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BASIS Lesson Plan

Lesson Name: Please Play with Your Food

Grade Level Connection(s)

NGSS Standards: Grade 4, Physical Science/Life Science (4-PS3, 4-LS1)
FOSS CA Edition: Grade 5, Life Science: Living Systems

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

Teaser/Overview

This hands-on lesson guides students to explore how the sweetness we taste in a food item does not necessarily correlate to the amount of sugar in that food item. Through simple, fun experiments with fruit and yeast, students will explore how science can help them figure out which foods have the most sugar!

Lesson Objectives

- Students will conduct simple experiments, from design and hypothesis to testing and conclusions.
- Students will understand the difference between a subjective test (eg a taste test) and an objective experiment (eg a yeast experiment).
- Students will discover that there is sugar in many different types of food – sometimes, more or less than we think!
- Students will better understand how scientists look at the world and how students can find their own answers to questions about the world around them.

Vocabulary Words

- **Yeast**: Microscopic (too small to see) fungi that are capable of converting sugar into alcohol and carbon dioxide
- **Microorganism**: A very tiny (*micro*!) living thing (*organism*!) that can't be seen with just your eyes
- **Carbon dioxide**: a colorless, odorless gas that we exhale when breathing
- **Cell**: The smallest unit of a living thing; all organisms are made up of cells

- **Hypothesis**: Educated guess in science
- **Objective**: not influenced by personal feelings or opinions in looking for or representing facts
- **Subjective**: influenced by personal feelings, tastes, or opinions; not objective

Materials

Scientist Volunteers will bring:

- Images of yeast
- Can of tomato soup (12g sugar)
- Box of fruit loops (12g sugar)
- Images of sugary food comparisons
- Ziploc bags
- Yeast (added into bags)
- Several pipettes and cups
- Bananas, carrots, grapefruit, sweet potatoes, blueberries, organized such that every group of 5 students has enough of each food to mix into one Ziploc bag, as well as enough for all students to taste (large food items should be pre-cut)
- Water

Materials teachers should provide:

- Pens/pencils, rulers

Classroom Set-Up

Students should be split into groups of 5.

Classroom Visit

1. Introduction (10 minutes)

Role Model Introduction:
Being a role model is an important part of being a BASIS volunteer! Begin your lesson by explaining who you are and what you do as a scientist. Feel free to tell your "story" as if giving an elevator pitch to elementary school students: Why did you become a scientist? What questions are you trying to figure out? What do you do in your job? Why should students relate to you? Feel free to bring in photos, specimens, and other props. Let your personality shine through!

Topic Introduction:
After you introduce yourselves as role models, take some time to introduce the topic of this lesson: sugar content in food. It may be helpful to keep the suggested take-away in the back of your mind throughout the lesson: **The sweetness that we taste in a food item does not necessarily correlate to the amount of sugar in that food item.**

Your topic introduction should introduce students to the phenomena they will explore: how sweet a food tastes does not necessarily indicate how much sugar it contains. As much as possible, try to frame this information as questions posed to the class, rather than as a lecture. This helps activate students' prior knowledge and facilitates student-guided conversation.

1. Introduce the phenomenon that the class will explore: sugar content of food
    - Hold up a can of tomato soup and a box of fruit loops.
    - Ask students to turn to the person next to them and make a **hypothesis** (define): which do you think has more sugar, and why?
    - Have students return attention to the front, and take a poll: which do you think has more sugar? Record results of poll on the board.
    - Briefly explain how the amount of sugar can be gleaned from the nutrition label.
    - Ask a student to read from the label how much sugar is in the can of soup (have another student confirm); repeat for box of cereal.
    - Invite students to share their reactions to what the class just figured out.
    - Share images of other examples (eg one Yoplait yogurt vs two Krispy Kreme donuts; one Snapple iced tea vs one can of Coke).
    - Guide students to agree on the phenomenon that the sweetness we taste doesn't necessarily correlate to the amount of sugar in food.
2. Guide students to identify a question to ask
    - Record questions on the board
    - Explain to students that you have brought materials to help the class try to figure out one question among the many possible questions: **How can we find out which foods have the most sugar?**
3. Introduce the remaining information students will need to have in order to successfully complete the hands-on experiment
    - Guide students to make suggestions of how we might be able to investigate the question
    - Explain that yes, we will use taste, but we will also use another method
    - Introduce the terms **subjective** (define) and **objective** (define)
    - Introduce **yeast** (write on board)
        - Ask for definitions (eg makes bread rise)
        - Provide definition: eg, "Yeast is a **microorganism** (write on board, come back to define) that eats sugar and then makes **carbon dioxide** (write on board, come back to define) from it."
        - Show images of yeast

    - We can measure the carbon dioxide gas from the yeast to see how much sugar the yeast has eaten. If there is a lot of carbon dioxide, then we know the yeast ate a lot of sugar.
- Now that we know what yeast does, does anyone have any other ideas of how we can design an experiment that will help us figure out which foods have the most sugar?

Teaching Tip: Say, Write, Show

- Bring in photos and props to illustrate the topic intro
- Write new vocabulary words, key terms, and brainstorm lists on the board
- Help students make sense of vocab through root words, eg micro+organism
- Refer back to the board to engage visual learners and English Language Learners

2. Learning Experience (30-40 minutes)

*Students will be split into groups of 5.

1. What does our background knowledge tell us?
    - Volunteers show the class five foods that will be tested for sugar content
    - Students record their hypothesis: which foods will have the most vs least sugar?
2. What does a scientific experiment tell us? (Set up yeast experiment)
    - Each table group gets one cup of water (filled about halfway)
    - Experiment begins: each student receives 1 bag with (1/2 tsp) yeast already inside and a pipette that they will use to add the water later
    - Before passing out the food, have each student write the name of the food that they will be putting in the bag (can have each student group count off 1 through 5; 1s will have banana, 2s will have blueberries, etc)
    - Distribute the food. Each student will put one piece of food into his/her bag
    - Each student adds two squirts of water using a pipette
    - Each student tries to squeeze out air from the bag and closes the bag; then mixes up the yeast and food
    - Have students make observations about the bags – pay special attention to the amount of air in the bag
    - Set all bags aside while yeast eats
3. What does our subjective experience tell us? (Taste experiment)
    - Remind students of their initial hypothesis from Step 1 above – which foods will have the most vs least sugar?
    - Each group receives a small amount of each food (enough so each student can taste)
    - Each student tastes a bit of each food
    - Each student orders the foods from least sweet to most sweet (*Note: You may want to hand out the food in rounds so that students don't eat all foods at once!)

- Groups discuss their findings, and determine based on what each student tasted, which foods they think are the most sweet and which are the least sweet. Does this affect their hypothesis about which foods have the most sugar?
- Invite groups to share their group hypothesis with the class
- Create bar graph on the board out of groups' hypotheses

4. Back to "What does a scientific experiment tell us?" (Return to yeast experiment)
    - Ask students to make and record observations of the yeast bags
    - Guide students step-by-step to measure the CO2
        i. Take the ruler and measure the height of the bag in centimeters
        ii. Write down the number for each bag
    - Collect results in a bar graph on the board

3. Wrap Up: Review and Discuss the Learning Experience (5-10 minutes)

*This is the "discussion and conclusions" part of the lesson

- Which foods did we think would have the most sugar before we did either of the two experiments?
- Which foods did we think would have the most sugar after we did the taste experiment?
- Which foods do we think have the most sugar now, after doing the yeast experiment?
- Are all three answers the same? Why or why not?
- Which is the correct answer (our conclusion)?
- Invite observations and questions

Contextualize the conclusion:

- Some foods are made to taste sweet without sugar. To us, they all taste sweet, but only some foods have sugar.
- An experiment can test our hypothesis and an instrument can help us measure it.
- Graphs help us look at the results we get from an experiment.
- Scientists are careful to design experiments that are as **objective** as possible, and to keep their **subjective** experiences separate as much as possible.
- How can what we learned today help us understand foods? (revisit images/examples from intro)

Classroom Management Tips: Encourage Participation

- Wait 3 seconds before calling on students to answer a question. You'll be impressed with how many more (and often, more diverse) hands go up.
- It's tempting to call on eager students, but give everyone a chance!
- Be flexible in how you communicate questions and responses, reiterating information in different ways if needed.
- For more classroom management tips, visit www.crscience.org/volunteers/volunteertools

4. Connections & Close (5 minutes)

Connections to the real world around students:

- Ask students if they have heard of **cellular respiration**; if so, guide quick discussion; if not, give a quick explanation. Focus on connecting the experiment to what actually happens inside our bodies:
  - **Cells** (define) break down the sugar that we eat.
  - The energy that is released during this process helps us do everything we do during the day, from breathing to studying to running around
  - When that sugar is broken down, carbon dioxide is released – just like in our experiment! Eventually, that carbon dioxide travels through the body to our lungs, and we breathe it out. (Ask students to breathe out onto their hand – they're breathing out carbon dioxide!) Water is another by-product.

Close:
Wrap up as a role model by leaving 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

Teachers who wish to extend the impact of this lesson may find the following CRS web pages useful:

- http://www.crscience.org/educators/helpfulreports
- http://www.crscience.org/educators/treasuretrove

Standards Connections

NGSS:

- Connections by topic
  Life Science: 4. Structure and Function.
  Physical Science: 4. Energy.
- Connections by disciplinary core ideas:
  Life Science: 4-LS1 From Molecules to Organisms: Structure and Processes
  Physical Science: 4-PS3 Energy
- Connections by scientific & engineering practices
  1. Asking questions and defining problems
  3. Planning and carrying out investigations
  4. Analyzing and interpreting data
- Connections by crosscutting concepts
  2. Cause and effect: Mechanism and explanation

5. Energy and matter: Flows, cycles, and conservation

- Connections by performance expectation:

  4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

  4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

FOSS CA Edition kit: Grade 5 Life Science: Module 3, Sugar and Cells