Child Brain 101
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For Prevention Works! A Community Coalition of Clallam County
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A word from Prevention Works!
Let’s start with an Activator…

- What connection might you make between this photo and the human brain?
- Take a few minutes to reflect individually.
- At the signal, share with a partner.
- Anyone want to share?

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Let’s make sure we are all on the same page...

"Just a darn minute — yesterday you said that X equals two!"
Perspective is important.
Flexible thinking is important.
Parents Matters - Caregivers Matter

https://www.nap.edu/download/21868
Session Norm: Presume positive intentions

- There are no personal or professional indictments here.
- Keeping an open mind and thinking flexibly is pivotal in moving this conversation, and our work with children and families, forward.
- Watching one’s air time and encouraging others to share ideas is optimal.
Session Norm: Use professional behaviors with devices

Monitor your actions so others can stay focused on the professional learning.

Ask me or seat partners for assistance if needed.

Thank you for keeping learning as the purpose for our time together.
Five important messages for keeping high engagement of all learners:

I care about you and what you think.
I teach and model the behaviors I want to see in a learning space.
We all can grow and improve with hard work.
We can all measure our growth in some way.
Learning is the most important outcome in our classrooms or learning spaces.
Some Points to Remember:

- We need to look at humans from a strength-based model.
- Each human is good at some skills and needs help with others.
- Snapshots are less informative than full-length movies.
- Challenging behaviors and ideas tend to surface when and where the most unexpected things tend to happen.
“There are no achievement gaps at birth.” (Delpit 2012)

Preschool in Greenland

Preschool in Everett (photo Robin Arnold)
Where are we going? Let’s set the stage for our time today.
Let’s start with a review the contents of the resource folder.
One important resource on that list...
How People Learn and How People Learn II are available, FREE, via the link:


OR

Search: How People Learn and the webpage for the above link should be the first item listed as The National Academies Press.
Another important resource on that list...
Office of the Superintendent of Public Instruction (Washington State)

Behavior Menu of Best Practices and Strategies is available, FREE, via the link:

http://www.k12.wa.us/SSEO/BehaviorMenu.aspx
Let’s start with a review the contents of the resource folder.

Why did I quickly review these resources with you before we discuss the content of this session?

Think with a partner…

Anyone want to share their thinking?
How thinking works... (Willingham 2009)
Thinking about information is time well spent.

Today, I would like participants to think about:

- Current information about the child brain from the fields of cognitive science and neuroscience
- Applying this information to a variety of professional and personal contexts
- Using this information to help humans navigate the 21st Century
Definitions: Cognitive Science and Neuroscience

Cognitive Science
- multidisciplinary and scientific study of thought, learning, and mental organization which draws on aspects of psychology, linguistics, philosophy, and computer modeling

Neuroscience
- multidisciplinary branch of biology that scientifically studies the nervous system at the cellular level as well as the human level
Example--How Cognitive Science and Neuroscience look at a brain state: Attention

Cognitive Science

- Humans have evolved two types of attention: “hunter’s attention” and focused attention
- Attention should be measured on an individual basis along a range from “hunter’s attention to focused attention.

Neuroscience

- Physiological deficit (hemineglect syndrome) results from an insult in the right parietal cortex (ventral frontoparietal network), which important in involuntary attention
- Still working to isolate gene(s) which carry attention markers or are expressed epigenetically along a continuum
My connection to Cognitive Science...
...on a personal note...Neah Bay HS saw incremental and sustained success with the application of cognitive science in its school systems...

% 10\textsuperscript{th} graders pass state math test in 2005  % seniors who met state math requirement in 2013
...on a personal note...Neah Bay HS saw incremental and sustained success with the application of cognitive science in school systems...

% $10^{th}$ graders pass state math test in 2005

% seniors who met state math requirement in 2013

4%
...on a personal note...Neah Bay HS saw incremental and sustained success with the application of cognitive science in school systems...

% 10th graders pass state math test in 2005  % seniors who met state math requirement in 2013

4%  100%
...and on an even more personal note...

Figure (left) - MRI of normal brain, 27 y/o male

Figure (right) - MRI of brain with SEGA, 23 y/o male, my youngest son (5/7/18)
Time for a 10-minute bio break...
The 21st Century is motivating important shifts for humans.
Information and knowledge are updating all the time

- Humans have instantaneous access to all the world’s knowledge, no matter the emotional or intellectual maturity
- Humans can communicate instantaneously in a public and global forum
- Knowledge is evolving faster than the social systems it affects - e.g. social media technologies outpace the human systems using this tool
- Knowledge will be doubling every 12 hours by 2020
- It’s not all about facts
- Information revolution underlies collaboration as a key skill in the 21st Century (as well as AI)
A major shift - brain science is advancing and available

Look at the graph to the right.

Think about the graph for two minutes. At my signal, find two other humans and talk about what you each see in the graph.

Perhaps a few participants might like to share observations?
Another shift new to recent times: *The Shift in Developmental Timing* for young humans

- Schools are a relatively new cultural invention for managing the learning of young humans
- Puberty is happening earlier - science not sure why
- Humans are learning more information at an earlier age - Flynn Effect
- “Millennial Paradox” - Relatively recent development that has adolescents and young adults with little/no focused practice of adult skills
- Must connect adolescent and young adult learning to core life skills—the capabilities needed as adults
What exactly is a Child Brain, and what do we know about it?

For our sessions, we will use Dr. Gopnik’s divisions:

-- Birth to age 5 (~90% of brain growth by age 5. FYI-- Society for Neuroscience prefers no % estimated)

-- Age 6 to Adolescence (Synaptic pruning begins)
The brain physically changes based on its experiences.

Connections begin simply.

Experiences make simple circuits more complex.
What exactly is Brain Architecture? -

“Brain architecture provides the foundation for all future learning, behavior, and health.”

- Center for the Developing Child at Harvard University

Please look in your resource folder...Handout # 6 -- 20 minutes

Stand up, take your handout, and find two or three people you do not know. Read silently or jigsaw the reading. When all are ready, answer this question and discuss: Which of the 5 key concepts in Brain Architecture is the most important? Why?
Serve and Return interactions shape Brain Architecture.

- [https://www.youtube.com/watch?v=KNrnZag17Ek&t=152s](https://www.youtube.com/watch?v=KNrnZag17Ek&t=152s)
The brains of young children learn in two primary ways:

1. **Observational Learning** - includes watching/listening to others; trial-and-error

2. **Learning from testimony** - listening to what others say about the world and how it works

Young children actively interpret incoming information and work to understand both what humans do and why they do it. “And they are surprisingly, even disturbingly, accurate”. (Gopnik 2016:89)
What differences in meaning (between these two sentences) strike you?

“Let’s see what this does.”

“Let me show you what this does.”
Birth to Age 5 -

We know that:

➢ the human newborn is totally dependent on others, and that the period of protracted childhood is necessary to allow brains to mature.

➢ our youngest humans have the most brain plasticity, and quickly make new neural connections based on experiences.

➢ our youngest humans learn most from exploring the world through play - Play produces chemicals that make brain more sensitive to more play-based and exploratory experiences,

➢ early childhood is a period of innovation and change.

➢ brain growth uses a great deal of energy - 66% of calories by age four.

➢ the entire brain is used in learning and connections happen across multiple areas.
Cognitive science tells us that birth - 5 y/o brains can make assumptions and deductions, in absence of, or in spite of, direct instruction.
Age 6 to Adolescence

We know that:

- plasticity decreases from previous levels
- synaptic pruning begins to delete connections that are not reinforced
- exploratory learning begins to shift to *exploitative* use of what has been learned - mastery learning
- exploratory learning is more autonomous, and schools manage the transition from *exploratory* to *exploitative* learning
- age 7 seen as “Age of Reason” in many cultures
- Areas of the brain are becoming more specialized
Learning is about appropriate discipline with no harshness...

https://www.youtube.com/watch?v=u8Fcf4vVvdI

Here is your “assignment” for lunch...

1. Think about these questions before and after you watch the video...
   -- Where do you see positive reactions from the participants?
   -- Where so you see places the adult human could have acted differently?
   -- Any other thoughts or observations you would like to share?
Enjoy your lunch...

Time for a break!
An important human behavior is keeping calm and maintaining self-control...

Think about: What are some of the adult strategies in the “Boys and Paint” video you recognized?

Think about: What are some of the child strategies in the “Boys and Paint” video you recognized?
The limbic system is found beneath the cortex in the brain (in the temporal lobes). This group of structures helps to regulate emotions, motivation, learning, and memory. Matures early.

The amygdala integrates memory and emotions. The hippocampus encodes new memories.
The cerebral cortex is found on the surface of the cerebrum and is responsible for awareness, perception, and thought. Matures at 30.

The frontal lobes are found above the eyes. The parietal lobes are immediately in back of the frontal lobes.

“The frontal lobes coordinate voluntary movements and speech, memory and emotion, higher cognitive skills (like planning and problem-solving) and many aspects of personality.”

--BrainFacts (2018:11)
Brain science tells us:

The amygdala activates when a stress or threat is present.

When the amygdala is on, thinking stops.

When the amygdala is on, learning stops.

When the amygdala is on, things only get worse if we don’t de-escalate.

De-escalation “turns off” the amygdala and lets thinking and learning happen again.

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*The amygdala is larger, and the hippocampus (learning and memory) and prefrontal cortex (controls thinking, emotions, behavior) are smaller, in humans who undergo toxic stress and/or have PTSD.*
Heard about ACEs - Adverse Childhood Experiences?

ACEs include experiences with trauma:
- Physical, sexual, and/or emotional abuse
- Physical and/or emotional neglect
- Caregiver mental illness
- Household and/or community violence
Let’s review together...

Please look in your resource folder for Handout #7 - ACEs Infographic.
Take a few moments to read the infographic and think with some of the other humans at the session.

Given our discussion about how thinking works...

How might ACEs affect the brains of younger humans?
What effects might ACEs have on how the young brain thinks?

Anyone want to share?
How thinking works... (Willingham)
ACEs affect the areas of the brain that mature the earliest... (Center for the Developing Child at Harvard)
Toxic stress (and ACEs) affect how a human genome is expressed...

Please look in your resource folder for Handout #8 - Epigenetics

The mechanism by which trauma can negatively affect the human genome is the same mechanism by which the human genome can be repaired.

Teaching Executive Function skills allows humans to reduce the creation of chaos and unexpected events, and to handle unexpected events more successfully.

Supportive relationships calm the physiological responses generated by stress.
Parents, family, caregivers, and family service providers need to understand both Epigenetics and Executive Function.

- Epigenetics is the process by which trauma on the genome can be repaired.
- Most humans can be restored to healthy functioning.
- The phrase “executive function” refers to a set of skills. These skills underlie the capacity to plan ahead and meet goals, display self-control, follow multiple-step directions even when interrupted, and stay focused despite distractions, as well as other skills.
- Not everyone is born with Executive Function skills, but nearly everyone can learn them.
Let’s spend a bit more time with Executive Function...

Look at Handout #9 - Executive Function infographic
I also have a handout for you that is not in the folder.
These three interrelated skills have independent developmental timelines:
   --Working Memory
   --Inhibitory Control
   --Cognitive Flexibility/Ability to Shift

Task for you all:
Break into groups of three. Each group member should choose one of the three Executive Function skills on the handout, read the information about that skill, and prepare to share your third of the work with your group members.
Any thoughts to share?
Any thoughts to share? - Need a break?
Epigenetics is the mechanism by which Toxic stress and ACEs can be mitigated...
The Center for Disease Control tells us six parent/caregiver behaviors are needed for young brains (birth to age 8) to thrive.

- Responding to children in a predictable way
- Showing warmth and sensitivity
- Having routines and household rules
- Sharing books and talking with children
- Supporting health and safety
- Using appropriate discipline without harshness
Let’s apply some knowledge about how thinking and learning works...
Developmental consequences of trauma (Ingram, 2013)

- Difficulty trusting others
- Social isolation
- Difficulty seeking help
- Hypersensitivity to physical contact and space invasions
- Increased medical, emotional and mental problems
- Poor affect regulation, and self-regulation
- Problems with academic achievement
- Oppositional/antisocial behaviors
- Difficulty planning for the future
Considerations for Young Brains: Teaching Lagging Skills (EF)

Young humans needing behavioral supports often lack five important critical thinking skills, some of which are developmental:

1. Self-regulation
2. Considering the outcome of an act
3. Understanding the impact of one’s actions on another
4. Having words to convey a feeling or thought, especially when there is an ongoing problem
5. Responding to change in a flexible manner

Direct instruction, not modeling alone, must be a part of the solution. See Dr. Ross Green’s websites for additional resources.
Expected is better than Unexpected

- Reliable routines reduce disruptions and distractions
- Reliable routines and clear, common language reduce misunderstandings
- Proactive communication reduces the unexpected; use common language
- Teaching routines and reactions is critical
- Some humans need more practice than others
Let’s talk more about the power of Serve and Return...

https://www.youtube.com/watch?v=DOfEu2zqrkQ

Please look in your resource folder...Handout # 10.

Please take 5-7 minutes to review the handout.

Why did I ask you to read the handout after you watched the video?
Trauma-informed Rule #1 - Have high expectations for all young humans

- High expectations must be established for all children, no matter the cultural/linguistic/economic background of the child
- Graduating from high school with a plan for life after high school should be a goal for all young humans
- Empower young humans by creating relevant systems where “earning and learning” are associated with Executive Function supports
- High expectations are associated with reward, recognition, and relevance
Trauma-informed Rule #2: Steer clear of power struggles

- Use humor when possible; no sarcasm
- Stay calm and confident; de-escalate when possible; learn to let some things go
- Be proactive; use written and visual supports when possible
- Be aware of spatial sensitivities; ask permission to come into the space or to touch work or property
Trauma-informed Rule #3: Responsive relationships can mitigate the effects of trauma

- Reliable routines and expected responses help establish responsive relationships
- Responsive relationships allow automaticity for parts of the critical Serve and Return exchanges
- Coordinated responses (from multiple humans to one human) to certain Serve and Return situations can help increase automaticity in one area and therefore, attention and learning in another
Trauma-informed Rule #4: Help create coordinated responsive relationships when possible

https://www.childwelfare.gov/fei/ - The Family Engagement Inventory seeks to help providers from a variety of disciplines coordinate requirements and resources.

The best way to help change the thinking and behavior of a young human is to change the thinking and behavior of the older humans interacting with young humans. Coordinating the Serve and Return response builds capacity in young brains as well as in the family.
Need common use of Mindset and Improvement Cycle
Data Feeds a Cycle of Continuous Improvement—Humans need to know and understand this concept as it relates to learning. Small increments of improvement are most successful and sustainable.
Mindset: Here’s how we give humans in difficult situations HOPE.

- Hard work matters
- Practice leads to improvement
- Improvement, not perfection
- Growth is the currency
- Intelligence is malleable and can be grown
- Mistakes are a part of learning
- Collaborative problem-solving works
- Having a plan increases the probability of the outcome
Multi-Tiered Systems of Support (Ci3T) - http://www.ci3t.org/

Comprehensive, Integrated, Three-Tiered Model of Prevention
(Lane, Kalberg, & Menzies, 2009)

- **Tier 1**
  - Primary Prevention (≈80%)
  - Academic
    - Validated Curricula
  - Behavioral
    - PBIS Framework
  - Social
    - Validated Curricula

- **Tier 2**
  - Secondary Prevention (≈15%)
  - Goal: Prevent Harm
    - School/classroom-wide systems for all students, staff, & settings

- **Tier 3**
  - Tertiary Prevention (≈5%)
  - Goal: Reduce Harm
    - Specialized individual systems for students with high risk
  - Goal: Reverse Harm
    - Specialized group systems for students at risk
Since knowing facts and/or relying on power/authority are no longer at the pinnacle of human systems, here are some great responses when humans ask “why” certain systems or procedures are in place.

- Research about applications of cognitive science and brain architecture
- Research about the Science of the Development of Adult Capabilities
- New federal regulations within Every Student Succeeds Act (ESSA) (for public schools and districts)
- New federal and state guidance for health and safety issues, including physical health and behavioral health
- New efforts to coordinate services for families in need
Thank you for your time today!
Questions before we review resources?