Traumatic Effects of Stress on the Brain
Learning Targets

Following completion of this training

• I can explain the chemical changes that occur in the brain when experiencing stress
• I can explain the value of knowing the science/physiological aspects of the brain’s response to stress.
• I can identify ways to influence brain chemistry in myself and the students I serve.
The number one job of the brain is to process emotions. The number one job of the brain is to SURVIVE!

The brain hates novelty. The brain LOVES novelty!

If you laid out all of the blood vessels in your brain end-to-end, they would stretch halfway to the moon (about 120,000 miles).

Your brain is 10% fat. Your brain is 60% fat!

Being stressed isn’t just unpleasant – it can actually affect your brain development, killing neurons and neural connections and preventing new ones from forming.
✓ Your brain is 73% water. It takes only 2% dehydration to affect your attention, memory and other cognitive skills.  
True

✓ Twenty-five percent of the body’s cholesterol resides within the brain. Without adequate cholesterol, brain cells die.  
True

✓ A 2-year-old’s brain is 30% the size of an adult’s brain.  
False
A 2-year old’s brain is 80% the size of an adult’s!

✓ In general, men’s brains are 10% bigger than women’s, even after taking into account larger body size. However, the hippocampus, the part of the brain most strongly linked with memory, is typically larger in women.  
True

✓ Your brain can learn or concentrate on two things at once.  
False
Your brain CAN’T learn or concentrate on two things at once.
Most savants are born that way, but a brain trauma can cause acquired savant syndrome where ordinary people suddenly develop genius-level abilities they didn’t have before.  

While you are drunk, your brain is incapable of forming memories.  

The brain is unable to change.  

Trauma effects on the brain can be traced back through three generations.
“Having a scientific perspective on the biological challenges of stress will help you interact more objectively with others, maintain your cool, and offer guidance that can improve your life and the lives of the students you serve.”
Leslie Hart  Human Brain and Human Learning (1983),

• Argues that teaching without an awareness of how the brain learns is like designing a glove with no sense of what a hand looks like—its shape, how it moves.

• If classrooms are to be places of learning, then “the organ of learning,” the brain, must be understood and accommodate:
All around us are hand-compatible tools and machines and keyboards, designed to fit the hand. We are not apt to think of them in that light, because it does not occur to us that anyone would bring out some device to be used by human hands without being sure that the nature of hands was considered. A keyboard machine or musical instrument that called for eight fingers on each hand would draw instant ridicule. Yet we force millions of children into schools that have never seriously studied the nature and shape of the human brain, and which not surprisingly prove actively brain-antagonistic. (Hart 1983)
The capacity of a person to learn will never be greater than during adolescence.

"In many ways, it's the most tumultuous time of brain development since coming out of the womb,“
Neuroscientist, Dr. Jay Giedd
Normal Adult Brain Response Pattern:
Brain process under typical conditions

Observe → Input → Interpret → Process → Evaluate Options → Plan → Act
Alarm system
"Express Route"

Observe → Interpret

DANGER

React (Flight - Flight - Freeze)

Process
Evaluate Options
Plan

Act
With repeated stress, the Alarm System
“Express Route” becomes the main road

Observe

Alarm System

DANGER

Process

Evaluate Options

Plan

Act
A stressed brain often skips the filter and fails to interpret the situation with reason and logic. You are more likely to respond based on emotion.
3 Levels of Stress

Level 1: Positive
Brief increase in heart rate, mild elevations in stress hormones

Level 2: Tolerable
Temporary serious stress; buffered by supportive relationships

Level 3: Toxic
Chronic, prolonged activation of the stress response system; absence of supportive relationships
• 8,809 victims of abuse and neglect

• 1/3 of children birth to 6 are in foster care

• 27.7% poverty

• 35% receive SNAP
Since 1 in 4 children have been exposed to a traumatic event...

Presume that EVERY person you meet has been exposed to abuse, violence, neglect, or other traumatic experiences.—Make this a way of life!
Children with Disabilities are...

more likely to experience trauma...

WHY?
Did you know...

Stress can kill your brain cells. Stress can overload your brain with hormones that are intended only for short-term, which in turn can damage and kill your brain cells.
Stress response

large number of cortisol receptors

Stress-related release of cortisol can cause dendrites to shrink

Hippocampus
learning and memory
**FIGHT or FLIGHT**

**Noticeable Effects**
- Pupils dilate
- Mouth goes dry
- Neck + shoulder muscles tense
- Heart pumps faster
- Chest pains
- Palpitations
- Sweating
- Muscles tense for action
- Breathing fast + shallow - hyperventilation
- Oxygen needed for muscles

**Hidden Effects**
- Brain gets body ready for action
- Adrenaline released for fight/flight
- Blood pressure rises
- Liver releases glucose to provide energy for muscles
- Digestion slows - or ceases
- Sphincters close - then relax
- Cortisol released (depresses the immune system)

*E. Hedges*
A few more things...

1. When placed in challenging and uncomfortable situations the brain produces CORTISOL.

2. Strengthens and produces a surge of energy

3. Cortisol BLOCKS a person’s ability to learn (only functioning in fight or flight mode).

“Animal Brain”
Fight, Flight or Freeze?

Once the amygdala is activated in class, it takes at least 30 – 90 minutes to calm down for quality learning.

Threats, insults, put-downs and sarcasm activate the amygdala.
Discipline Problems Emerge When Teachers Expect *What They Cannot Get*

"Hey, show a little remorse about it!"

Many kids don’t have the full emotional range to respond well *UNLESS* they are taught *HOW* to respond in class.
If you activate the Fight, Flight or Freeze...

1. Be sure to apologize BEFORE class is over. You can say, “Sorry, I got frustrated and took it out on you. I will try not to do that ever again.

2. In the moment, the immediate thing to do is to GIVE THE STUDENT IMMEDIATE CONTROL over something (choice: a chore, object, errand or role). The “sense of control” decreases the stress and reduces feelings of anger and powerlessness.
People who have exposure to acute or chronic stress will adapt. The brain changes to become either:

1. **hypervigilant**, angry, or edgy, OR
2. **hypo-responsive**, which is apathetic and learned helplessness
Sometimes we adults make moral judgments about students because...children who suffer from chronic stress look like they have made a conscious choice to be lazy and unmotivated.
Students who have difficulty shifting/thinking flexibly due to chronic stress also struggle to cope with unexpected changes in their schedules, routines or homework, and may be viewed by their parents and teachers as “rigid,” “stubborn” or “single-minded.”
Pre-Frontal Cortex

Involved with...
- Solving complex problems
- Rich thought
- Emotion and personality expression

Home of “executive function” such as...
- Paying attention
- Remembering details
- Planning
- Organizing
- Prioritizing
- Self-Regulation
- Information Processing
The amygdala is responsible for...

• Detecting harmful or scary environmental stimuli
• Activating our stress response system, which can impair the pre-frontal cortex

When this happens, we are less able to:
• think rationally
• control our emotions
• engage in effective planning
The Hippocampus

• Important to memory formation and essential to learning.

• Under stress:
  ▫ memory impairment
  ▫ hurt knowledge acquisition

• Changes in the hippocampus have been linked to anxiety disorders.
Chronic Stress

- May manifest as a disability
- Alters brain circuits
- Sends stress response in constant high alert (unable to shut off)
- Impairs the pre-frontal cortex
- Hurts executive function
- Diminishes a child’s ability to:
  - Learn
  - Regulate emotions and behaviors
  - Interact in socially appropriate ways
Hidden Stressors

- Perfectionism
- Boredom
- Working out TOO much
- Sensory Sensitivity (fragrances, chemicals, toxins, fluorescent lights, etc.)
- Clutter
- Failure to unplug and disconnect
- Fear of Missing Out
- Social Media
Maslach defined 3 key signs of burnout:
1. Emotional Exhaustion,
2. Depersonalization, and
3. Reduced Personal Accomplishment.
Meltdowns

- A kid who is experiencing a meltdown is emotionally on fire! No learning can occur and NOTHING you say or do will be effective at this time.
- Don’t set students up for failure by forcing them to respond. Take a time out!
- As an adult we LOSE authority when we lose control over our emotions.
Look for your Stress Sweet Spot

• Too little stress = bored, unmotivated
• Too much stress = overwhelmed, fearful, frozen
• Moderate stress = energized, on task, efficient
Combat Stress with...

Meet Your Happy Chemicals

Dopamine

Serotonin

Oxytocin

Endorphin

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The Feel Goods...

• There are many neurotransmitters and hormones that help in controlling and regulating the functions of the brain, but the most important ones contributing toward mood are norepinephrine, dopamine serotonin, oxytocin, and endorphins.

• The “feel goods” create a rich and motivated learning environment.
Endorphins

• *Endorphins make you feel calm.*
• With high endorphin levels, *we feel less pain and fewer negative effects of stress.*
• Your body produces *endorphins when you relax, exercise, laugh, or learn new things.*
• If you practice producing calming hormones, it will help when you are under stress.
When a person is placed in a safe, fun environment or presented with a positive challenge...ENDORPHINS and other feel goods (Serotonin and Dopamine) are produced.
How to Release Endorphins:

- Exercise
- Laughing
- Sex
- Music
- Meditation
- Acupuncture
- Eating chocolate
- Eating hot peppers
- Drinking alcohol
Dopamine...Lighting a Fire (Motivation and Achievement)

• Only produced when effort is given under 3 conditions:
  1. Risk
  2. Urgency
  3. Excitement

• Dopamine is related to mood, reward, pleasure, motor activity, and focus, but is actually about DESIRE.
Dopamine Fun Fact...

Expectation results in more dopamine than the actual event.
Dopamine Is More Than a Feel Good

• Your brain releases extra dopamine when an experience is enjoyable.
• As positive emotions cause dopamine to travel to more parts of your brain, additional neurons are activated.
• A boost in dopamine not only increases your own sense of pleasure, but it also increases other neurotransmitters, such as acetylcholine (dominant memory making NT), that enhance alertness, memory, and executive functions in the prefrontal cortex.
How to Release Dopamine:

- Exercise
- Meditation
- Certain foods (e.g., bananas, almonds, avocados, apples)
- Certain health supplements (L-tyrosine, Curcumin)
- Music
- Sex
- Good sleep
- Weight/Fat loss
- Contact (hugging)
- Dancing
- Cold showers

- Acupuncture
- Sugar

**Negative Ways:**
- Caffeine
- Power
- Shopping
- Video games
- Gambling
- Nicotine (increases by 200%)
- Cocaine (increases by 400%)
- Amphetamines (increases by 1000%)
- Alcohol
Serotonin: ahhhh Calming NT

- Is released when we get a reward
- Produces a calming effect
- Gives us the feeling of pride
- Keeps us motivated to do things that will give us approval
How to Release Serotonin

- Sunlight
- Reframing thoughts toward positivity
- Exercise
- Brain-friendly diet
As much as 95 percent of the serotonin in your body is produced in your gut. A brain healthy diet is a must!

Eat foods rich in L-tryptophan:
- chicken,
- turkey,
- salmon,
- beef,
- nut butter,
- eggs, and
- green peas
Oxytocin: The Bonding Hormone

- “love hormone” or “cuddle chemical”
- makes us social
- reduces the release of cortisol
- reduces stress and anxiety
- reduces inflammation and accelerate healing
- increase positive personality traits such as empathy, warmth, trust, and openness
- increases feelings of calmness and security
- increases creativity
- improves self-perception in social situations
How to Release Oxytocin

• Highest levels of Oxytocin are produced during
  ▫ child birth,
  ▫ sex, and
  ▫ being in love.

• Other ways to produce Oxytocin:
  ▫ Touch
  ▫ Vitamins C & D
  ▫ Meditation/Yoga
  ▫ Music
  ▫ Massage
  ▫ Being around pets
  ▫ Warm temperature
  ▫ Giving gifts
  ▫ Socializing
Emotions & Your Brain

• Cognition and emotions have over an 80% overlap. We usually do what we FEEL like doing.
• Feelings are the On/Off switch to learning and productivity.
• Motion changes emotions.
Interpreting the Research: How Important is Understanding and Adapting to Emotions?

- Teacher Student relationships = 0.72
- Classroom Behavior Climate = 0.80
- Teacher “in Sync” with Student States = 1.42

Source: Classroom Management That Works by Robert J. Marzano, Jana S. Marzano and Debra J. Pickering
Emotional States: These Systems Can Help You Focus on Student Well-Being

Affective
- Emotions
- Attitude
- Feelings

Cognitive
- Strategy/Choices
- Mindset/Skills

Behavior
- Effort/Grit
- Energy/Focus
- Persistence

Eric Jensen
Emotional States

1. States Usually last for seconds or minutes, moods last for hours or days.
2. We experience 100s of states every day.
3. More states impede learning than help it.
Qualities of States

• Usually run a “Cycle”...One state leads to another state

• States are self-regulated; the longer you’re in a state, the more comfortable it becomes.

• We all range from being very flexible to very inflexible with our states
Our STATE effects our behaviors!

- When we are depressed, we do only things that those with depression usually do.
- When we are tired, we don’t feel like doing things which require high energy.
- When we are optimistic, we often say “YES” to requests and take on more than usual.
- When we are grumpy, we treat others differently than when we are feeling good.
 STATES are influenced by...Everything

Kid’s “download” the negatives of chaos, disharmony, poor relationships, foul language, poor manners, and weak vocabulary just as quickly and automatically as they would any positive or enrichment input.

From ages 0-5 the world is “downloaded” into the brain. Highly immature frontal lobes are unable to delete or reframe any negative input.
STOP assuming students already know how to behave; most DON’T know!
Name that State...
Name that State...
Name that State...
Name that State...
Name that State...
Name that State...
Which States Do You Foster?

- Anticipation
- Safety
- Curiosity
- Trust
- Confusion
- Hope
- Confidence
- Hunger to learn

- Boredom
- Fear
- Isolation
- Hostility
- Frustration
- Despair
- Insecurity
- Disinterested
Your STATE is as important or more important than the student’s state.
Ways to Shift States

- Provocative Questions
- Novelty
- Scavenger hunt
- Write
- Switch groups
- Walk
- Music
- Turn & Talk

- Brain breaks
- Joke
- Spot the differences
- Controversial statement
- Write
- Drawing
- Stories
- Stretch
To Get the Behavior You Want

1. Notice the state the person is already in
2. Ask yourself: Is he in a state that would allow him to say “YES.”
3. If not, change their state BEFORE asking them for the eventual behavior you want.
YOUR TURN

• One person from each table draw a state from the center of the table.
• Without telling anyone what the state is, put everyone at your table in that state in 1 minute or less.
Primed the Brain

- Movement
- Breathing deeply
- Hand Massage
- Focused attention
- Create trigger lists
- Give time to clear the mind
- Do something different
- Focus on positivity
- Find a common interest

- Laughter
- Wet their appetite (curiosity)
- Music
Music and the brain

**Corpus callosum:** Connects both sides of the brain

**Motor cortex:** Involved in movement while dancing or playing an instrument

**Prefrontal cortex:** Controls behavior, expression and decision-making

**Nucleus accumbens and amygdala:** Involved with emotional reactions to music

**Sensory cortex:** Controls tactile feedback while playing instruments or dancing

**Auditory cortex:** Listens to sounds; perceives and analyzes tones

**Hippocampus:** Involved in music memories, experiences and context

**Visual cortex:** Involved in reading music or looking at your own dance moves

**Cerebellum:** Involved in movement while dancing or playing an instrument, as well as emotional reactions

SOURCE: Music for Young Children
References


- Jensen, Eric (2017). Teaching with the Brain in Mind.


- Zeiglar –Dendy, Chris. TEACHINGTEENAGERS WITH ADD, ADHD, and Executive Function Deficit 2nd Edition