Online Learning Modules:
Understanding the Brain

COLORADO
Department of Education

Provided by:

The Exceptional Student Services Unit

Brain Injury Team

The Building Blocks of Brain Development© & Neuroeducational Evaluation

Heather Hotchkiss, MSW
Principal Brain Injury Specialist

Speaker: Heather Hotchkiss, MSW

- Principal Brain Injury Specialist – Colorado Department of Education, Exceptional Student Services Unit
- Dually credentialled as a Director of Special Education and School Social Worker

<u>Past Experience:</u>

- Special Education Director & Coordinator
- Specialized Assessment, Autism, Brain Injury, Transition & Behavior Team Coordinator
- Mental Health Consultant
- RtI Coordinator
- School Social Worker
- MH Clinician - Dual Diagnosis Treatment Facility (for Adults) & Locked Adolescent Mental Health Acute Care Unit
- Teacher Assistant

Who are we talking about?

Kids with…

Brain Architecture

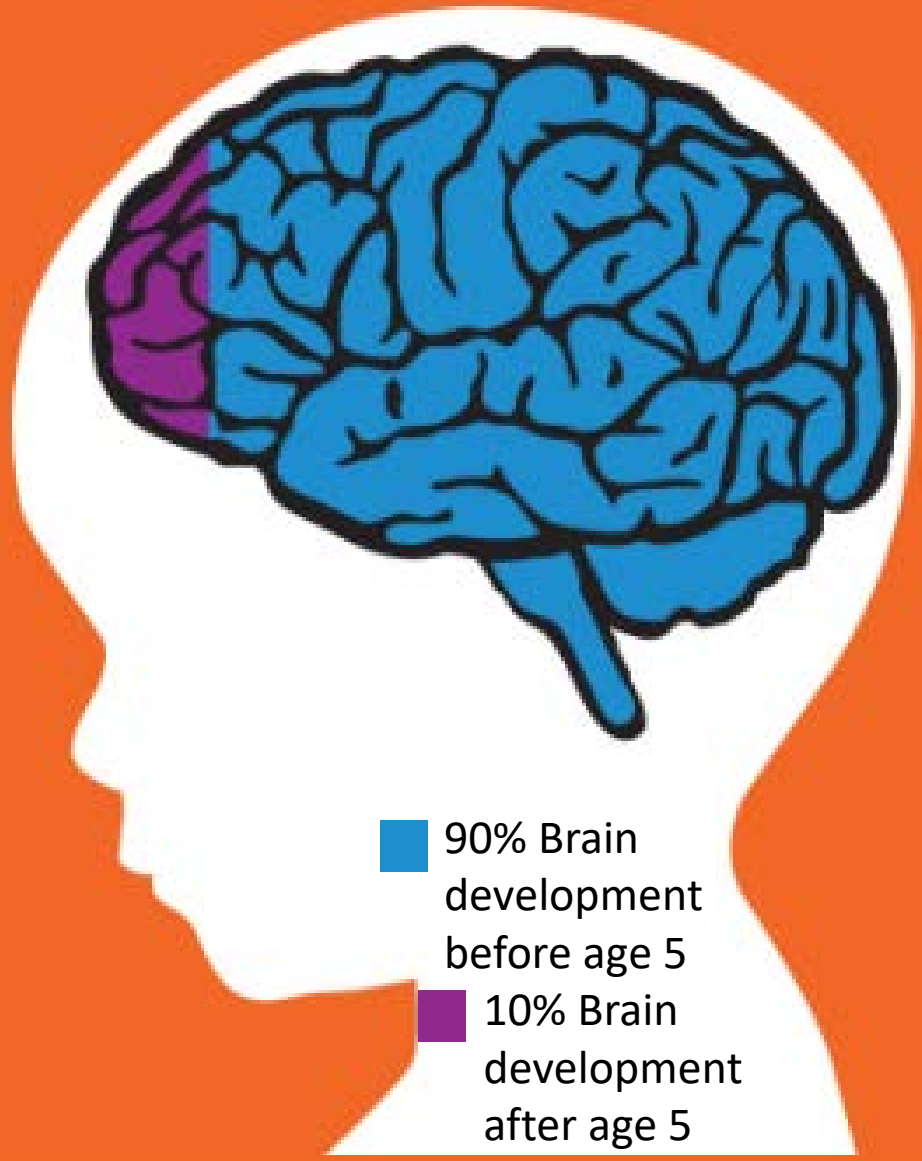
Early experiences affect the development of **brain architecture**

- provides the foundation for all future learning, behavior, and health.
- adverse experiences early in life can impair brain architecture, with negative effects lasting into adulthood.

Source: Harvard Center for the Developing Child

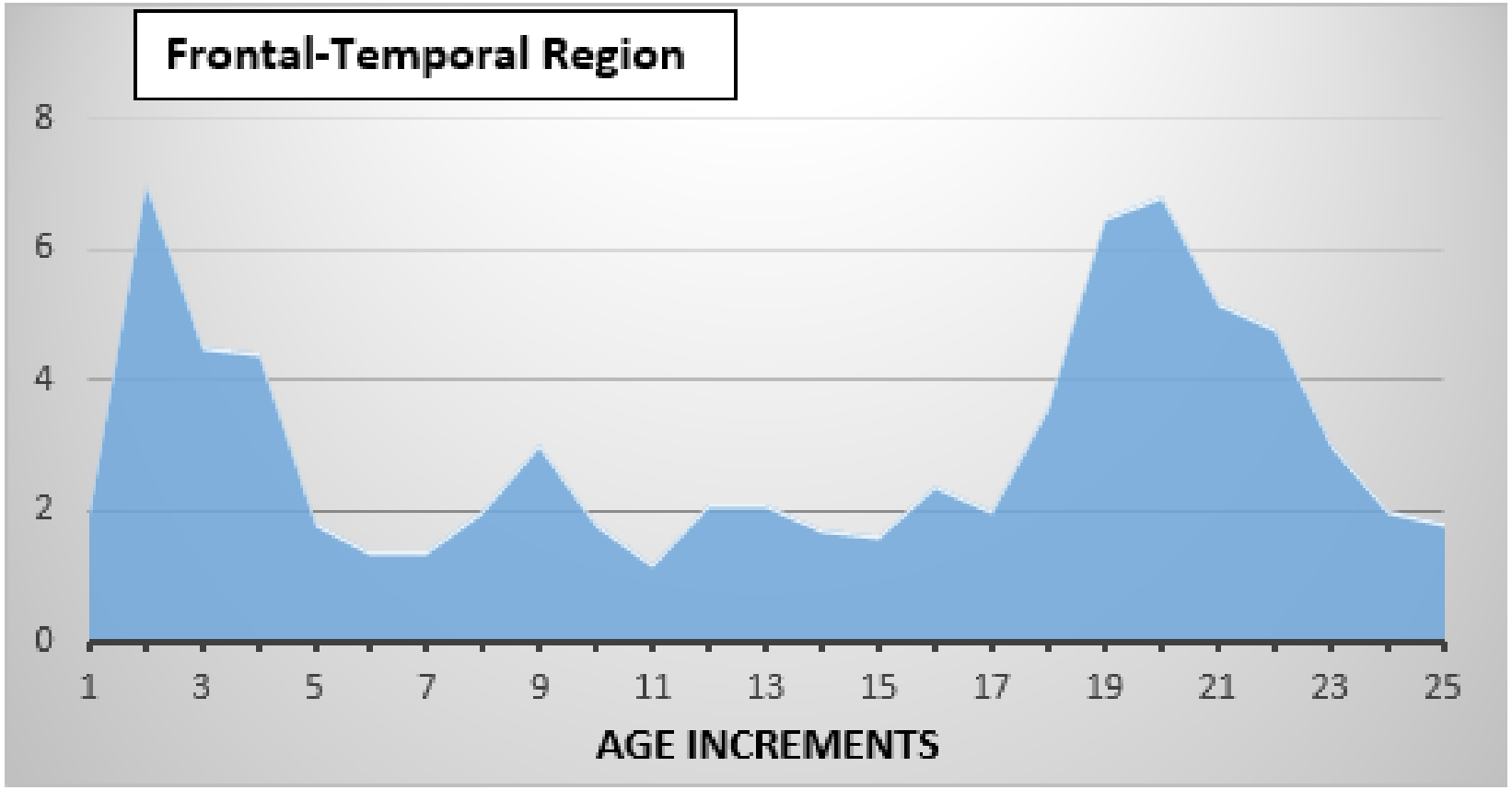
90%

of a child's brain development happens before age 5



Source: Harvard Center for the Developing Child

Maturation



(Adapted from Savage, 1999)

Brains are built over time from the bottom up

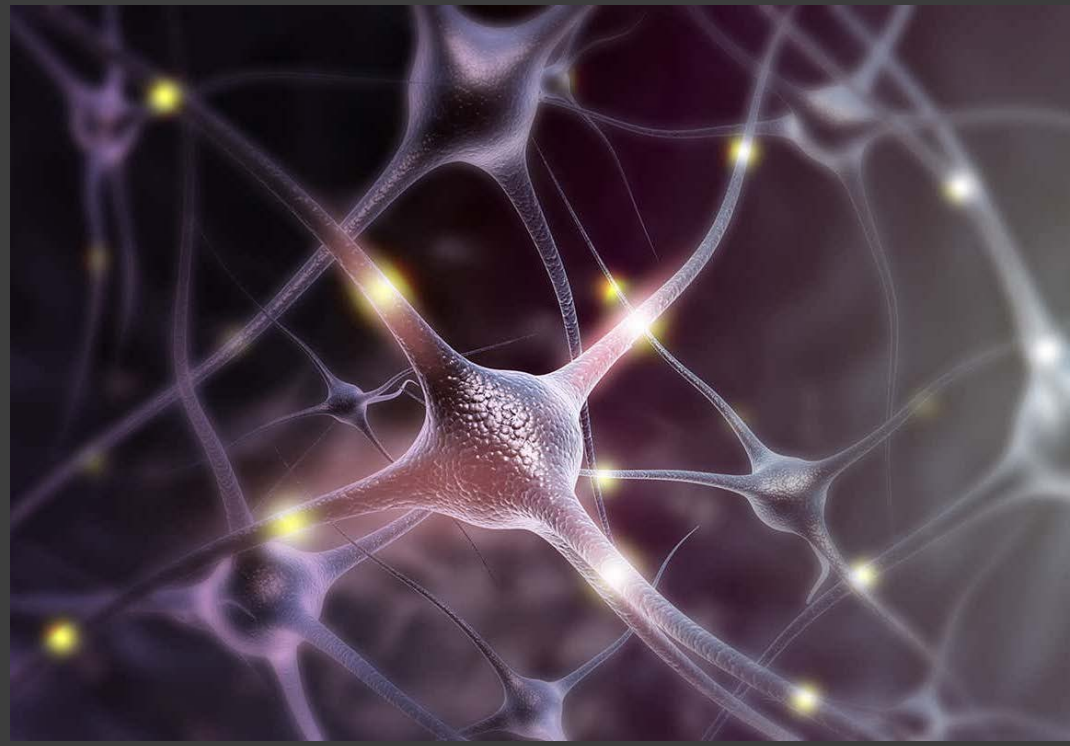
- An ongoing process that begins before birth and continues into adulthood.
- Simpler neural connections and skills form first, followed by more complex circuits and skills.
- In the first few years of life, 700 to 1,000 new neural connections form every second.
- After this period, connections are reduced through a process called pruning, which allows brain circuits to become more efficient.

Source: Harvard Center for the Developing Child

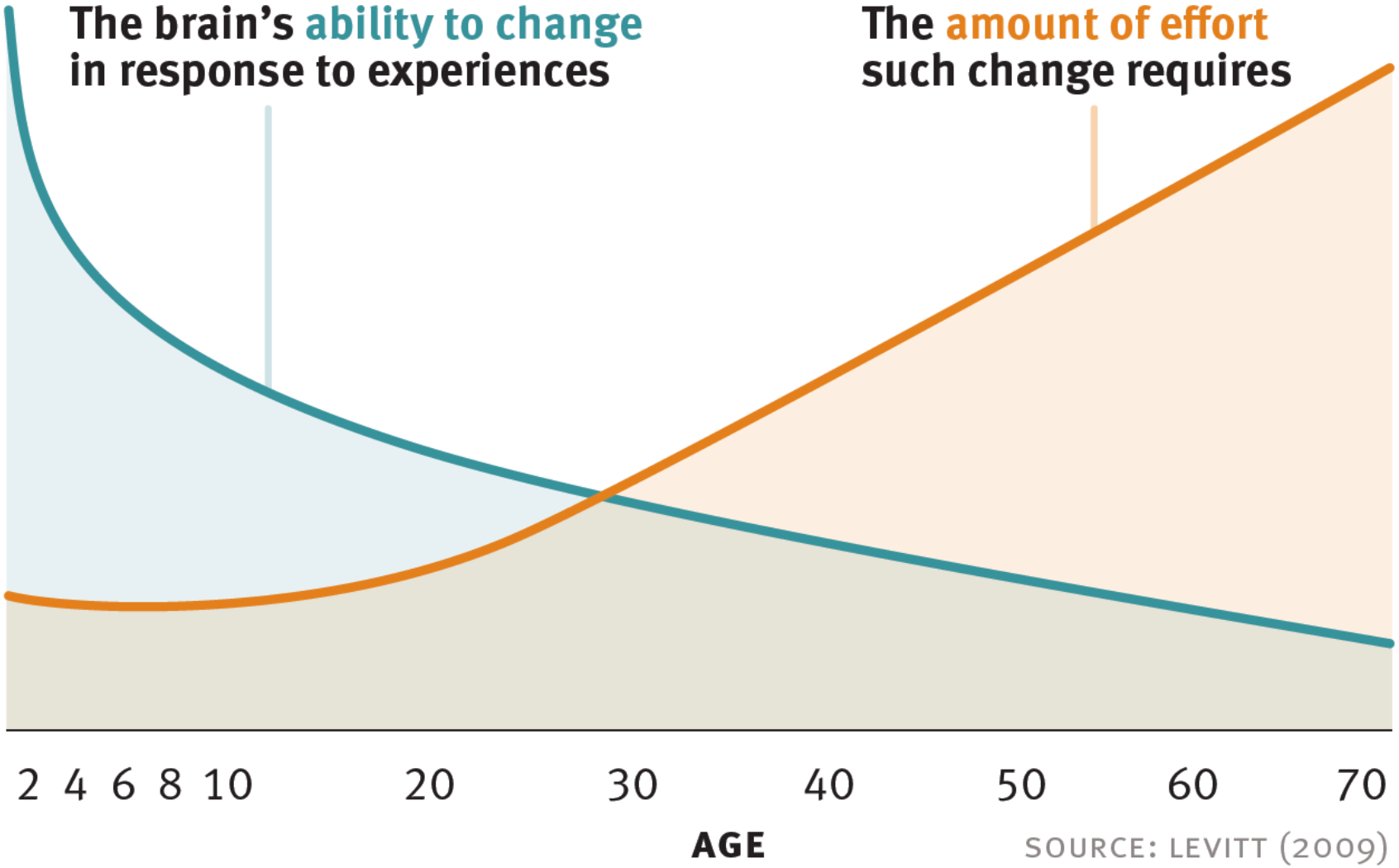
Billions of Connections

Brain architecture is comprised of billions of connections between individual neurons across different areas of the brain.

- Enable lightning-fast communication among neurons that specialize in different kinds of brain functions.
- The early years are the most active period for establishing neural connections, but new connections can form throughout life and unused connections continue to be pruned.
- The connections that form early provide either a strong or weak foundation for the connections that form later.



Source: Harvard Center for the Developing Child



Center on the Developing Child HARVARD UNIVERSITY

www.developingchild.harvard.edu

Complex Problem Solving Machine

COMPETENT LEARNER

EFFECTIVE COMMUNICATOR

ADAPTABLE

BORN SURVIVOR

Survival by Adoption, Adaption and Maturation

Source: Harvard Center for the Developing Child

Toxic stress weakens the architecture

- Experiencing stress is an important part of healthy development.
- Toxic stress can “reset” the body’s response system.
- This can lead to lifelong learning, behavior, physical and mental health issues.
- This can impair the development of neural connections, especially in the areas of the brain dedicated to higher-order skills.

Source: Harvard Center for the Developing Child

How Early Childhood Experiences Affect Lifelong Health and Learning

Ongoing, severe stress and adversity in early childhood is connected to chronic disease in adults. What can we do about it? In this animated video, narrated by Center on the Developing Child Director Jack P. Shonkoff, M.D., learn what the latest science tells us about how early experiences affect not only early learning and school readiness, but also lifelong health. Understand the effects of adversities such as poverty, discrimination, systemic racism, exposure to violence, and child maltreatment, abuse, and neglect on the developing brain and many other systems in the body. Challenge yourself to think about how we can use policies and resources to address the sources of these problems.

https://developingchild.harvard.edu/resources/how-early-childhood-experiences-affect-lifelong-health-and-learning

Why Do Disruptions in Brain Development Occur?

COLORADO
Department of Education

Some Causes of Differences, Disruptions or Gaps

- Genetics
- Prenatal Development (before or during birth)
  - Substance Exposure in Utero
  - Lack of blood flow or oxygen
- Early childhood experiences
  - Nutrition
  - Adverse Childhood Experiences (ACEs)
  - Trauma
- Acquired Brain Injury (after birth)
  - Traumatic Brain Injury (TBI) – external force (e.g., falls)
  - Non-Traumatic Brain Injury (nTBI) – internal event (e.g., stoke)
- Bio-chemical (habituation, sensitization)

Alcohol use during pregnancy can lead to lifelong effects.

Up to 1 in 20 US school children may have FASDs.

People with FASDs can experience a mix of the following problems:

Physical issues

- low birth weight and growth
- problems with heart, kidneys, and other organs
- damage to parts of the brain

Which leads to...

Behavioral and intellectual disabilities

- learning disabilities and low IQ
- hyperactivity
- difficulty with attention
- poor ability to communicate in social situations
- poor reasoning and judgment skills

These can lead to...

Lifelong issues with

- school and social skills
- living independently
- mental health
- substance use
- keeping a job
- trouble with the law

Drinking while pregnant costs the US $5.5 billion (2010).

SOURCES: CDC Vital Signs, February 2016. American Journal of Preventive Medicine, November 2015.

Why focus on children's stress?

Because too much stress:

- Makes it more difficult for children to get along with others
- Interferes with children's ability to focus, think and learn
- Has a profound effect on children's physical, emotional and mental health

By helping children learn positive coping strategies to deal with stress, you can help:

- build resiliency and,
- prevent escalation to distress, anxiety and meltdowns.

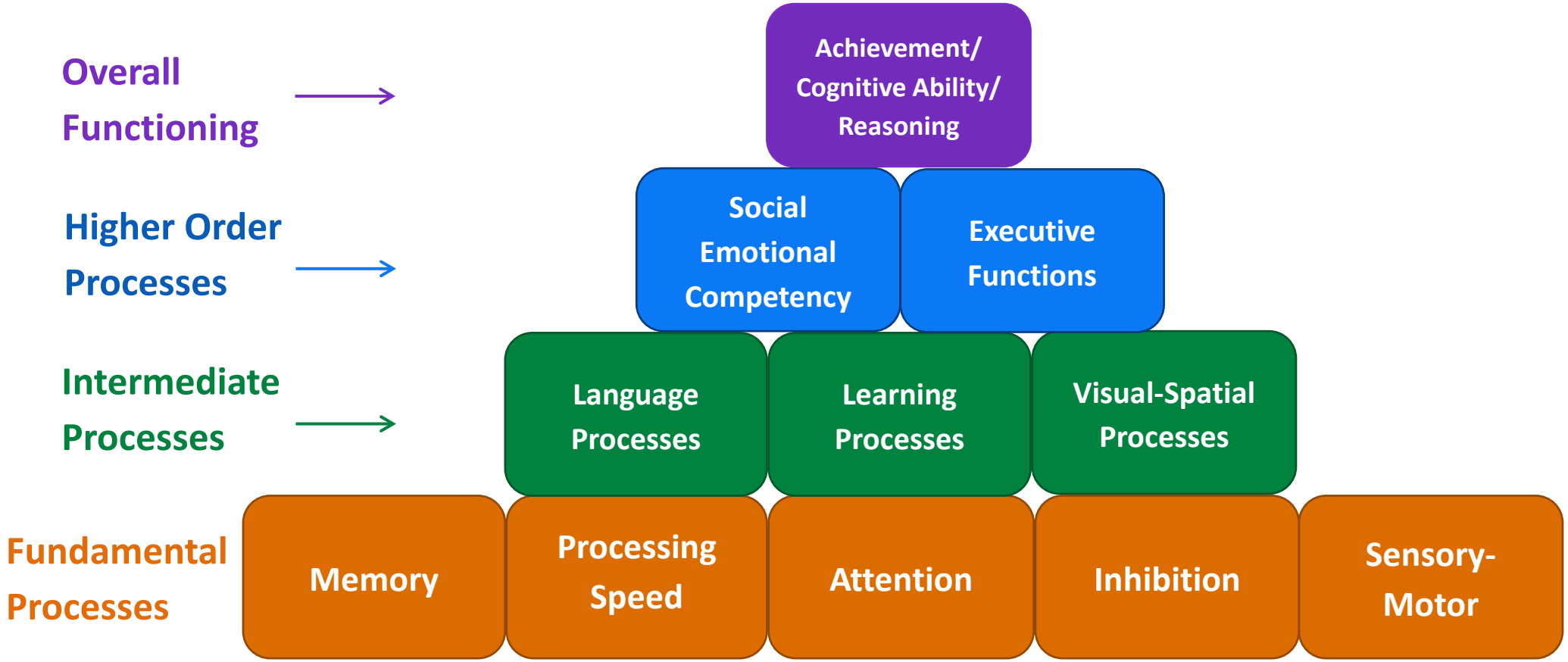
www.psychologyfoundation.org/Public/Public/Programs/Kids_Have_Stress_Too/Kids_Have_Stress_Too_.aspx

Building Blocks of Brain Development©

Colorado Brain Injury Steering Committee

- Neuroscience, research, neuro-cognitive processes and assessment
- No ONE model of neurocognitive development
- Simplistic framework that describes the complexity of neurocognitive functioning and inter-relatedness.
- Simple way for parents and educators to understand the brain, and how learning and behavior can be affected
- Neuroeducational model – multidisciplinary teams CAN do this.
- Three components: Cognitive Processes/Building Blocks, Assessments, Interventions
- If we understand the BRAIN, we understand learning and behavior

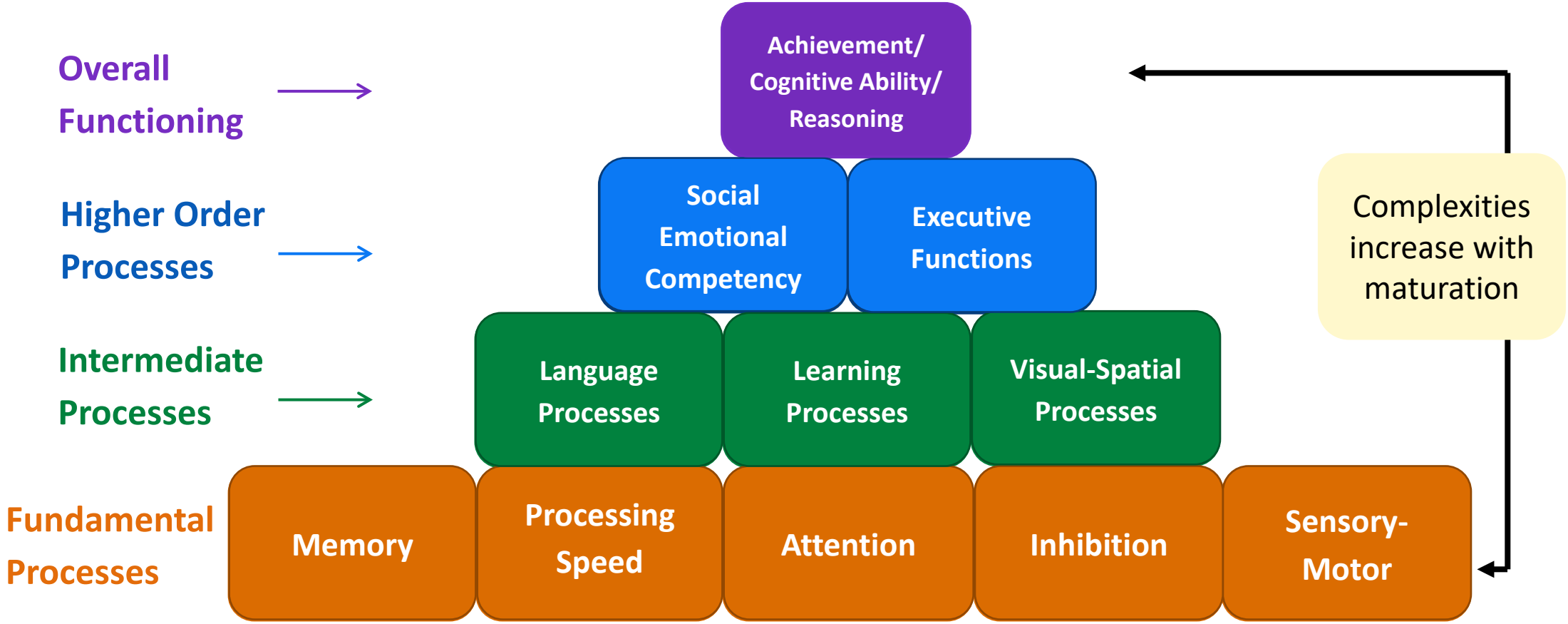
Building Blocks of Brain Development©



The Hierarchy of Neurocognitive Functioning © - created by Peter Thompson, Ph.D. 2013, adapted from the works of Miller 2007; Reitan and Wolfson 2004; Hale and Fiorello 2004.

The Building Blocks of Brain Development © – further adapted by the CO Brain Injury Steering Committee, 2016.

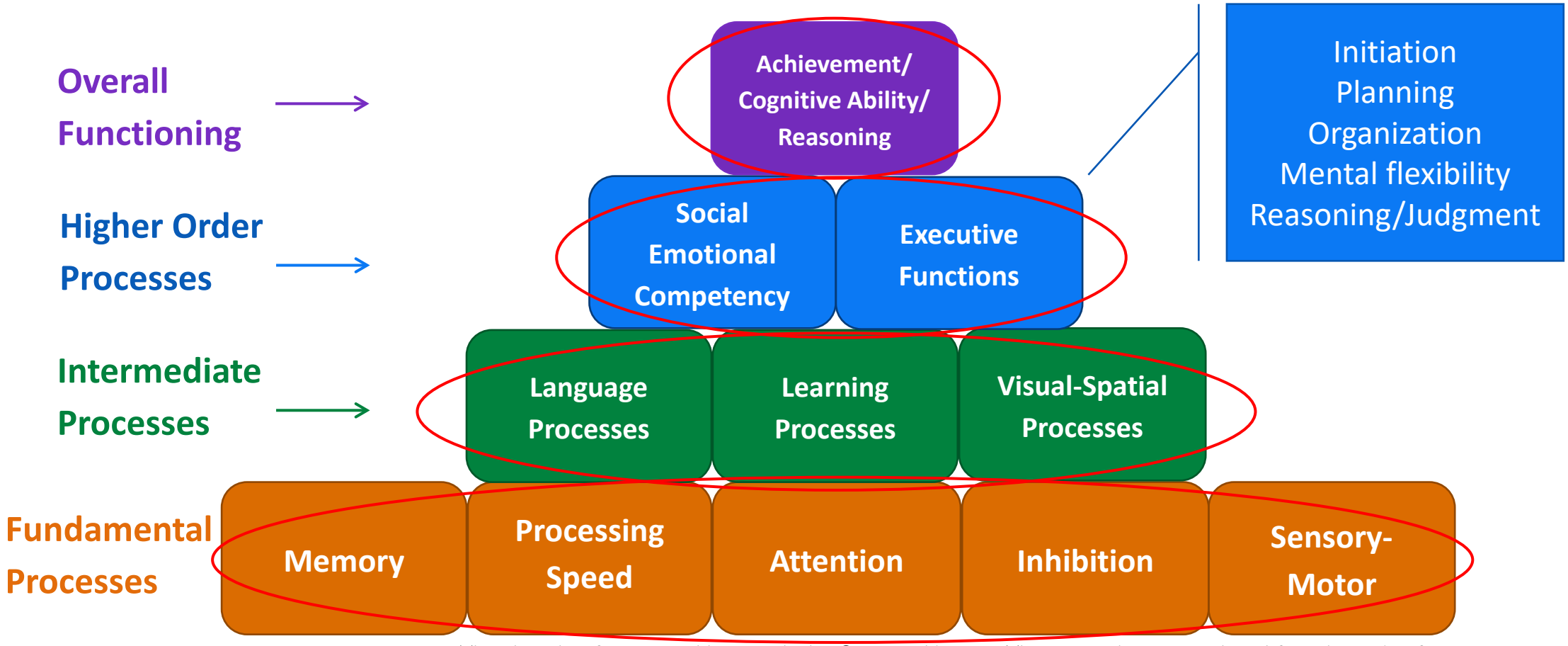
Building Blocks of Brain Development©



The Hierarchy of Neurocognitive Functioning © - created by Peter Thompson, Ph.D. 2013, adapted from the works of Miller 2007; Reitan and Wolfson 2004; Hale and Fiorello 2004.

The Building Blocks of Brain Development © – further adapted by the CO Brain Injury Steering Committee, 2016.

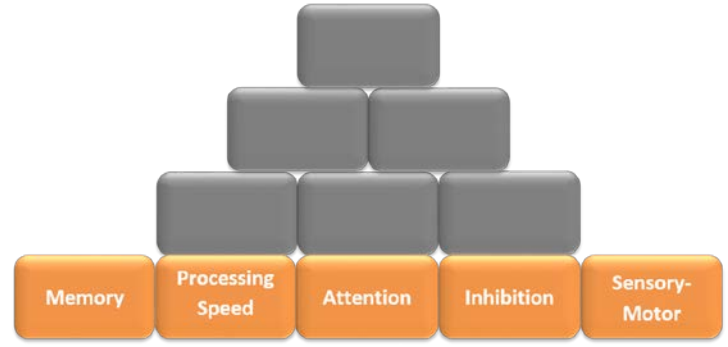
Building Blocks of Brain Development©



The Hierarchy of Neurocognitive Functioning © - created by Peter Thompson, Ph.D. 2013, adapted from the works of Miller 2007; Reitan and Wolfson 2004; Hale and Fiorello 2004.

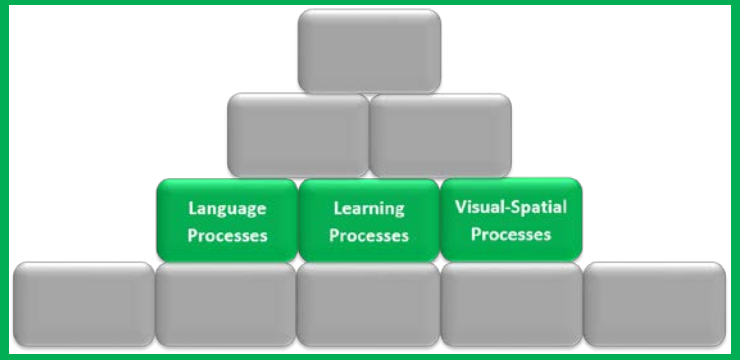
The Building Blocks of Brain Development © – further adapted by the CO Brain Injury Steering Committee, 2016.

Fundamental Building Blocks



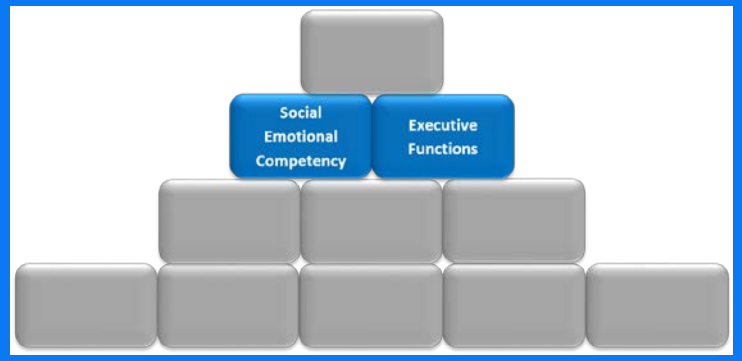
- Attention: *The ability to sustain focus on the information necessary for learning or completing tasks*
- Inhibition: *The ability to inhibit, block or hold back an impulse.*
- Processing Speed: *How quickly information is received, processed, and/or outputted.*
- Memory: *The mental ability to store and retrieve words, facts, procedures, skills, concepts and experiences.*
- Sensory Processing: *Perceiving and responding to what is seen, heard, smelled, tasted, felt and touched, as well as our sense of balance (vestibular) and our "position sense" (proprioception).*

Intermediate Building Blocks



- Language:
  - *Receptive: The ability to understand language.*
  - *Expressive: The ability to express one's thoughts and feelings into words and sentences.*
  - *Social Pragmatic: The verbal and nonverbal rules of social language and interactions.*
- Learning: *The ability to learn new concepts and information.*
- Visual-Spatial: *The ability to generate, retain, retrieve and transform well-structured visual images.*

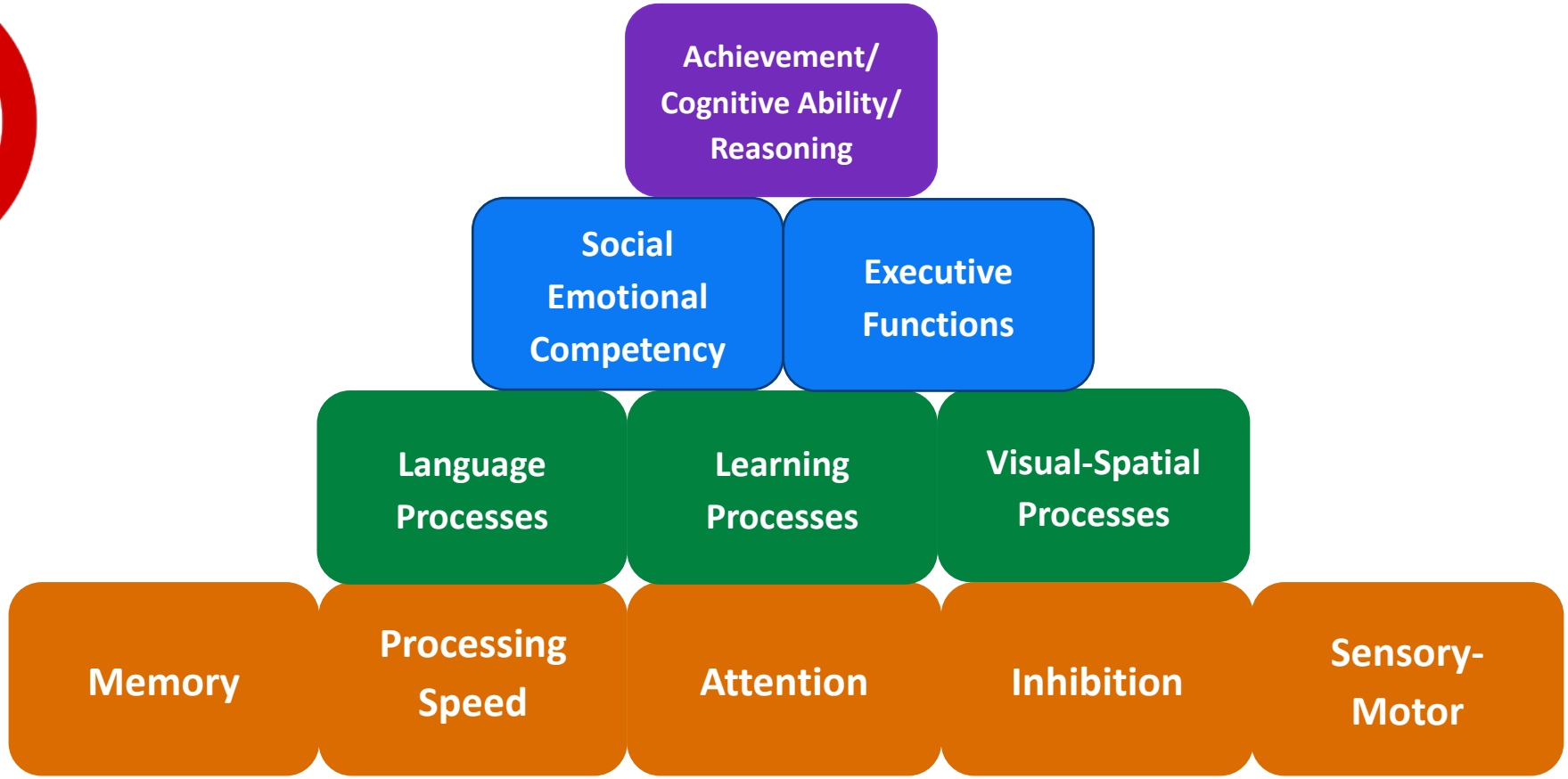
Higher Order Building Blocks



- Social Emotional Competency: *The awareness of social issues and one's emotional status. Behavioral self-regulation, control and self-monitoring are also part of this domain.*

- Executive Function: *deliberate and controlled mental functioning*
  - ***Initiation*** *- The ability to independently start an action or activity.*
  - ***Mental Flexibility*** *- The ability to easily shift from one idea, train of thought, activity or way of looking at things.*
  - ***Planning*** *- The ability to set a goal, identify a sequence of actions to reach the goal and carry out that sequence of steps.*
  - ***Organization*** *- The ability to create and maintain orderliness in thoughts, activities, materials and the physical environment.*
  - ***Reasoning*** *- The use of deliberate and controlled mental operations to solve novel and on the spot problems*

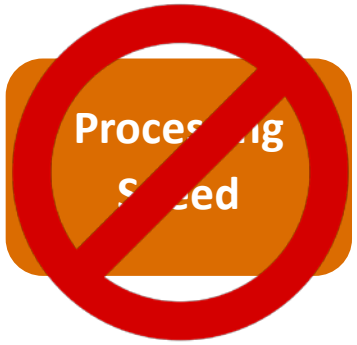
Building Blocks of Brain Development©



The Hierarchy of Neurocognitive Functioning © - created by Peter Thompson, Ph.D. 2013, adapted from the works of Miller 2007; Reitan and Wolfson 2004; Hale and Fiorello 2004.

The Building Blocks of Brain Development © – further adapted by the CO Brain Injury Steering Committee, 2016.

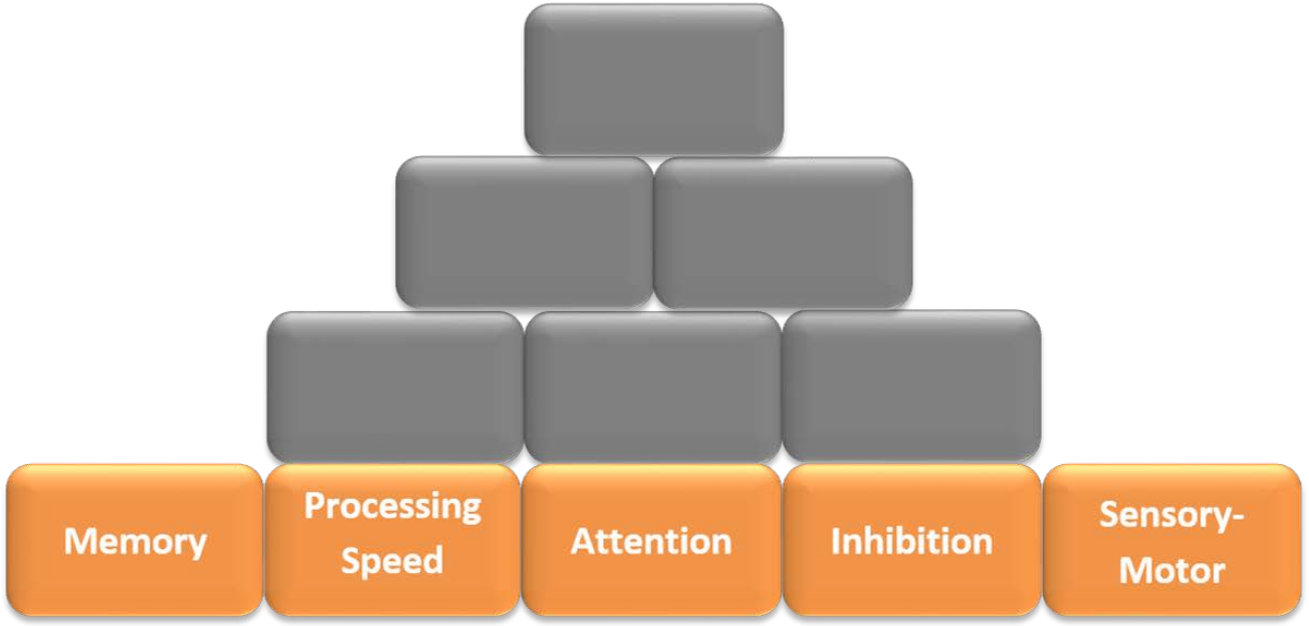
Building Blocks of Brain Development©



The Hierarchy of Neurocognitive Functioning © - created by Peter Thompson, Ph.D. 2013, adapted from the works of Miller 2007; Reitan and Wolfson 2004; Hale and Fiorello 2004.

The Building Blocks of Brain Development © – further adapted by the CO Brain Injury Steering Committee, 2016.

Fundamental Building Blocks



Memory

Fundamental Processes

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.
- There are several types of memory, including short-term, long-term, working, visual, auditory, procedural, and declarative.
- 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.

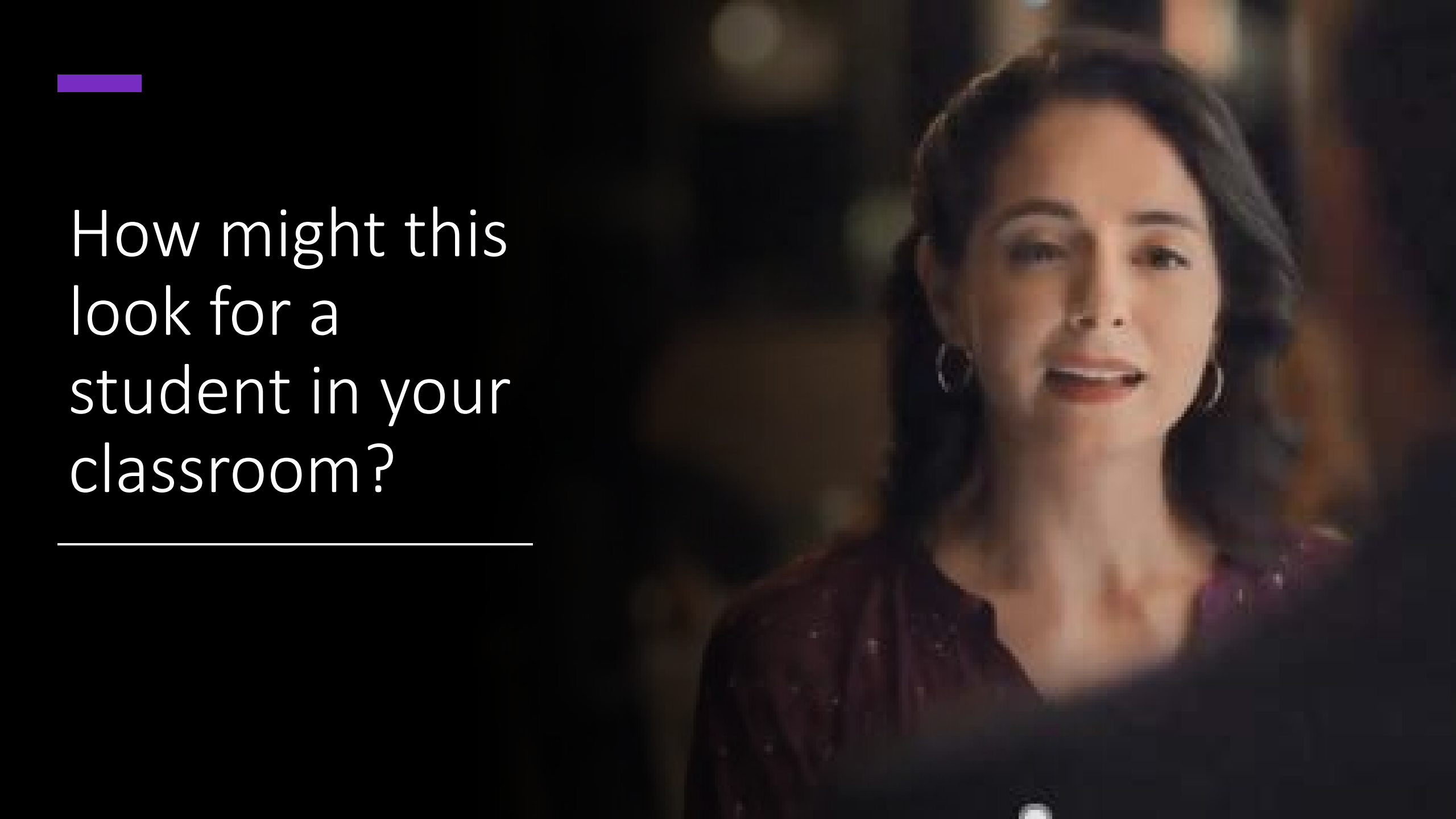
Processing Speed

Fundamental Processes

Processing Speed: *How quickly information is received, processed, and/or outputted.*

- 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 or disruption, 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 affected area (this takes longer).

How might this look for a student in your classroom?



Attention

Fundamental Processes

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.

Inhibition

Fundamental Processes

Inhibition: *The ability to inhibit, block or hold back an impulse.*

- Inhibition is associated with the attention process in the brain – it is the ability to inhibit an impulse, long enough to consider multiple thoughts and behavioral options so that a more adaptive behavioral choice can be made.
- This process may be referred to as “mental brakes”, “a filter” or the ability to “think before you act”.

Sensory Motor

Fundamental Processes

Sensory Processing: *Perceiving and responding to what is seen, heard, smelled, tasted, felt and touched, as well as our sense of balance (vestibular) and our "position sense" (proprioception).*

- 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.

Sensory Motor

Fundamental Processes

Fine Motor: Involves the use of small muscles of the hands to make smooth, coordinated or fine motions.

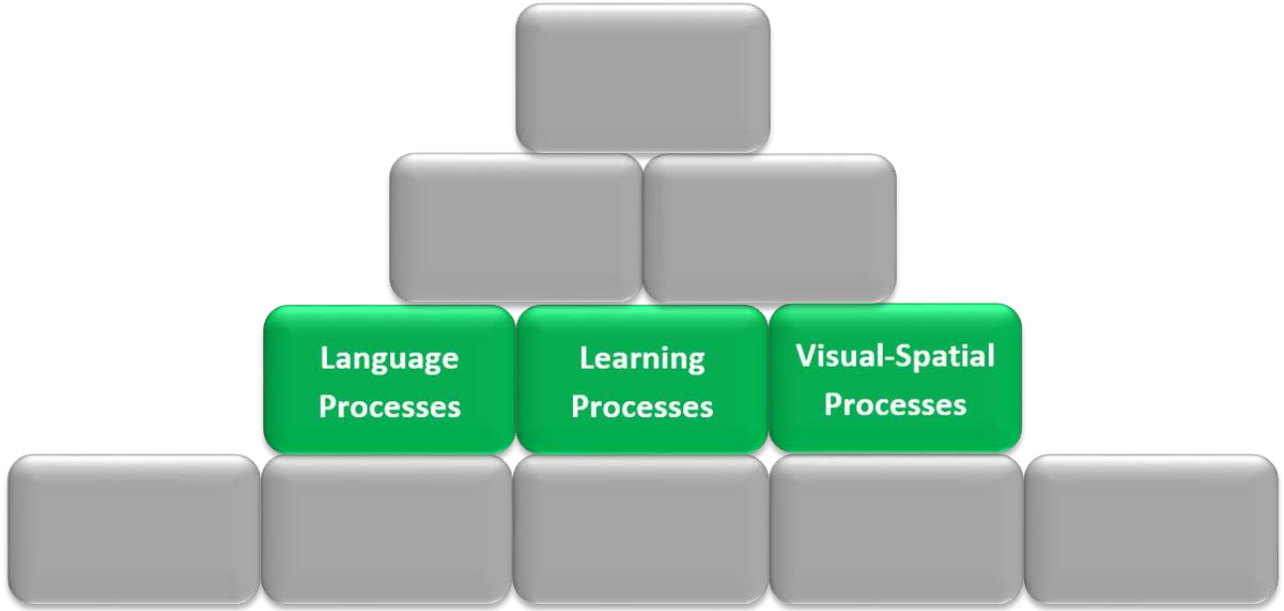
- May produce difficulties with fasteners, coordination, cutting, drawing/handwriting, etc.

Gross Motor: Involves the coordinated use of the large muscles of the body.

- May produce difficulties with posture, carrying objects (e.g., lunch tray), walking/running – bumping into things, stumbling, etc.

“unresolved issues…it’s like having an itch in my brain that I can’t scratch”

Intermediate Building Blocks



Language Processes

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.

Language Processes (continued)

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

- The ability to follow social rules and using or altering communication for social purposes.

Learning Processes

Intermediate Processes

New Learning: *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, it is sent to other areas of the brain so the information can be comprehended on a deeper level.

Visual-Spatial Processes

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. When visual information is processed in the occipital lobe, it divides the information and sends it to the lower left part of the brain (temporal lobe) or to an upper part of the brain called the parietal lobe.
- 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.

Higher Order Building Blocks

Executive Functions: Initiation

Higher Order Processes

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.

Executive Functions: Planning

Higher Order Processes

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 neurological structures involved with regulation, organization, and problem solving, the upper frontal lobe of the brain is intimately tied to planning.

Executive Functions: Organization

Higher Order Processes

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 difficulties with ordering of materials.

Executive Functions: Mental Flexibility

Higher Order Processes

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.

Executive Functions: Reasoning

Higher Order Processes

Reasoning: *The use of deliberate and controlled mental operations to solve novel and on the spot problems*

- 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.

Social Emotional Competency

Higher Order Processes

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.*

- There are two primary areas associated behavioral and emotional regulation.

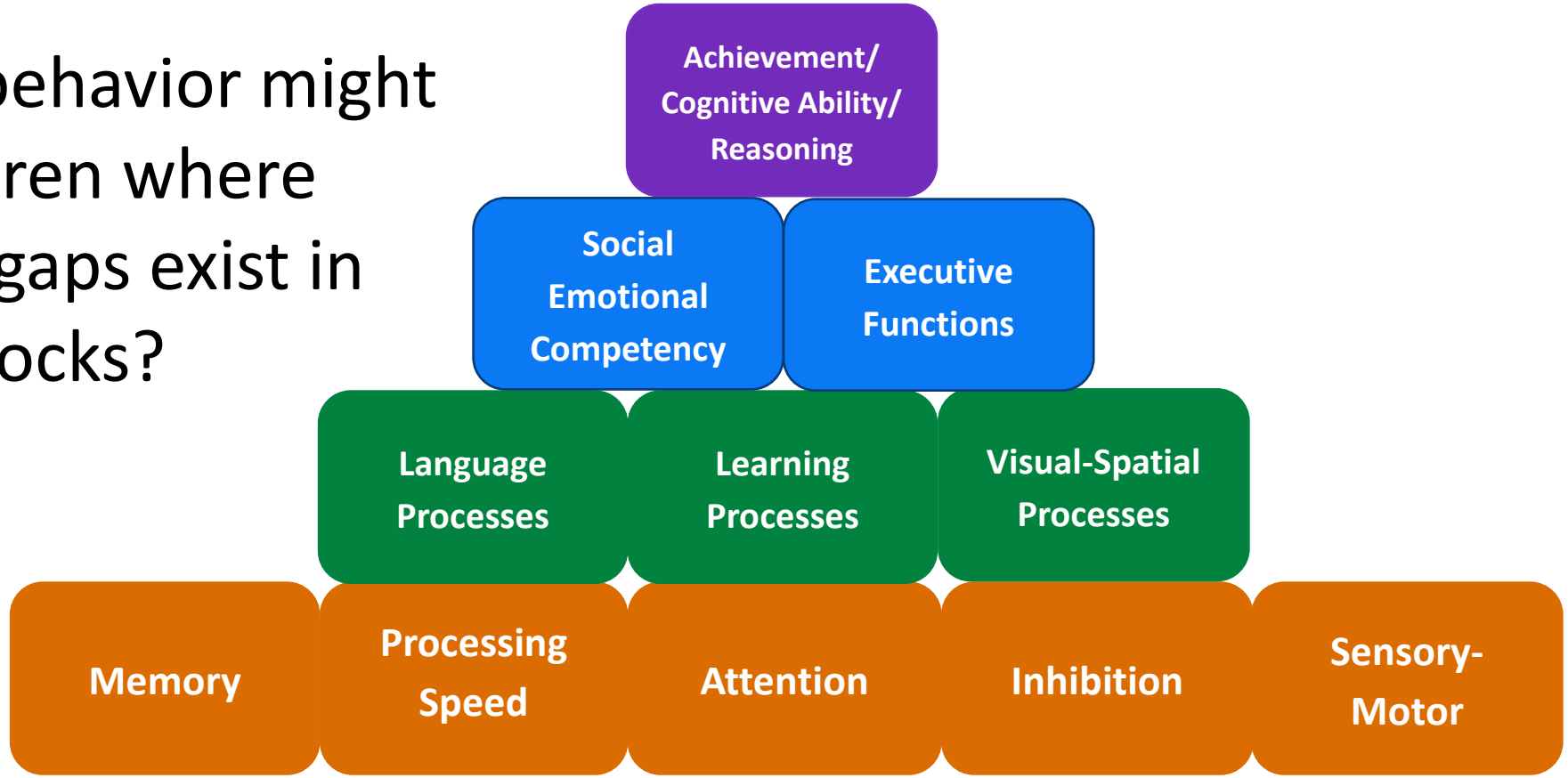
  1) The frontal cortex is implicated in pro-social behaviors and assists with impulse control/inhibition.

  2) The limbic system is associated with the creation of emotions. When these deep brain structures are damaged, the person may develop severe emotional difficulties.

Can you identify some of the Building Blocks that aren’t fully functioning?

Building Blocks of Brain Development©

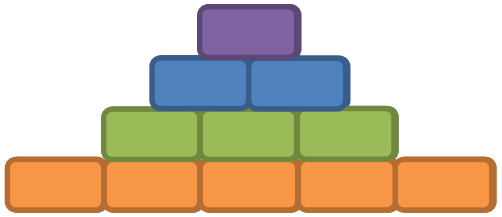
- What type of behavior might we see in children where differences or gaps exist in the Building Blocks?



Building Blocks of Brain Development©

3 Components:

1-Brain Processes (Building Blocks)



2-Assessment/ Evaluation

3-Strategies

ALIGNMENT

http://www.cde.state.co.us/cdesped/sd-tbi

http://cokidswithbraininjury.com/educators-and-professionals/brain-injury-matrix-guide

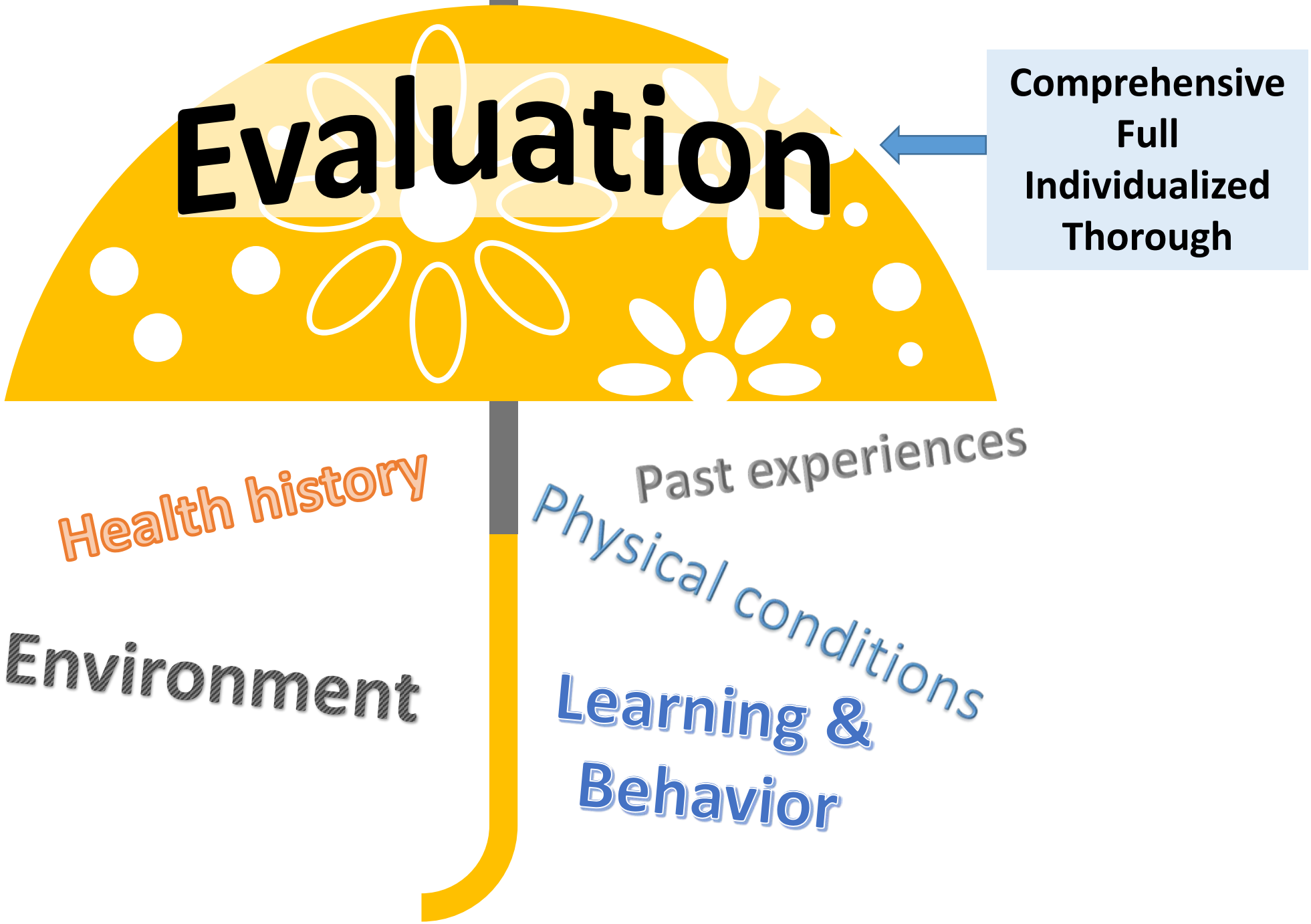
The Golden Thread - the **logical progression** through the body of evidence that weaves throughout a student's educational plan connecting all the pieces to tell a **complete educational story** of the student.

What is Neuroeducational Evaluation?

More than just assessment

More than Eligibility Determination

Provides the NOW WHAT?


Evaluation
Comprehensive
Full
Individualized
Thorough
Health history
Past experiences
Physical conditions
Environment
Learning &
Behavior

Evaluation of

Learning & Behavior

In the school setting

=

Neuroeducational Evaluation

Disruptions may cause UNEVENNESS

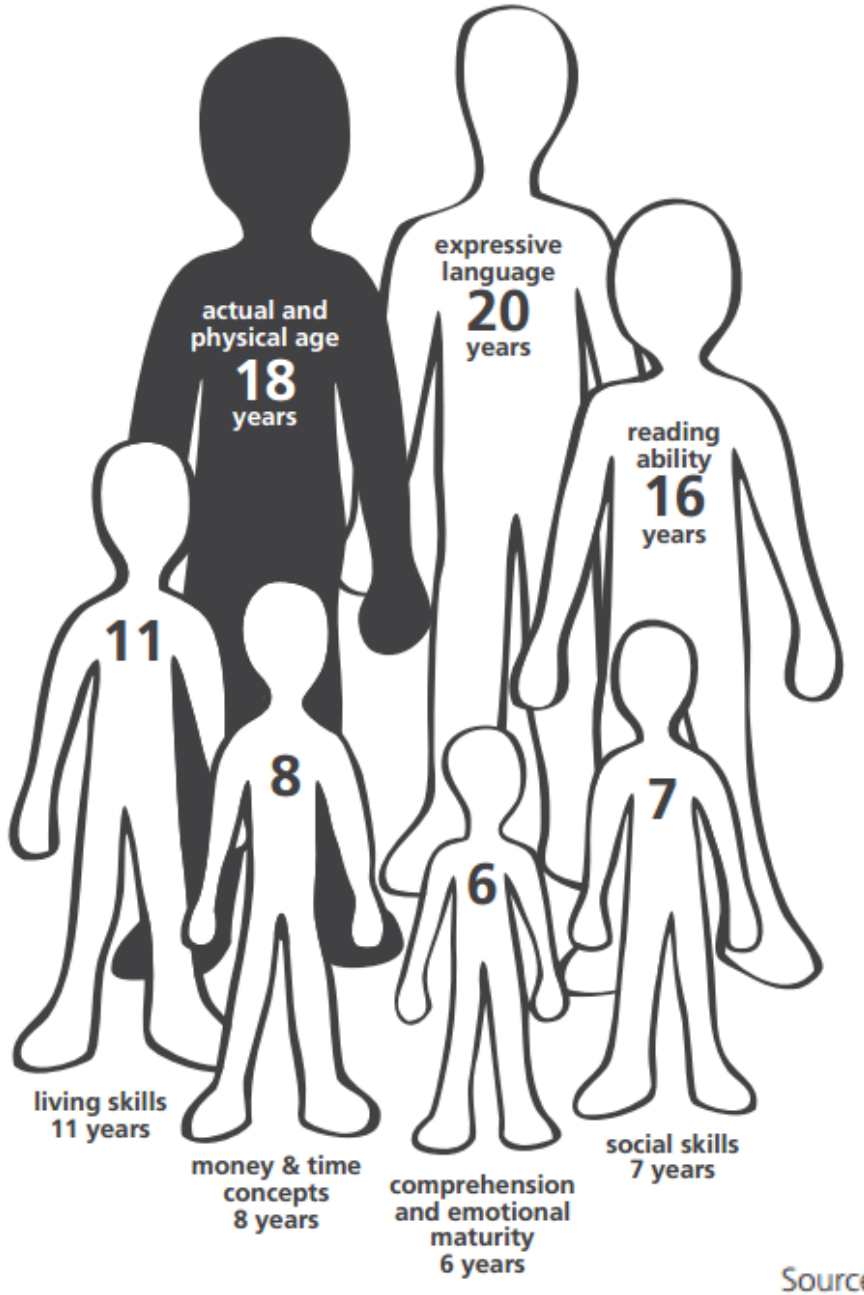
A child's performance can be "**uneven**" across settings, over time, and across content areas.

Examples:

- Across Building Blocks – a 10 yr old shows typical abilities in motor areas but has the social-emotional regulation of a 5 yr old.

- Within Building Blocks – shows above average abilities in expressive language and difficulties with receptive language

- Over time – a student knows material on Tuesday but cannot retrieve the same information later that same week. This is often viewed as opposition.

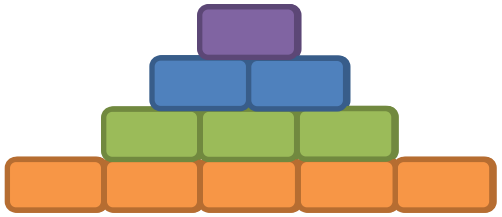


Source: Jodee Kulp
http://www.betterendings.org

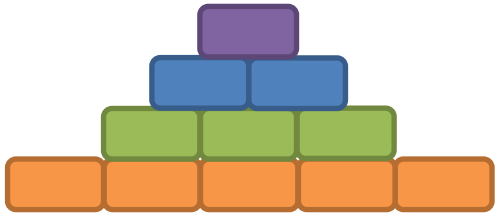
Building Blocks of Brain Development©

3 Components:

1-Brain Processes (Building Blocks)



2-Assessments



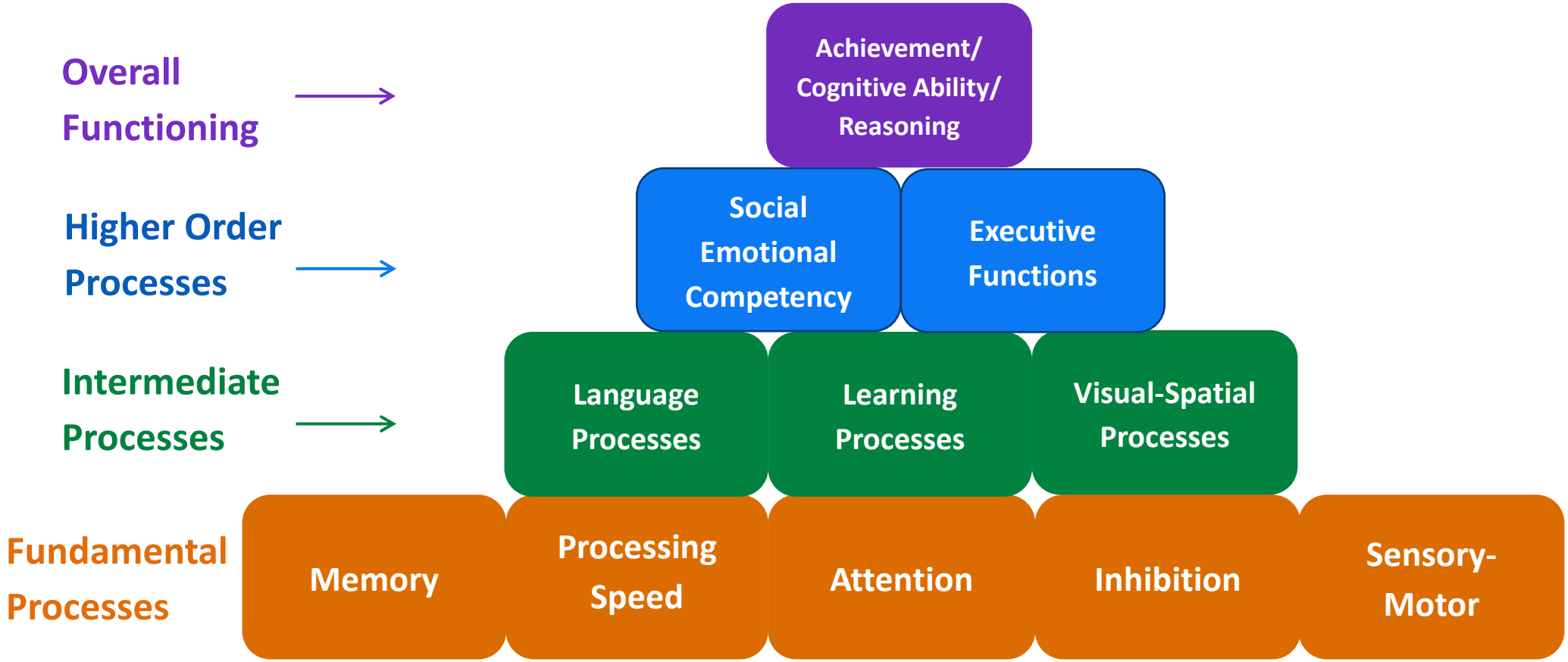
3-Strategies

ALIGNMENT

http://www.cde.state.co.us/cdesped/sd-tbi

http://cokidswithbraininjury.com/educators-and-professionals/brain-injury-matrix-guide

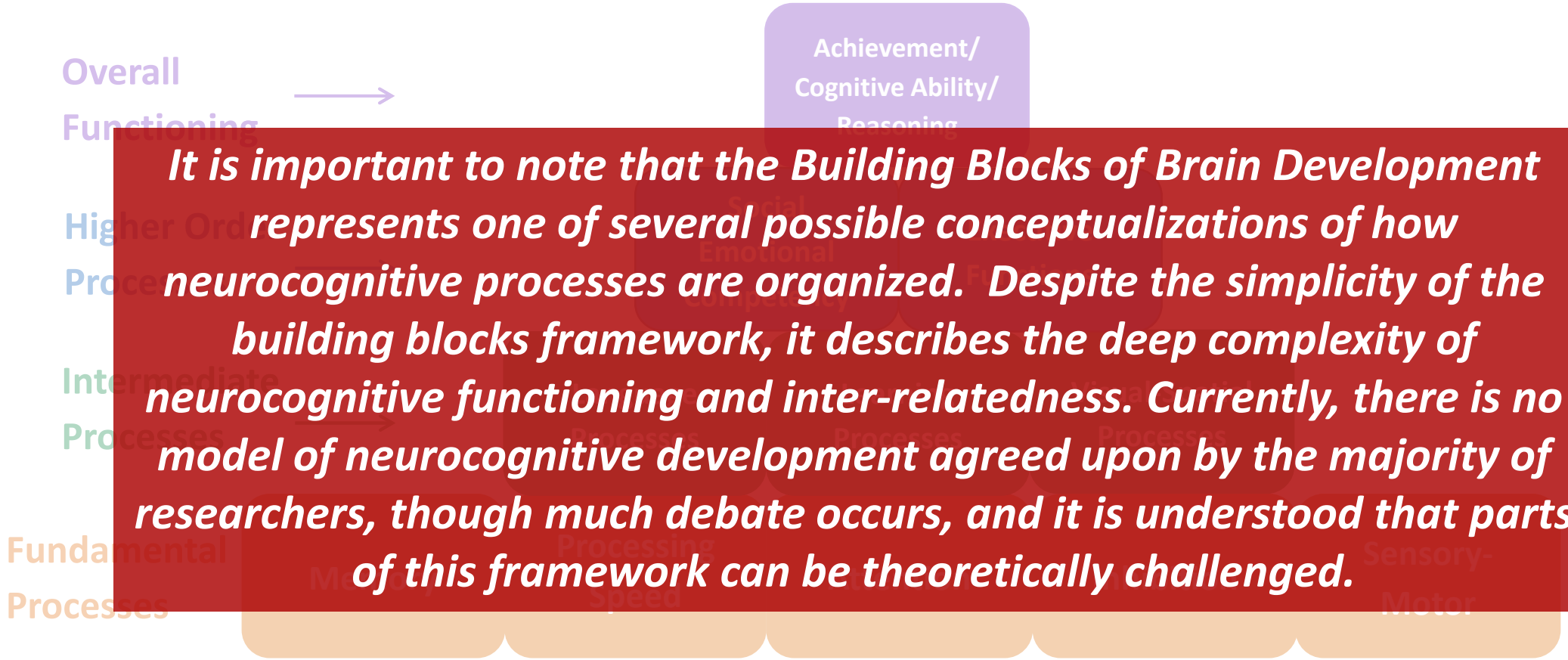
Building Blocks of Brain Development©



The Hierarchy of Neurocognitive Functioning © - created by Peter Thompson, Ph.D. 2013, adapted from the works of Miller 2007; Reitan and Wolfson 2004; Hale and Fiorello 2004.

The Building Blocks of Brain Development © – further adapted by the CO Brain Injury Steering Committee, 2016.

Building Blocks of Brain Development©



It is important to note that the Building Blocks of Brain Development represents one of several possible conceptualizations of how neurocognitive processes are organized. Despite the simplicity of the building blocks framework, it describes the deep complexity of neurocognitive functioning and inter-relatedness. Currently, there is no model of neurocognitive development agreed upon by the majority of researchers, though much debate occurs, and it is understood that parts of this framework can be theoretically challenged.

The Hierarchy of Neurocognitive Functioning © - created by Peter Thompson, Ph.D. 2013, adapted from the works of Miller 2007; Reitan and Wolfson 2004; Hale and Fiorello 2004.

The Building Blocks of Brain Development © – further adapted by the CO Brain Injury Steering Committee, 2016.

Key Points

- Every brain is different
- Our brains are actively developing throughout our 20’s
- Early childhood experiences lay the foundation for lifelong learning, behavior, physical and mental health
- School teams CAN do Neuroeducational Evaluation

Key Points

(Continued)

The Building Blocks of Brain Development:

- Is a simple way for parents and educators to understand the brain, and how learning and behavior can be impacted
- Is based on neuroscience, research, neuro-cognitive processes and assessment
- Has three components:

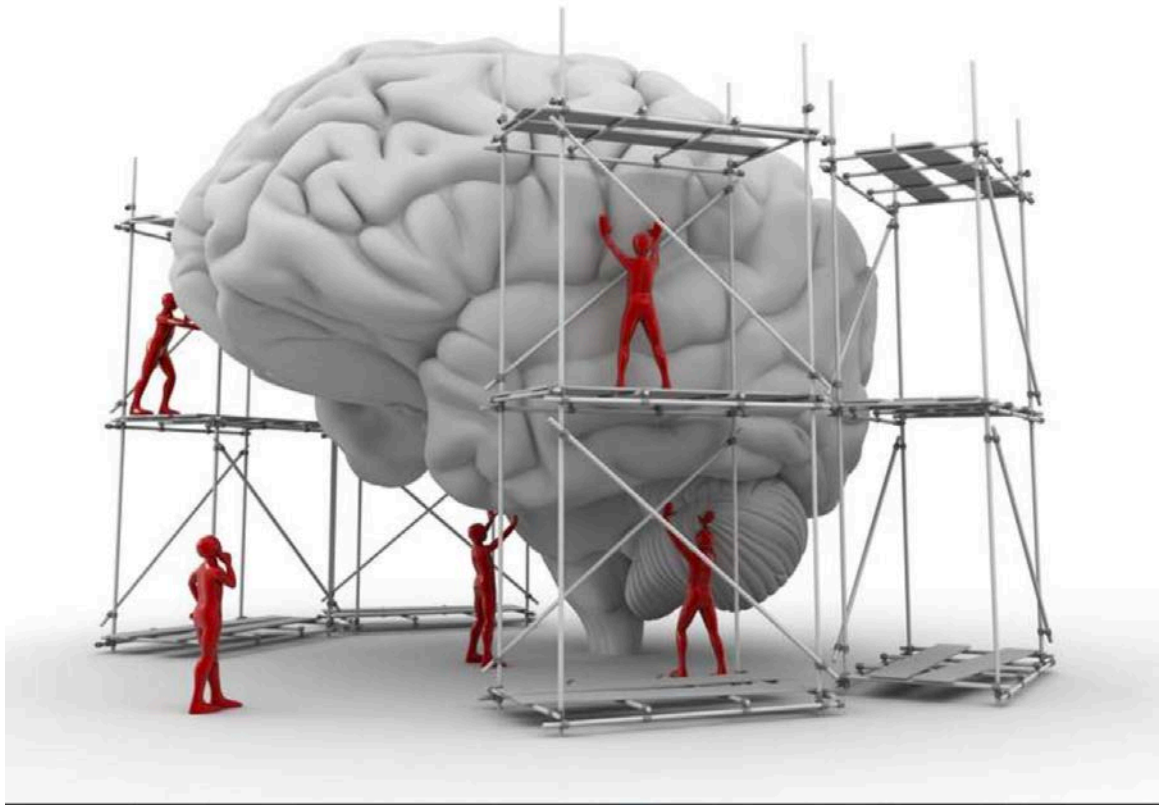
1. Cognitive Processes/Building Blocks,
2. Neuroeducational Evaluation Tools/Assessments, and
3. Strategies to address the gaps

- If we understand the BRAIN, we understand learning and behavior

For more information:

- Building Blocks of Brain Development Overview www.cde.state.co.us/cdesped/sd-tbi_buildingblocks
- Brain Injury in Children & Youth: A Manual for Educators: free online download with the strategies to address gaps http://www.cde.state.co.us/cdesped/sd-tbi
- Colorado Kids Brain Injury Resource Network: Includes an online, user friendly, clickable version of the Building Blocks of Brain Development with the Neuroeducational Evaluation component http://cokidswithbraininjury.com/educators-and-professionals/brain-injury-matrix-guide/

Questions?



Heather Hotchkiss, MSW

Principal Brain Injury Specialist

Exceptional Student Services Unit

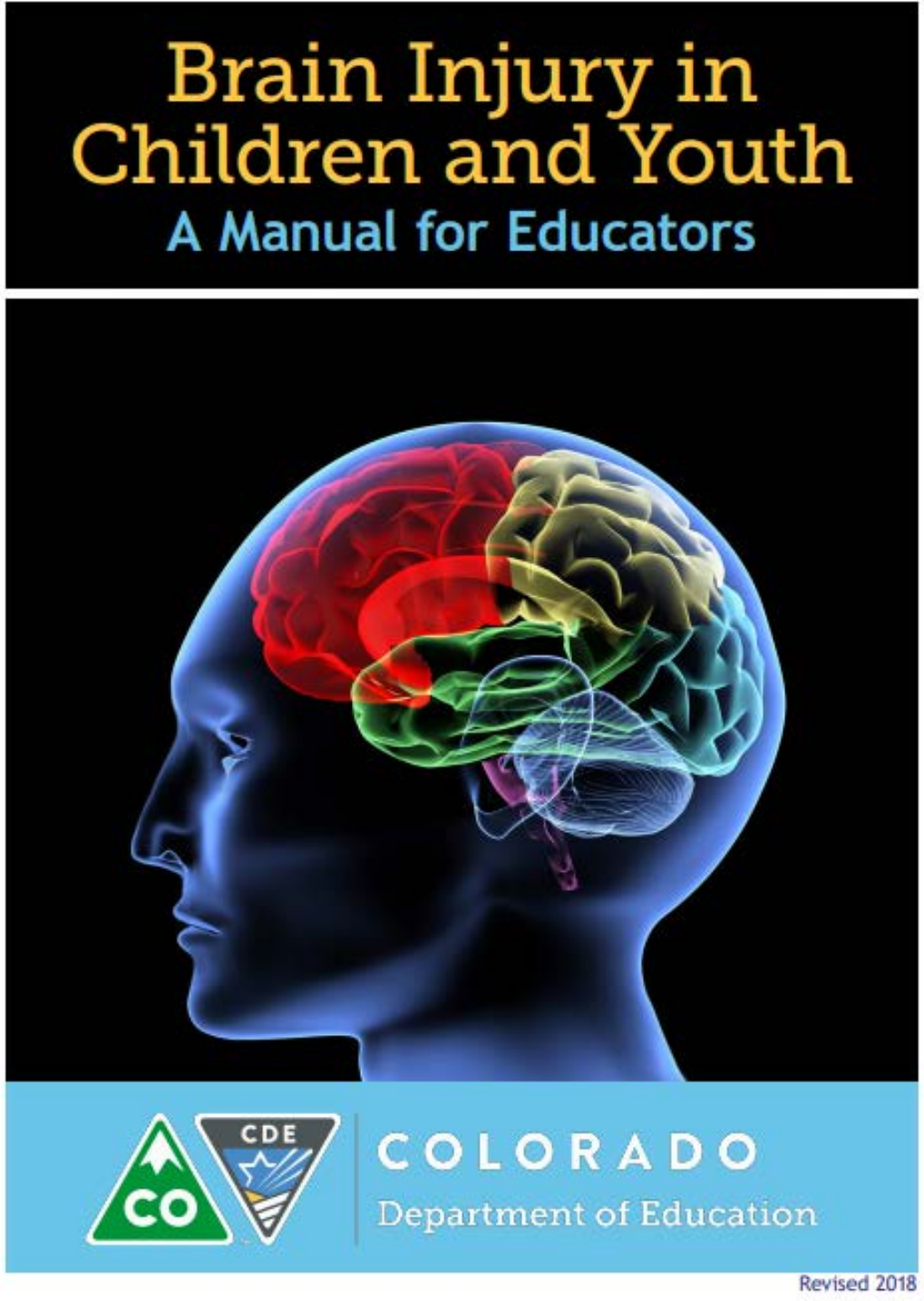
Colorado Department of Education

Hotchkiss_h@cde.state.co.us

303-866.6739

www.cde.state.co.us/cdesped/SD-TBI.asp

www.cde.state.co.us/cdesped/tbi_manual_braininjury



More CO Resources

- CO Department of Education – Exceptional Student Services Unit:
  - Fetal Alcohol Spectrum Disorders (FASD) - http://www.cde.state.co.us/cdesped/fasd
- Article: Neuroeducational Evaluations – The School-Based Answer to Pediatric Neuropsychological Assessments (2017. Crawford, N., Hotchkiss, H., McAvoy, K.)
- Website for Parents and Professionals: www.COKidswithbraininjury.com

BrainSTEPS CO

Strategies Teaching Educators, Parents, & Students

A BRAIN INJURY SCHOOL RE-ENTRY CONSULTING PROGRAM

- Brain Injury School Consulting Program
- In many Districts/BOCES across the state
- Inter-disciplinary Consultation Team
- Trained in brain injury and The Building Blocks of Brain Development©
- Funded in partnership by:

COLORADO Department of Education

MINDSOURCE BRAIN INJURY NETWORK

For more information go to: http://www.cde.state.co.us/cdesped/brainsteps

JOIN US!

- New Teams are trained each year!
- Free Team and Member Resource Kits
- Free trainings, coaching & consultation
- Access to the CDE provided Online Reporting for BrainSTEPS (ORBS) database resource

http://www.cde.state.co.us/cdesped/brainsteps

Brain Injury Alliance COLORADO

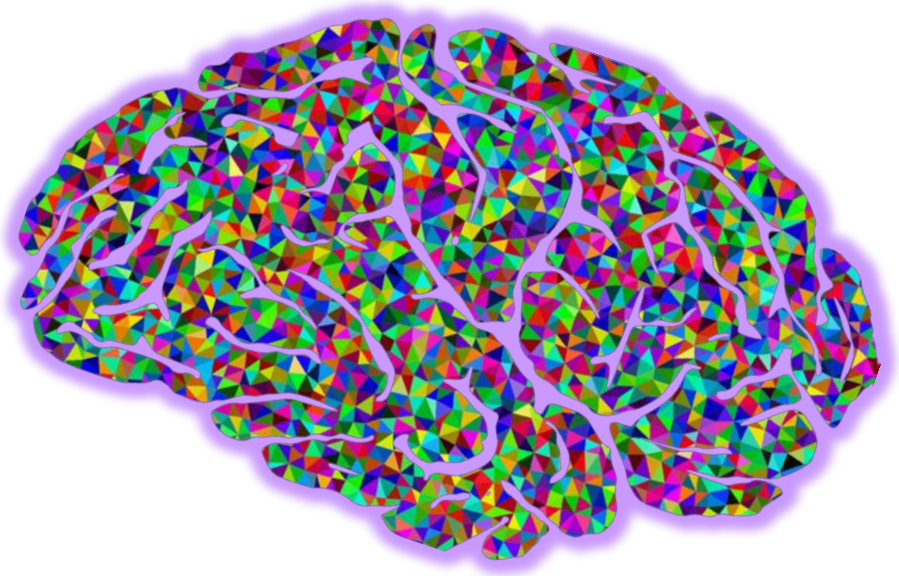
MINDSOURCE BRAIN INJURY NETWORK

Services

- **Education Consultation**
- **Resource navigation**
- **Outreach and education**
- **Juvenile/criminal justice**
- **Self-management & skill building**
- **Classes and workshops**
- **Recreation and social programs**
- **And more – when in doubt, refer to us!**
- **ALL AGES CAN ACCESS THIS FREE SUPPORT!**

More Brain Injury Resources

- Center on the Developing Child – Harvard University https://developingchild.harvard.edu/
- Centers for Disease Control: https://www.cdc.gov/traumaticbraininjury
- Brainline Kids: http://www.brainline.org/landing_pages/features/blkids.html
- Other Authors & Trainers:
  - Dr. Laura Anthony - https://www.unstuckontarget.com
  - Dr. Peg Dawson and Dr. Richard Guare - https://www.smartbutscatteredkids.com
  - Dr. Ross Greene - https://drrossgreene.com
  - Sarah Ward - https://efpractice.com



Heather Hotchkiss, MSW

Principal Brain Injury Specialist

Colorado Department of Education

Hotchkiss_h@cde.state.co.us

303-866.6739