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Of Brains and Safety: Elementary Neuroscience

Curriculum Guide

Curriculum Learning and Behavioral Goals:

The overall goals of the curriculum are to make a link between neuroscience and safety by introducing young children to the human brain and nervous system, and to encourage habits of keeping their brains safe while having fun doing common, normal activities that children do.

In the process, this program seeks to engage young children's powerful thinking processes by focusing on their relative strengths to observe their surroundings, sort and classify what they observe, and then describe what they had learned verbally, visually, or kinesthetically. As children use these cognitive skills, they are developing the ability to think scientifically.

Key Concepts to Communicate:

1. The brain is what makes you go and what makes everything about you work.
2. You use it to make good decisions.
3. The brain can get hurt, and sometimes does not get better.
4. We need to take care of our brains because they take care of us.
5. People can study the brain. Neuroscientists are one group of women and men that uses different ways to find out how the brain makes *us* work.

Principles behind the Curriculum's Approach: How do children learn best?

As teachers certainly know, early-childhood students are naturally drawn to science. It is active and exciting just like children. Teachers recognize this link and provide science experiences that are appropriate to the cognitive development of the students. These thinking processes develop in a predictable sequence and lay the foundation for more advanced and abstract thinking when students are older.

1. *Hands-on learning* - Children learn best by doing and by using real life objects. Hands-on activities are engaging and motivating for children, and they promote curiosity. In this curriculum for example, we students examine brain samples and create brain models.

2. *Inquiry* - Science experiences are guided by questions. As answers are pursued, new questions arise. This curriculum asks questions such as: "What does your brain do?" and "Can your brain get hurt?"

3. *Multi-sensory methods* - As more senses are used, information gathering is maximized. This curriculum employs auditory, visual and tactile stimuli.

4. *Student interaction* - Having students work cooperatively facilitates the exchange of ideas. During the brain program the children interact in a full group, in small groups, and one-on-one with peers and adults. Students' observations and discoveries promote more curiosity and inquiry.

Suggested Adult-to-Student Ratio for Presenting the Brain Curriculum:

For a Kindergarten class, a 1:4 ratio of adults to children is suggested to help students with activities, plus 1 adult to rove and/or prepare for the next activity. For example, a class of 25 Kindergarten students ideally would have a total of 6 adults participating.

For children in grades 1-5, the ratio of adults to children could gradually be reduced to 1:6.

Step-by-Step Lesson Plan:

Coordinating with the Classroom Teacher Prior to the Program Presentation Date

1. 1-2 weeks in advance of your presentation date, meet with the hosting classroom teacher.
2. Go over the curriculum together.

3. Please discuss goals and expectations, background information about the class, and roles:
a. the teacher's goals and your goals for the program
b. any portions of the curriculum that may be problematic or need modification
c. any difficult situations or responses from children that the teacher or you anticipate

> ***A definite must: Discuss ahead of time with your supervisor and the classroom teacher any professional/legal obligations and the procedures that will be in place for handling a reportable situation, such as child or elder abuse, if such comes to your attention.***

d. how the curriculum fits with the class's overall science curriculum
e. scientific concepts and areas of science that the children have studied before your program
f. why this curriculum is being presented in the class now
g. how many students and adults will participate
h. any special needs children, and what accommodations can be done
i. the roles and tasks during the program that you, the teacher, and other adults will carry out

4. Go over the location of equipment and activity stations:
a. where can the laptop and Powerpoint projector be set up
b. is there a screen in the classroom; does one need to be brought in
c. do you need an extension cord? Is one available?
d. is there room for the children to move around for the various activities?
e. is any special permission needed from school, parents, etc. for the program?
f. are water-based markers, clear tape, and scissors available in the classroom for the children?

5. Ask if there is anything else you should know?

6. Two-three days before the program, call to reconfirm everything with the classroom teacher.

In-Class Presentation:

I. Introduction

Set up laptop and Powerpoint projector

Slide 1: "Neuroscience for Kids" show as backdrop

Presenters briefly introduce themselves, describe interests in science / health
Ask the class what students have been studying in science? About the human body?

Assess what the children know about the human brain and keeping it safe

a. What does your brain do?
b. How does your brain find out things?
c. Does your brain need exercise?
d. How do you exercise it?
e. Can your brain get hurt? How?
f. Who rides a bike now? (Show of hands.) Who wants to learn to ride a bike?
g. Do you have to wear a helmet when you ride your bike?
(The State of Oregon requires bike riders to wear helmets if they are 16 years old or younger. But, it's a good idea if everyone who rides a bike wears one.)

II. Bike Accident Re-enactment (powerpoint) and Egg Drop

Show re-enactment of a bike accident *(This is not a graphic portrayal of the accident.)*.

a. Has anyone been in a bike accident or seen a bike accident? If so, what happened?
b. I'm going to show you a bike accident that happened to a 3rd grader last summer

Slide 2: STREET INTERSECTION – 8:30 a.m. on a summer morning
What does this mark on the pavement mean? What's this area between the white lines?
Add cars and bicyclists stopped at the intersection.
What color is the traffic light? What does the "walk" sign say?
Who should stay stopped at the intersection?
Who should be allowed to cross the intersection?
Show the car and bicyclists starting to cross the street.
Show the SUV speeding up bike lane, running red light, hitting one bicyclist, then fleeing.
Indicate that no one drove over the bicyclist after he was knocked into middle of street
People stopped to help; fire, ambulance, and police came; bicyclist transported to ER
Discuss the behavior of the driver of the SUV
Indicate that the driver was intoxicated; eventually was arrested and went to jail
The bicyclist was very lucky; his injuries were minor and he's doing very well.

Slide 3: BROKEN HELMETS
These broken helmets were all in accidents.
What would happen to your head if you were not wearing a helmet?
Does a helmet always protect you?
The best thing is not to have an accident.

Egg-drop Demo

Ask students what we could do to show the difference between what happens to an unprotected brain in an accident compared to a brain that has some protection.

Bring out two eggs and a small bucket, and paper towels
a. Ask for a volunteer; ask her/his name
b. Put small bucket on floor and discuss what would happen if we dropped an egg into it
c. Ask if we should test that hypothesis
d. Have the volunteer drop one egg into the bucket
e. Examine the results: the hard shell cracked open and the soft insides got smooshed
(If the bucket fails to catch the egg, the paper towels may come in handy)
f. Thank your volunteer and have her/him sit down

Ask for another volunteer; ask her/his name
a. Set aside the small bucket and scrambled egg
b. Ask, What we could do to protect an egg and prevent it from cracking?
c. We don't have a bike helmet for an egg, but…. impact-resistant egg vehicle
d. Discuss what would happen if we dropped an egg riding in the "vehicle"
e. Ask if we should test that hypothesis
f. Help the volunteer secure the remaining intact egg in the protective vehicle
g. Have the volunteer drop the vehicle
h. Examine the results, and discuss
(If the vehicle fails to protect the egg, the paper towels may again come in handy. You can explain, the egg vehicle, like a bike helmet does not always protect; the best thing is not to have an accident.)
i. Thank your volunteer and have her/him sit down

Ask for another volunteer; ask her/his name
a. Have the volunteer put on the bike helmet and fasten the loose straps
b. Do you think this will work if Johnny/Jenny crashes? Why? What do we need to do?
c. Fit the helmet properly on the volunteer
d. We will give you a guide to take home, and info on where to get a helmet
e. Thank your volunteer and have her/him sit down

III. Brain Pictures (powerpoint)

Ask if anyone has seen a picture of the human brain?

Slide 4: HUMAN BRAIN (SIDE VIEW) – have you ever seen a picture of a real human brain
What does it look like to you?
Now, what part helps us to walk and balance?
And what part helps us decide what we do?
Where does the brain work on hearing? touch? taste? smell?
What did we leave out? (sight)
Discuss why the frontal lobe is so important: helps us make good decisions

Slide 5: HUMAN BRAIN (TOP VIEW) – tell me, what's different about this picture
From the top, you see that the brain is divided into two halves, a right side and a left side
Does it look like a ball? Yes/No? Kind of scrunched together?
Ask for a volunteer; ask her/his name

Slide 6: WHY IS BRAIN WRINKLY?
Bring out a full sheet of newspaper
The brain is kind of like a sheet of newspaper because it's folded in on itself
Hand the sheet of newspaper to your volunteer
If this sheet of newspaper was your brain, how would you get it to fit inside your head?
Volunteer scrunches newspaper into a ball
Right! Now you can show your family how the brain fits inside your head
If you unfolded the brain it would be about the size of a sheet of newspaper
Why is it good that our brains have folded up instead of staying flat?
Thank your volunteer and have her/him sit down

IV. Study of the Brain (powerpoint)

Slide 7: SCIENTISTS – This woman and this man are two REAL scientists who study the brain.
They study what alcohol and drugs do in the brain.
Have you heard of alcohol? What is it?
What are drugs? When are they good for you? When are they bad for you?

Slide 8: LIGHTS ON / LIGHTS OFF
What do drugs do to the brain?
Does it work better? Not as well?
The brain of the person who didn't drink alcohol shows a lot more going on
Now, what part of you controls what you do and makes everything about you work?
So, if your brain is not working so well, what happens to the rest of you?
What's going on with the brighter brains on top and the darker brains on the bottom?
Which brain would you want?
Any questions????

V. Brain Development (powerpoint and demos)

Slide 9: BRAIN GETTING MORE POWERFUL!
Development at ages, 5, 10, 15, 20
Worksheet: BrainPOWER!
- Students work in teams of 2 to 6; divide class accordingly
- Each student gets a worksheet to use
- For each age, each group tries to come up with the most stuff the brain can do
- For an infant (3 months old), groups get 35 seconds to make a list
- For a 12-year old, groups get 45 seconds to make a list
- For an adult (their teacher), groups get 55 seconds to make a list
- One student in each group is the recorder
- The recorder writes a group list made up of all the group members' responses
- Ask each group for its responses to each age
- Tabulate each group's responses on a master list for each age
- Discuss the similarities and differences from age to age
- Ask students, what are their brains really good at right now?
- How are your brains becoming more powerful?
- Ask students to do the last item on the worksheet:
  - What do I want to be an expert at doing?
  - What does my brain be able to do so I can become an expert?

Slide 10: BRAIN NETWORKS

Demo: Neural Chain
Divide the class in half into two teams
Teams race passing messages from hand to brain and back to hand
Race 3x
Give teams one minute to configure a faster message pathway
Re-race 3x
Can "pruning" make the brain work faster?

Demo: Amygdala and Prefrontal Cortex
What part of your brain are you using to make decisions?
Two individuals meet on a park bench, one is sooo hungry, the other has a pizza
Each individual has a group of neurons, or a "chorus"
The chorus for each person chooses one part of the brain to respond
That part of the brain selects from among options, and guide's the individual
The action goes back and forth, different choices lead to different behaviors

VI. Small Group Activities: *Announce that we have three activities for everyone in the class*

Activity #1: Brain Models

1. Use modeling compound to make models of the brain that children can take home
2. Each child starts with a ball of compound slightly larger than a golf ball
3. Water-based markers can color the compound without transferring the color to hands or table
4. Apply the marker, and then knead the compound until the color is distributed as desired
5. Divide the compound
    a. make two equal size large balls
    b. make two equal size smaller balls
    c. the size ratio for the large size and smaller size can be about 4:1

6. Roll each of the two smaller balls into a "snake" about 1/8" in diameter
    a. Very gently roll each snake into a ball but DO NOT squeeze or compress
    b. Each ball looks a bit like a ball of twine; set both aside

7. Roll each of the two larger balls into larger "snakes" about 1/8"-1/4" in diameter
    a. Very gently roll each larger snake into an egg shape, but DO NOT squeeze or compress
    b. Gently form one egg shape into the right hemisphere and the other into the left
    b. Then gently attach them together

8. Gently form each of the small "twine" balls into the two halves of the cerebellum
    Connect to the larger hemispheres – Done!

9. Put the brain model in a small ziplock plastic bag when finished for the student to take home
    Kept in a sealed plastic bag, the modeling compound is moldable for several weeks
    Left open to the air, the compound dries to a solid in 2-3 days

Activity #2: Comparing Brains

1. Use *ComparingBrains!!!* Worksheet to record measurements of brains
2. Help students identify a common object that is similar in size to each brain
3. Compare how the different brains are similar, different
4. What does having a larger brain mean? a smaller brain?
5. Try to identify the cerebellum on each brain
6. Try to identify the olfactory bulb on each brain
7. Another good reason to wear a bike helmet:
    a. Your brain floats in liquid; it can slam against the skull if you get hit in the head
    b. A bike helmet can reduce how hard the brain hits the skull
8. Have each student write one question s/he has about the brain

Activity Station #3: Brain Hats

1. From a sheet of thin plastic foam cut out a 2" wide strip; use clear tape to form a hatband
2. Color one right and one left brain hemisphere; attached plastic stickers as desired
3. Identify major brain areas related to the five senses
4. Tape the hemispheres to the hatband, try out the hat – Done!

VII. Concluding the Program

Wrap up with the children:

a. What did you like best and least about the program?
b. When you go home today, what will you tell your parents and families about the brain?
c. Why is the brain important? what does it do?
d. How can the brain get hurt?
e. How do we take care of our brains.
f. Who studies the brain? *(We do! And neuroscientists too!)*
g. Who wants to be a scientist?
h. Thank them for their invitation and for their participation

Presentation Materials List:

Scientist Garb and Accessories:

lab coat, ID badge
brain model
tools/toys of the trade (stethoscope, otoscope, etc., if you are qualified to use them)

PowerPoint Presentation:

laser pointer
laptop, with ppt presentation loaded
ppt projector
power strip, extension cord

Egg Drop Demo:

2 eggs
small bucket
impact-resistant egg vehicle
paper towels

BrainPOWER! Activity:
- Worksheet

Neural Chain Demo:
- Cue cards

Neural Network Demo:
- Amygdala and Pre-frontal Cortex Cue cards

Activity #1: Brain Models
- modeling compound
- small ziplock plastic bags

Activity Station #2: Comparing Brains
- comparative anatomy brains/sections
- worksheets

Activity Station #3: Brain Hats
- sheets of foam for hat bands
- photocopied outlines of the brain to color
- scissors

Safety Handouts (for parents/caregivers):
- safety tips from ThinkFirst Oregon
- bike helmet fitting guide