A LIFESPAN OF BRAIN DEVELOPMENT
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Description:
Brain architecture is a process that begins early in life and continues throughout adulthood. In this lesson learners will navigate the brain, map brain anatomy, learn fun brain facts and explore methods to boost brain development throughout the lifespan.

Objectives:
- Participants will be able to identify the major parts of the brain.
- Participants will be able to discuss functions of different sections of the brain.
- Participants will discover interesting facts about the brain and its functions.
- Participants will explore ways to boost brain development throughout the lifespan.
- Participants will keep an active and healthy brain.

Optional Activities for the Program:
- View the multimedia video entitled Experiences Build Brain Architecture.
  (http://developingchild.harvard.edu/resources/multimedia/videos/three_core_concepts/brain.)
- Incorporate physical activity into your meeting to increase blood flow and oxygen to the brain.
- Play memory games, cards, etc. that require sustained concentration.

Resources Used:
http://developingchild.harvard.edu/resources/multimedia/videos/three_core_concepts/brain


Materials Needed:
Each participant will need handouts with brain diagrams and basic lesson information.
The following supplies will be needed for each participant for the Build A Brain Activity:
- One Blow Pop sucker or Tootsie Roll Pop (any flavor)
- Six Sheets of Tissue Paper (different colors)
- Cut the tissue paper into small squares that are large enough to cover sucker
- One rubber band (small)
Brain Facts

- The brain weighs about three pounds.
- 85% of the weight is in the cerebrum, the largest part of the brain.
- The brain is made up of 75% water.
- It has no pain receptors, so the brain cannot feel pain.
- The brain consolidates memories as we sleep.
- Yawning sends oxygen to the brain and cools it.
- The brain is divided into two hemispheres. The left and the right.
- One hemisphere of the brain is usually considered dominate.
- If you are left-brained you are more analytic and logical. You usually enjoy math and science. You may also enjoy manipulating language.
- If you are right-brained you use your intuition and are more holistic in your thought process. Right-brained people are often creative and enjoy music and art.
Brain Anatomy

A. Corpus Callosum

- The Corpus Callosum is the nerve bundle in the center of the brain.
- Messages must move through the Corpus Callosum to get from one side of the brain to the other.

B. Brain Stem

- The brain stem controls all the things that your body does without thinking about them.
- It controls such things as digestion, breathing and the beating of your heart.

C. Cerebrum

- The cerebrum is the biggest part of your brain.
- Different parts help you see, hear, taste, smell and touch.
- Other parts help you understand what you are sensing.
- Parts of the cerebrum make your muscles move.

D. Cerebellum

- The cerebellum helps your body keeps its balance.

Build A Brain Activity

The brain stem is represented by the sucker stick. The cerebellum is represented by the candy inside the sucker. The corpus callosum is represented by the shell of the sucker. The cerebrum is represented by the six layers of crumbled tissue paper of varying colors.

To build a model of the brain:

1. Unwrap the sucker.
2. Identify the brain stem (sucker stick), the cerebellum (candy inside the sucker) and the cerebrum (outer sucker shell).
3. Crinkle the six squares of tissue paper. Note that the crinkled paper has more surfaces to hold and organize information than the flat paper did. This is why your brain is shaped the way it is!
4. Wrap the layers of tissue paper over the sucker loosely to form a brain shape.
5. Secure the tissue paper at the base of the brain stem to hold the model together.
6. Discuss and review the sections of the brain by using this model.
Brain Connections

The brain consists of 100 billion neurons or nerve cells. Each neuron can have thousands of connections with other neurons. Neurons that “are fired” or stimulated together “wire together”. The place where the fired neurons wire together (connect) is called a synapses.

Note the diagram above shows how neurons become connected through repetitive learning experiences. The newborn in Figure A has had few opportunities to experience the world. However, by one month (Figure B) the baby has gained sensory information and some connections (synapses) have been formed. By six months of age it is easy to see how much the child has learned by the amount of synapses that have been formed in the brain (Figure C). By the age of two the child has repeated many behaviors. The more a behavior is repeated the more set the brain connection becomes (Figure D). As the connections become more set the synapses become stronger which allows information to flow through the brain at a faster rate of speed.

Repetitive behaviors (both positive and negative) that become “hard wired” can make lifelong habits. Neurons that are seldom stimulated lose their connections and are pruned by the brain. If you don’t use it (neuron) you will lose it! The rate of brain development varies with each individual. Brain connections are made as a result of experience. No two brains are alike because everyone has had differing experiences which shape its development. Brain growth and development is greatest during the first three years of life. However, neural (neuron) development continues throughout the lifespan. Keeping your body and brain active will help improve mental processes throughout your life!
Brain Development Throughout the Lifespan

A. Early Childhood
- Between the ages of two and six brain weight increases from 70-90 percent of its adult weight.
- During this time there is rapid growth at the front of the brain.
- Memory, language, and thinking skills improve because of brain development.
- Overproduction of connections and synaptic pruning continues.

B. Later Childhood / Early Teens
- The back of the brain begins its final growth spurt around age 10 or 11.
- The final growth spurt of the brain progresses from the back of the brain to the front.
- The cerebellum (which controls physical and motor coordination) develops first.

C. Teenagers
- The mid-brain develops quickly during the teenage years up causing dramatic changes in motivation and emotional control. This often causes teens to appear lazy. Teens misread the emotions of others and quickly become moody and irritable as a result.
- The front of the brain (prefrontal cortex) also experiences a growth spurt during this time. However, it won’t be fully developed until the age of 25.
- The prefrontal cortex perform the following executive functions: focusing attention, organizing thoughts, problem solving, weighing consequences, making predictions about the future, forming strategies/planning, balancing short-term rewards with long term goals, shifting/adjusting behavior when situations change, impulse control, delay of gratification, modulation of intense emotions and inhibiting inappropriate behavior.
- The brain lacks “its braking system” during the teen years because these important brain functions have not yet developed. This causes teens to take undue risks and increases dangerous behaviors such as unprotected sex and drug use/abuse.

D. Adulthood
- Age related changes in memory vary widely across tasks and individuals. Most abilities remain fairly stable throughout early and middle adulthood.
- Dramatic gains have been shown in problem solving because of the development of expertise in people ages 40-60.
- Aging leads to an accelerated decline after age 60. Accelerated loss of brain weight also occurs at this age.
- After age 60 brain loss often outweighs improvement and maintenance.
Brain Boosting Ideas

A. Early Childhood/Childhood
- Be warm, loving and responsive to your child.
- Listen to your child and respond appropriately.
- Encourage safe exploration.
- Establish consistent routines and rituals.
- Limit television viewing.
- Ensure good health, nutrition and safety.
- Talk, read and sing with your child daily.

B. Teens/Pre-teens
- Encourage exercise. It helps clear the mind and improves mood!
- Monitor your teens stress level and provide support as needed. Chronic stress shrinks the memory center of the brain!
- Fuel the brain with protein rich foods. The body breaks down protein into amino acids which are essential for alertness and mental ability.

C. Adults
- Stay mentally active.
- Learn something new...become a lifelong learner!
- Stay physically active.
- Eat a healthy diet.
Anatomy and Functional Areas of the Brain

Functional Areas of the Cerebral Cortex

1. Visual Area: Sight
   - Image recognition
   - Image perception
2. Association Area: Short-term memory
   - Equilibrium
   - Emotion
3. Motor Function Area: Initiation of voluntary muscles
4. Broca's Area: Muscles of speech
5. Auditory Area: Hearing
6. Emotional Area: Pain
   - Hunger
   - "Fight or flight" response
7. Sensory Association Area: Sensation from muscles and skin
8. Olfactory Area: Smelling
9. Sensory Area: Sensation from muscles and skin
10. Somatosensory Association Area: Evaluation of weight, texture, temperature, etc. for object recognition
11. Wernicke's Area: Written and spoken language comprehension
12. Motor Function Area: Eye movement and orientation
13. Higher Mental Functions: Concentration
   - Planning
   - Judgment
   - Emotional expression
   - Creativity
   - Inhibition

Functional Areas of the Cerebellum

14. Motor Functions: Coordination of movement
    - Balance and equilibrium
    - Posture