty learning

EXECUTIVE FUNCTIONS

- New Learning
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TOP 10 SKILLS EVERY GREAT LEADER NEEDS TO SUCCED FROM INC.COM

1. Inspires and motivates others
   Great leaders create a vision of the future that is vivid and compelling, and that motivates employees to want to achieve it. Future Thinking

2. Displays high integrity and honesty
   Great leaders are honest and transparent, and have high integrity—they do what they say they are going to do, and they walk their talk. Initiation and Planning

3. Solves problems and analyzes issues
   Ultimately, leaders are recruited, trained, and chosen to solve organizational problems. Organization and Problem-solving
• 4. Drives for results
Some people are happy to sit back and watch the world go by, while others aren’t unless they are making things happen in their organization. Great leaders have a higher level of perseverance and stick-to-itness.
• 5. Communicates powerfully and prolifically
Great leaders communicate with their people often and in a variety of different ways. - Social Pragmatics
• 6. Builds relationships – Social Competence

• 7. Displays technical or professional expertise.
Higher order thinking and training
• 8. Displays a strategic perspective
Great leaders have a long-term vision of the future, and they avoid getting bogged down in the here and now. Future Thinking and Planning
• 9. Develops others.
• 10. Innovates ”The ability to innovate is a key skill for every leader.

http://cognitiveconnectionstherapy.com
Cognitive Connections – Center for Executive Function Skill Development

http://www.socialthinking.com

DOMAIN AREAS – SENSITIVE TO A TBI

- Attention
- Processing Speed
- Memory
- Sensory-Motor:
  - Fine Motor
  - Gross Motor

- A Practical Guide to Assessment and Intervention
  Reg Davidson and Richard Guare
  - Sensory-Motor:
    - Fine Motor
    - Gross Motor

Smart but Scattered: The Revolutionary “Executive Skills” Approach to Helping Kids Reach Their Potential Paperback – January 2, 2009
By Peg Denzer • Author, Richard Guare • Author

- Attention
- Processing Speed
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MITIGATING FACTORS?

• Can a person with a known disability or illness be held accountable for inappropriate behaviors?

• Are there mitigating factors related to disability, illness, trauma, stress, substance use/abuse?

• Can you hold a returning veteran accountable for hitting his wife while knowing he suffers from PTSD, TBI and was under the influence of alcohol at the time of the incident?

MANIFESTATION DETERMINATION

• Manifestation determination is a test employed when a student who receives special education services (or a 504 or there is knowledge of a “disability”) is considered for suspension, expulsion or any alternative placement due to some behavioral concern. It is a process where the behavior of a student who receives special education is considered to determine if the actions that resulted in the consideration of some disciplinary action against the student were manifestations of the student’s disability.

MANIFESTATION DETERMINATIONS

• (i) In general. Except as provided in subparagraph (B), within 10 school days of any decision to change the placement of a child with a disability because of a violation of a code of student conduct, the local educational agency, the parent, and relevant members of the IEP Team (as determined by the parent and the local educational agency) shall review all relevant information in the student’s file, including the child’s IEP, any teacher observations, and any relevant information provided by the parents to determine—

  • (I) if the conduct in question was caused by, or had a direct and substantial relationship to, the child’s disability; or

  • (II) if the conduct in question was the direct result of the local educational agency’s failure to implement the IEP.

• (ii) Manifestation. If the local educational agency, the parent, and relevant members of the IEP Team determine that either subclause (I) or (II) of clause (i) is applicable for the child, the conduct shall be determined to be a manifestation of the child’s disability.
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THE TERM SETTING EVENT IS USED TO DESCRIBE THE EVENTS THAT MOMENTARILY CHANGE THE VALUE OF REINFORCERS AND PUNISHERS IN A PERSON’S LIFE. THE OCCURRENCE OF A SETTING EVENT CAN EXPLAIN WHY A REQUEST TO COMPLETE A TASK RESULTS IN PROBLEM BEHAVIOR ON ONE DAY BUT NOT ON THE NEXT.

Setting Events:
- Fatigue
- Seizures
- Pain
- Mental "fogginess"
- Hunger
- Sensory over-load
- Sensory under – load
- Medications

SUGGESTIONS:
- NEPSY II Attention and Executive Functioning Subtests
- D-KEFS Delis-Kaplan Executive Function System
- Conners 3rd Edition
- Cognitive Assessment System (CAS)- Attention Composite (Consider Planning Composite)

INTERVENTIONS
- Clear desk and area of everything except what is needed for the task at hand.
- Seat nearest the location of instruction and away from distractions (e.g., doors, windows, high traffic areas).
- Connect new learning to prior knowledge or with areas of interest.

SUGGESTIONS:
- WISC-IV Working Memory
- WAIS-IV
- NEPSY-II Memory and Learning
- DAS-II Memory & Working Memory
- DAS-II Recall of Designs
- DAS-II Recall of Objects Delayed
- WJ-III Memory Subtests (Thinking Ability)
- Test of Memory and Learning-2 (TOMAL)
- Children’s Memory Scale (CMS)
- Wide Range Assessment of Memory and Learning 2 (WRAML2)
INTERVENTIONS

MEMORY

Suggestions:
- Use verbal prompts and auditory modalities.
- Teach the concept and then ask the client to teach you or others - having them teach others activates numerous areas of the brain.
- Use visuals, graphic information, sticky notes and encourage client to form a mental visual picture of verbal information.

PROCESSING SPEED

Suggestions:
- Break instructions and assignments into manageable pieces-limit amount of information give at one time.
- Present information in several ways (verbal, written, visuals, modeling).
- Provide written directions and combine verbal information with visuals.
- Frequent checks for understanding.
- If the client appears “blank” or is not doing what you have asked, repeat the main points. Do not elaborate or add details.

SENSORY-MOTOR

Suggestions:
- Allow the client to stand up and lean on the table when working.
- Encourage heavy work activities (e.g. standing pushups against wall, carrying boxes or books, stacking chairs).
- Allow use of computer

LEARNING PROCESSES

Suggestions:
- Wide Range Assessment Memory and Learning 2-WRAML2
- NEPSY-II Memory and Learning- Immediate Trials
- DAS-II Recall of Objects-Immediate Trials
- Woodcock Johnson-III Cognitive- Visual-Auditory Learning
- Test of Memory and Learning-2 New Learning Index
- Wechsler (WMS-III) and Children’s Memory Scales
- CELF-4, Paragraph Recall Subtest
- SCATBI for Adolescents (Scales of Cognitive Ability for TBI)
### INTERVENTIONS

#### LEARNING PROCESSES

**Suggestions:**
- Teach outlining and highlighting of most important concepts.
- Provide copies of guided notes and outlines.
- Extra time to complete projects and assignments.
- Encourage client to review what information has been learned daily.

- Provide client with upcoming topics, notes and materials (preview and reinforce concepts at home).
- Use real world examples-make connections between new learning and information student already knows.
- Teach the concept and then ask the client to teach you or others.

#### VISUAL-SPATIAL PROCESSES

**Suggestions:**
- DAS-II - Spatial Subtests
- WISC-IV Perceptual Reasoning Subtests
- WAIS-IV
- WJ-III Cognitive- Spatial Relations, Picture Recognition
- NEPSY-II- Visualspatial Processing
- K-ABC 2 NonVerbal Scale
- Leiter-R
- Visual Motor Integration (VMI)

#### LANGUAGE PROCESSES

**Suggestions:**
- Clinical Evaluation of Language Fundamentals (CELF) - 5
- CELF Pre-School
- CELF Metalinguistics
- Pre-School Language Scale
- Comprehensive Assessment of Spoken Language (CASL)
- Peabody Picture Vocabulary Test (PPVT-4)
- WORD-2
- WISC-IV Verbal Comprehension

#### SOCIAL-EMOTIONAL COMPETENCY

**Suggestions:**
- Social Skills Rating System (SSRS)
- Vineland Adaptive Behavior Scales-2
- Adaptive Behavior Assessment System-2 (ABAS-2)
- Scales of Independent Behavior-Revised (SIB-R)
- SFA- School Functional Assessment
- Interviews
- Classroom Observations
### INTERVENTIONS

**SOCIAL-EMOTIONAL COMPETENCY**

**Suggestions:**
- Give clear and simple direction
- Build on existing strengths
- Build in peer feedback and modeling (the client may be more receptive)
- Minimize verbalizations and logical explanations
- Maximize hands-on demonstrations
- Teach strategies and how to use them rather than offering assistance
- Discuss and practice age-appropriate behaviors in real life situations
- Create structured social activities
- Assume limited ability to generalize from one setting to another
- Label the emotion and direct the client to show the acceptable behavior

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**EXECUTIVE FUNCTIONS: REASONING**

**Suggestions:**
- DAS-II
- Non-Verbal
- WISC-IV Perceptual Reasoning Subtests
- WAIS-IV
- K-ABC 2 Nonverbal Scale
- CAS Simultaneous Processing Composite
- Test of Adolescent Problem-Solving (TOPS)
- WJ-III, Verbal Analogies and Analyses-Synthesis

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**EXECUTIVE FUNCTIONS: MENTAL FLEXIBILITY**

**Suggestions:**
- BRIEF
- NEPSY II- Attention and Executive Function
- WJ-III Cognitive- Concept Formation
- D-KEFS
- Assessment Observations
- Parent/teacher interview

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**EXECUTIVE FUNCTION: PLANNING**

**Suggestions:**
- NEPSY II-Attention and Executive Function
- D-KEFS
- WJ-III Cog- planning subtest
- CAS- Planning Composite
- BRIEF
- Assessment Observations
- Parent/teacher interviews

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**INTERVENTIONS**

**EXECUTIVE FUNCTION: PLANNING**

Suggestions:
- Teach the client how to develop a step-by-step guide for problem solving by identifying the problem, considering relevant information, listing and evaluating possible solutions, creating a plan of action, and evaluating the plan of action.
- Provide step-by-step visual directions and instructions.
- Teach use of graphic organizers and other planning strategies to organize their thoughts.
- Model appropriate planning by verbalizing your own step-by-step process as you complete a task.
- Teach time management and prioritizing.
- Teach how to develop short term and long term goals.
- Support student in connecting new information with what they already know.

**EXECUTIVE FUNCTION: ORGANIZATION**

Suggestions:
- Establish a daily routine as much as possible; the ability to predict what is going to be happening will help the client organize their behavior better.
- Teach the client how to develop a step-by-step guide for problem solving by identifying the problem, considering relevant information, listing and evaluating possible solutions, creating a plan of action, and evaluating the plan of action.
- Use visual schedules, planners, checklists, or electronic organizers to help them organize their day and prepare themselves for transitions.
- Help the client break down long-term and larger projects. Start with the due date and then work backwards to determine when the smaller steps need to be completed. Mark those dates in their planner or on a calendar.

**ANTECEDENT MANAGEMENT**

Thus, behavior management techniques can be classified into two categories:
1. Antecedent strategies, which are used before a behavior occurs in an effort to prevent or elicit a behavior, and
2. Consequent strategies, which are used after a behavior occurs in an effort to prevent the continuation and recurrence of a behavior or to reinforce a behavior.

Although both can be effective, antecedent techniques are used more often than consequent strategies with older adults, persons with disabilities and students with executive functioning disabilities because they are easier to apply, require less caregiver time, and are generally considered less manipulative, and therefore more acceptable, by caregivers and professionals.

**STEPS IN TEACHING A SKILL**

**FBA – FUNCTION OF THE BEHAVIOR?**
Internal & external environment - Constantly asking …
what about the setting events? Sensory and physical/ emotional dysregulation? What’s the underlying disability or skill deficit?

Teach
Understand language?
Need visual cues?
Have their attention?
Ability to make new learning?
Ability to remember?

Generalize – new places, new people, varied situations – how does that affect the setting events?

FLUID FBA

FBA = FUNCTION OF THE BEHAVIOR?

CONSEQUENCE-BASED STRATEGIES

Thus, behavior management techniques can be classified into two categories:
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Go back to the question of the:
• The environment (setting events?)
• The function of the behavior
• The teaching of the skill
• The generalization of the skill

Behavior charts (use of rewards) and Behavior Plans (use of consequences – “do this …or else”) presupposes “skill is in place and will is at play”

A Behavior Contract is NOT a Behavior Intervention Plan (BIP)
A Behavior Plan is consequence based, a BIP is a treatment plan

After you are 100% sure the student has:
• acquired the skill
• generalized the skill

Then it is OK to strengthen the skill with reinforcement.

However...
If you find you are using reinforcers too often to sustain the desired behavior...

GO BACK TO THE QUESTION OF SKILL