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BASIS Lesson Plan

Lesson Name: Brain talk! How brains communicate

Grade Level: 5th

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Standards Connection(s):

CA Science Standards: Life Sciences, Grade 5
NGSS: Life Sciences, Grade 4

**Note to teachers: Detailed standards connections can be found at the end of this lesson plan.*

Teaser/Overview

In this lesson, students will learn how their various senses allow them to move and interact with the world. They will learn about the different parts of the brain that allow them to perform these actions and how these brain regions are connected. Students will participate in an interactive task testing their hand eye coordination and will collect their own data and observations. They will then hold and touch real brains so they can see the brain regions we will talk about. Finally, students will apply what they learned to real world situations such as sports and music.

Lesson Objectives

- Students will participate in a hand-eye coordination task and a tactile identification task. Students will record data such as how they were able to complete the tasks and why they interacted with the objects in the way they did.
- Students will discover that the brain is a complex organ that is made up of many different parts. They will be able to identify the brain regions that process different senses and allow them to move.
- Students will understand what a scientific model is and how it can help them learn, remember, and share knowledge about brains.

Vocabulary Words

- **Sensation:** Processing any of the five senses (touch, taste, smell, hearing, vision).
- **Neuroscience**: The study of the brain.
- **Hypothesis**: An educated guess about what will happen when you change something.

- **Frontal Lobe**: The part of your brain just behind your forehead that helps control things like planning, reasoning, social behavior and movement.
- **Parietal Lobe:** The part of your brain directly under the top of your skull that helps control things like perception of touch and where we are in space.
- **Occipital Lobe:** The part of your brain on the back of your head that helps process visual information that comes in from the eyes.
- **Temporal Lobe:** The part of your brain on the sides of your head that helps process sound information that comes in from the ears, helps you speak, and helps you make memories.
- **Cerebellum:** The part of your brain just above the nape of your neck that helps control things like movement, posture and balance.
- **Cortex:** The outer layers of your brain that are the last to develop. Humans have a larger cortex than most other animals.
- **Sensory cortex:** The part of your brain involved in processing sensation.
- **Motor cortex:** The part of your brain involved in movement and performing actions.
- **Model:** A representation of something else. For example, a gingerbread house is a model of a house.

Materials

Scientist Volunteers will bring:

- Preserved human brains
- Trays
- Gloves
- Coloring sheets
- Worksheets for data collection
- Paper bags, oranges, pine cones, hacky sacks, blindfolds
- Visual model of the brain

Classroom Set-Up

- Scientists will need access to a sink and a whiteboard/chalkboard
- Students should be seated for an introduction
- We will then pass out materials for the interactive tasks
- Students will be split into partners where one will collect data while the other conducts a task and then they will switch roles
- After the hands-on portion students will come back together to be put into larger groups of 4 or 5 students for the human brain exploration part of the lesson
- Students will reconvene for a 10-minute wrap up of the lesson, which will include a introduction to models. Students will be given an interactive take home sheet to reinforce the lessons.
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Classroom Visit

1. Introduction (10 minutes)

Role Model Introduction:

Before we get started, we will introduce ourselves briefly and explain what we research in graduate school.

Topic Introduction:

We'll start by giving a few examples of what your do in your daily lives. For example - dodging a ball. You hear it, you see it, and you move out of the way. How does the brain connect these senses with your decision to move and the actual movement to get out of the way? (Other example include hitting a baseball or crossing traffic). We will explain that your brain is involved and introduce our first vocabulary words such as "neuroscience" (we will ask students to help define them). We will ask the students what they know and what they don't know about the brain. Finally, we'll introduce that we're going to use science to figure out part of that question!

2. Learning Experience (35-40 minutes)

The whole class will go through each of these stages simultaneously. For stages 1 and 2, they will be broken up into pairs. For stage 3, they will be broken up into groups of 4 or 5 students.

Students will be doing two experiments in Stages 1 and 2 that will help them figure out how we process sensation and how it helps us act within the world. As students complete these experiments, we'll ask them to think about what might be going on in the brain and fill out a worksheet as they go. When we're done, we'll come back together and talk about our findings as a group.

Stage 1: Sensory-motor connection (Tactile identification task)

- Teams are provided two bags labeled "object 1" and "object 2"
- One team member plays the role of scientist and the other will be the participant.
    - The scientist will ask the participant to identify object 1 and describe what the object feels like and how they are moving their hands. The scientist will record the participant's response on the worksheet.
    - The students will switch roles. The scientist will ask the participant to identify object 2 and describe what the object feels like and how they are moving their hands. The scientist will record the participant's response on the worksheet.

Stage 2: Visual-motor connection (Hand-eye coordination task)

- The participant will toss a hacky-sack while looking at it and while looking away, such as over their shoulder. The scientist will record the number of successful catches in each condition out of 10.
- The scientist will come up with a hypothesis about what will happen if they blindfold the participant and will then test it.
- Switch roles.
- Students will fill out their data worksheets and compare their performance. Why do you think it was harder/easier in the different conditions?

At the end of this stage, we'll come back together as a group and have students share what they found. We want students to think about how sensation alters what your actions are. We'll then explain where in the brain the sensation and motion is being processed. We'll point out the different brain areas and go over the rest of our vocabulary terms.

Stage 3: Brain areas in the human brain!

- Students will break up into groups of 4 or 5, counting off to do so.
- At each station, students will get a chance to look at and hold real, preserved human brains – can you find those brain regions we discussed?
- Can you identify where in your own head, roughly, this is taking place?
- Note: students must wear gloves and be gentle and respectful of the brains!

Stage 4: Coloring sheet - model of the brain (Optional, depending on time)

- If there's time, we'll introduce "model" as a vocabulary term and hand out coloring sheets for each student.

3. Wrap Up: Review and Discuss the Learning Experience (5-7 minutes)

We'll come back together as a group and ask student volunteers to come up to the front and demonstrate what brain areas were being used during their two experiments. We will have a large model of brain for them to draw on. They can connect brain regions and show how they think the brain areas interacted to allow them to complete each task. We will end up with a brain circuit!

We will also go over real-world connections such as sports, music, video games, cooking, etc. Lastly, we will ask students to identify other real world activities where these brain regions and skills are used.

4. Connections & Close (3-5 minutes)

Connections:

- Take-away: everything in the brain is connected and talks to one another! It helps you make your way in the world around us!
- Also, students will have take-home coloring sheets, if they haven't already been used during the lesson.

Close:

We will leave a few minutes for students to ask questions about science, about being a scientist, and about becoming a scientist. Then, thanks and goodbye!

Follow Up: After the Presentation

- To learn more, check out this awesome website! It includes a number of brain activities and experiments: https://faculty.washington.edu/chudler/experi.html
- Teachers can use the coloring sheets as take-home or in-class activity to reinforce content and connections

Standards Connections

California Science Standards, Grade 5:

- Life Sciences: Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials.

NGSS, Grade 4:

- Connections by topic: Life Science 4. Structure and Function
- Connections by disciplinary core ideas: 4-LS1 From Molecules to Organisms: Structures and Processes
    - 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction
    - 4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways
- Connections by scientific & engineering principles
    2. Developing and using models
    4. Analyzing and interpreting data
    6. Constructing explanations and designing solutions
    8. Obtaining, evaluating, and communicating information
- Connections by crosscutting concepts
    1. Patterns
    2. Cause and effect: Mechanism and explanation
    4. Systems and system models
    6. Structure and function