

**Lesson #M1: How Your Brain Thinks Thoughts**   **Time: 50 minutes**

Overview

This lesson is the first in a series of three lessons designed to promote a growth mindset in young people. It’s important that the mindset series of lessons is framed in a way that communicates that we need young people’s help to give advice about the growth mindset to other youth. Adults should avoid trying to “convince” young people about the growth mindset, but instead frame it as a forgone conclusion based on what we know about the brain. In this lesson, young people get an understanding of how the brain thinks thoughts as messages are transferred from neuron to neuron through synapses. Through a PowerPoint presentation, a ball toss activity, and a short video clip, young people will learn about their brains and will be introduced lightly to the growth mindset. The lesson closes with a fun Brain Quiz Show that celebrates young people’s new learning.

Goal

Demonstrate understanding of how the brain thinks thoughts.

Objectives

*By participating in this lesson, young people will:*

1. Identify basic structures of neurons and how thought patterns and learning are conducted.
2. Define growth mindset.
3. List that the brain needs proper fuel, sleep and challenge for optimal growth.
4. Describe why challenge helps your brain.

Anchor Vocabulary

* *Neuron-* a specialized, impulse-conducting cell that is the basic unit of the nervous system, consisting of the cell body and its parts, the axon and dendrites.
* *Axon-* the long thread-like part of the nerve cell (neuron) that transmits impulses out from the cell body.
* *Dendrites-* the branching process of a nerve cell (neuron) that conducts impulses from other cells into its cell body.
* *Synapse -* the space where a nerve impulse is relayed from one cell to another through chemicals called neurotransmitters. The chemicals *transfer* nerve information across the synapse just like a boat carrying a message between two shores. The electrical impulse from one cell triggers a chemical release in the *synapse* (space), and the chemical flows across the space and triggers the next cell’s electrical activity. The message flow is as follows: 1 cell’s axon—to synapse——to next cell’s dendrites.

Materials & Media

* Sound system or CD Player (and an upbeat song)
* Computer with MS PowerPoint installed
* One ball of string (or ball of yarn) for each group of ten youth
* A timer
* LCD Projector
* Step-It-Up-2-Thrive Video Clip: Lesson #11: *Star Wars Clip*
* Step-It-Up-2-Thrive Video Clip: Lesson #11: *Neurons & Synapses*
* Step-It-Up-2-Thrive Digital Resources: Lesson #M1PowerPoint: *How the Brain Thinks Thoughts*
* Optional: small prizes or treats for everyone who participated in the Brain Quiz Show
* Youth notebooks

Handouts

(none)

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| **Lesson Outline** | **Lesson Description** |
| **ENROLL**(3 min) | OpeningFraming and Enrollment Questions | **Build relationships with youth as they walk in the door.** **Q-Clap:** PLAY an upbeat song that students like. Get all students up and clapping. Build clapping to a crescendo and cut the music.**Slide #1: Title Slide****Ask Enrollment/Framing Questions:** * Guess what? Today we have some exciting information for you about your brain.
* A team at Stanford University has developed these workshops based on research they have done to understand how young people can have lots of success in life.
* Lot’s of young people like you have taken these workshops and said that these were the most interesting and useful things they learned.
* Believe it or not, the brain has a lot to do with success and we want to teach you how to use it.
* Who has ever bought a new stereo, xbox, or phone? Did it come with a user’s manual?
* Well the brain is a lot more powerful than all of those electronics and it doesn’t come with a users manual. So we thought we would create a workshop to provide one.
* (raise your hand) How many of you are curious about what’s going on inside your brain?

**Slide #2: We Need Your Help*** Excellent, even though we’ve learned a lot from the research at Stanford University, the truth is that we’re doing these workshops because we need your help.
* We need to learn how to share these messages about success with other students like you.
* It’ll mean a lot more coming from you than it will coming from adults like us.
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| **EXPERIENCE** (5 min) | Learning about the brain is posited as a help to dealing with challenges.  | **Challenges****Say:** * Did you ever wonder why sometimes you just completely forget something that you know you studied for?
* Or have any of you tried something really hard and just gave up because you couldn’t get it?
* Well, researchers have studied lots of students like you around the world and we find that these problems are extremely common.

**Slide #3: Warm Up*** Please take out a piece of paper, pencil or pen and answer this question.
* The purpose of this exercise is for you to start thinking about how what we will learn about brain research will help you face some of these setbacks or problems in school.
* Maybe one time you wanted to learn something well, but you didn’t know it as well as you wanted to.

**Slide #4: Kiesha*** Here’s what some young people had to say…
* Can someone read this for us?

**Slide #5: Alan*** Who can read this one?
* So we can see that these are common problems.
* Fortunately, lots of scientific research shows that these problems can be overcome by learning about the brain
* We’re going to start with a little movie clip that highlights two mindsets…
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| **EXPERIENCE**(8 min) | Star Wars Clip(4 min)Debrief(4 min) | **Slide #6: Star Wars© Clip****Show Step-It-Up-2-Thrive Video Clips: Lesson #11: *Star Wars © Clip*****Process activity.****Say:****What Happened?*** What did Yoda want Luke to do?
* Why wasn’t Luke successful? (answers). Yes, he had an attitude that he couldn’t do it.
* What was Yoda’s attitude or belief?

**Slide #7: The Growth Mindset****So What?*** Obviously this movie is a fantasy, but does it remind you at all of real life? How?
* Who can tell me about a time in your life when you had an attitude like Yoda, and showed a growth mindset about a challenge?
* How did your growth mindset help you?

**Now What?*** What advice would you give to someone who just says things like:
	+ “Well, I’m just no good at math.” OR
	+ “I could never become a good athlete.” OR
	+ “I’m just an angry person, so I’m not going to change…”
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| **LEARN & LABEL**(8 min) |  | **Slide #8: The Growth Mindset (continued)*** (read and explain slide)

**Say:*** Now we’re going to learn about what’s going on in your brain.
* Please take out your notebooks and take good notes from this PowerPoint, because at the end of this session, you’ll be able to use your notes for a Brain Quiz Show with prizes!

**Slide #9: The Brain*** Here’s a gross picture of the brain.
* But today we’ll use pictures like this next one.

**Slide #10: The Brain (2)*** So here’s a diagram of a brain that’s easier to look at.
* Now let’s drill down deeper and take a peek.

**Slide #11: A Dense Network of Neurons*** The brain, when you drill down deeper, is actually a dense network of neurons that are connected.
* Now let’s drill down even further to look at just one brain cell.

**Slide #12: Parts of Neuron*** In the diagram below, we’re just focusing on one cell. There are several parts that are important.
* First, you should be able to see the dendrites. Those parts reach out to get signals from other nerve cells.
* Just like in the ball tossing game, when you reach out your hands to someone else, you were sending out a signal, just like that the brain has its own arms reaching out. These are called the dendrites.
* Next, you can see the cell body. That’s like the brain of the cell. It gets the message from other brain cells.
* Next there’s an axon. It’s a long cable that carries the message and sends it out to another cell.
* Now that you can see that the neuron cell has different parts, you may be wondering how it does anything – how it thinks thoughts.
* Let’s go back to the picture of the network of neurons.
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| **EXPERIENCE**(8 min) | Activity(6 min)Debrief(2min) | **String Ball Toss****Slide #13: String Ball Toss****Take youth outside or to an open space and form a circle for each group of ten.****Say:** * Here’s a game. I’m going to throw this ball across the circle to one person, that person needs to hold his/her piece of the yarn and throw the ball to the next person. The ball needs to pass through everyone’s hands in the whole class. You figure out the pattern…
* Don’t change your place in the circle.
* Ready, go! (time the groups)
* Now let’s pretend that the ball is the new high school math you are doing.
* Pass the ball and try to get the same pattern, but with a faster time.
* Now we are going to try this one more time.
* Let’s see if you can beat your time!

**Process activity.****Say:*** What happened? (e.g. It became easier; learned patterns; benefitted from trying new strategies; started to be able to predict from experience; “got in a groove!”)
* Notice also that this web of yarn between us is much like how our brain works. The string represents the connections in our brain.
* The more we practice something, the stronger the connections become.
* Can you remember this activity when you’re working on hard goals and you feel like giving up?
* It’s important to believe you can do it, keep persisting, and keep trying new strategies, especially when things are tough.
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| **LEARN & LABEL**(2 min) | PowerPoint/Lecturette  | **Brain Content (continued)****Slide #14: How Thoughts are Transmitted*** The brain thinks thoughts by sending messages.
* The neurons in your brain are connected in a dense network, like a web. These cells communicate with each other.
* Each neuron is connected to between one and one million other cells. Overall in your brain, there are over a trillion connections.
* When you have a thought, it sends a signal from one set of neurons to another.
* Also, messages can travel as fast as 1000 feet per second, or 680 miles an hour, the speed of a fast jet plane. Then the brain turns the signals into thoughts or actions.
* In fact, your brain is the most complex 3 lb mass in the known universe!
* Here’s a video of a leading brain researcher explaining how neurons work.
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| **EXPERIENCE**(3 min) | Youth watch how neurons transmit signals. | **Slide #15: Neurons and Synapses Video**• Now we are going to watch a video about how thinking takes place. • You will hear an additional vocabulary word called Synapse. • A Synapse is the scientific name for the space between neurons. As an electrical signal reaches the ends of the axon, it changes to a chemical signal that flows across this synaptic space to the next cell. • You will hear how your brain cells connect with electrical and then chemical signals, and then electrical, and then chemical signals— from one cell to another. **Show Step-It-Up-2-Thrive Video Clip: Lesson #11: *Neurons & Synapses*****Say:** * Who can explain what they saw in this video?
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| **LEARN & LABEL**(8 min) | PowerPoint/Lecturette  | **Brain Content (continued)****Slide #16: Sending Signals*** “What part of the neuron receives messages from other cells?” Who knows the answer to this question
* But, let’s imagine what just happened in your brain to get this response.
* Your eyes read the words of the question and your ears heard “what part of the neuron receives messages from other cells?”
* Your neurons had to retrieve this information from your brain, through connections to other neurons with this answer. [CLICK ON ARROW]
* Your neurons go through a connection to get this word “Dendrites” then you said this aloud. You might also send signals to type this out [Click for typing hand]
* We just told you that the brain uses electric signals from one neuron to the next to think thoughts and send messages through connections….
* How much energy do you think this takes up?

**Slide #17: Energy Use of the Brain*** The brain is the biggest energy eater in your body, burning about 30% of the fuel your body uses.

**Slide #18: Your Brain Needs*** With all that energy being used, your brain needs certain things to function well.
* Fuel: Your brain needs healthy foods with Omega-3’s such as Eggs, Nuts and Fish
* Sleep: Your brain needs to recharge for at least 1/3 of the time (8-9 hours of sleep). If not you forget things more easily.
* Exercise: Movement and exercise increase breathing and heart rate so that more blood flows to the brain. A recent study found that walking actually improves memory.
* Challenge: If you don’t use brain cells, you’ll lose them. Research shows that the more you challenge your brain, the more connections you grow between cells.

**Slide #19: When you work hard at something…*** That is why many people say “practice makes perfect”.

**Slide #20: What Does Brain Science Mean for Successful Learning*** Read slide. Ask question:
* #2: If you just cram for a test, and don’t study the material except at the last minute, why would your brain be likely to forget the knowledge when the test is over? (Answer: Didn’t practice and space the practice.)
* Excellent, now we’re going to have a quiz show so you can show off what you learned today.
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| **REVIEW AND CELEBRATE**(5 min) |  Brain Quiz Show | **Brain Quiz Show****Slide #21: (Brain Quiz show rules)****Slide #22: What is a growth mindset?**ANSWER: The belief that your basic qualities and abilities are things that you can change and grow. **Slide #23: How does your brain think thoughts?**ANSWER: By sending messages across neurons.**Slide #24: Name four parts of a neuron.**ANSWER: cell body, axon, dendrites, axon transmitters**Slide #25: What are dendrites?**ANSWER: the branching process of a nerve cell (neuron) that conducts impulses from other cells into its cell body ORThe part of the neuron that receives messages from other cells.**Slide #26: How are messages transmitted in your brain?**ANSWER: From an electrical signal along the cell’s axon to a chemical signal in the synaptic space, that is picked up by the next cell’s dendrites and transferred to the nerve body electrically. (Electrical to chemical pathway)**Slide #27: Name four things your brain needs to function well.**ANSWER: Fuel, sleep, exercise, challenge**Slide #28: How do challenges help your brain?**ANSWER: The more you challenge your brain, and practice at getting better at something, the easier and faster it is for the brain to find that information and do well at the challenge. **Slide #29: Name three things that you would tell your little brother or sister about their brain.**ANSWER: (many answers are possible) Optional: **Offer prizes as a reward to all teams for their effort.****Say:*** Excellent work today. All this info you learned will be really valuable when you make your letters giving advice to other youth.
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Homework

(none)