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*Brad*

# Best Ever Bird Beak Lesson

A comprehensive S.T.E.M. Activity

More pages!  
More options!

Common Core  
Math & N.G.S.S.  
Aligned!



**PRIMARY, ELEMENTARY,  
AND MIDDLE GRADES**

By Brad Fulton

Educator of the Year, 2005

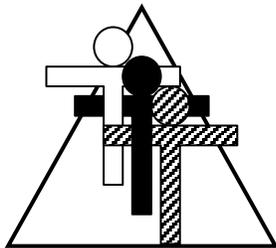
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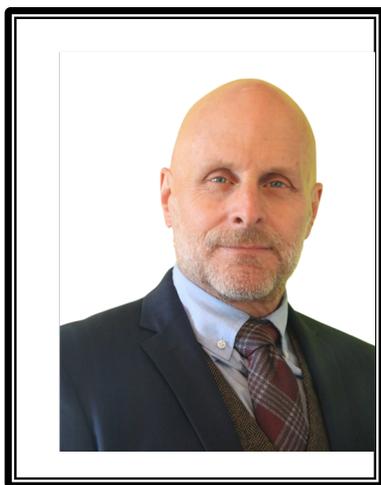


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# Brad Fulton

## Educator of the Year



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- ◆ Consultant
- ◆ Educator
- ◆ Author
- ◆ Keynote presenter
- ◆ Teacher trainer
- ◆ Conference speaker

Known throughout the country for motivating and engaging teachers and students, Brad has co-authored over a dozen books that provide easy-to-teach yet mathematically rich activities for busy teachers while teaching full time for over 30 years. In addition, he has co-authored over 40 teacher training manuals full of activities and ideas that help teachers who believe mathematics must be both meaningful and powerful.

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### **Author and co-author of mathematics curriculum**

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*Brad* 

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## OVERVIEW

# Bird Beaks

Students will enjoy participating in this engaging exploration that helps them understand the diversity of the animal kingdom and the concept of adaptation. They will mimic the feeding habits of birds with various types of beaks to learn how species have adapted to their environments. Options allow the lesson to be extended through the grade levels and into math, technology, and engineering for a full S.T.E.M. experience.

**Vocabulary:** adapt, environment, heredity

## PROCEDURE

1. Begin by gathering the materials. Many lesson options are presented, so you may want to read ahead first to decide which activity and which materials you will need. This materials list contains tools that represent the bird beaks and food samples that represent the bird diets.

Tool:	Food:
Tweezers	Rice, beans, spaghetti, and gummy worms
Small net or spoon	Swedish fish, and cereal with marshmallows
Eye dropper or straw	Water with red food coloring
Needle-nosed pliers	Pistachios or other nuts
Fork	Ramen, water, and red food coloring

You will also need some small cups for students to collect their food for counting, one test tube, and some trays to contain the water and other foods to minimize the messiness.

2. The set up for the lesson will again depend on which of the numerous options you wish to try with your students. Here are the instructions for each station's food setup, the type of bird associated with it, and the tool that will likely be most effective:

**Seed-eating birds:**

Mix some grains of **rice** with some uncooked **beans** and some **crumbled spaghetti** noodles and spread them into a tray. The rice represents bird seed, and the beans and broken noodles represent rocks and sticks respectively. The students have to gather the “bird seed” without eating the rocks or sticks. The best tool will probably be the **tweezers**.

**Insect-eating birds:**

Place a **gummy worm** or other “bug” into a **test tube**. The students have to try to reach into the test tube and capture the worm. **Tweezers** will work most effectively.

**Nut-eating birds:**

Place some pistachios or other nuts in a tray. The students must gather the nuts and crack them open. The **needle-nose pliers** will come in handy.

**Birds that drink nectar:**

Put some red colored water in a small cup. Students will use a **dropper or a soda straw** to get the liquid out of the cup. By placing their thumb or finger over the top of the straw, they can pick up small amounts of “nectar”.

**Raptors – meat eaters:**

Soften some ramen noodles by boiling them. Then cool them and put them in a small bowl or tray with some red colored water. This will represent meat and blood. The **fork** will allow students to tear away chunks of the “meat”. For greater realism, bend the tines of the fork like the letter “J” to mimic the shape of an eagle’s beak.

**Fish-eating birds:**

Place some Swedish fish in a tray with water. Students have to gather as many fish as possible in a single swoop. The **net or spoon** will work best.

### **Aquatic plant-eating birds:**

Place some cereal with marshmallows in a tray of water. The students have to scoop up the marshmallows without getting the cereal. A **spoon** will work well. If you wish, these last two stations can be combined by putting the cereal and Swedish fish in the same tray. The fish tend to sink while the cereal floats. This represents the fish that swim under water and the plants and insects that tend to be near the surface. The object is for the bird to get the right food without getting the wrong food. The net mimics a pelican's bill, while the spoon is more like a duck's bill.

3. This now gives you six or seven stations. Here is a handy tip that helped me in my middle school classrooms. Whenever I used stations, I set up *two* of each. That way, there were fewer students losing valuable time waiting in line at a station. There were always more stations than there were lab groups of students.
4. Now we will look at the many ways we can implement this activity for different purposes and grade levels. Student activity masters are provided with each option, so choose the one that best suits the needs of your students.

### **Option 1: Kindergarten and first**

Place the best tool at each station. Students will try to gather as much food as possible in a given time. In the case of the aquatic birds, they will get one “swoop”.

If you wish, you can post a picture of the bird that is represented at the station or you can use the bird pictures as a wrap-up at the end of the activity.

Students count how much food they gathered and record it. In the case of the nectar, the liquid volume can be measured. For the birds of prey, the food can be weighed or visually compared.

This will help students develop counting and number comparing skills and will introduce them to the variation in the types of beaks on bird species.

Name \_\_\_\_\_

# Bird Beaks



Help me  
get my  
food.

Station 1:

I got \_\_\_\_\_ pieces of food.

Station 2:

I got \_\_\_\_\_ pieces of food.

Station 3:

I got \_\_\_\_\_ pieces of food.

Station 4:

I got \_\_\_\_\_ pieces of food.

Station 5:

I got \_\_\_\_\_ pieces of food.

Station 6:

I got \_\_\_\_\_ pieces of food.

## Option 2: Grades K-2

Place the best tool *and one other* at each station. Students will try to gather as much food as possible in a given time. In the case of the aquatic birds, they will get one “swoop”.

Then students count or measure their food as before. However, now they have to *evaluate* the best tool by comparing the results using their data.

This can help students with greater than and less than concepts as well as develop their skills in evaluation, a much higher cognitive level than just counting.

### **Great Tip!**

Work across the grade levels. Younger students can do the lab with the assistance of older peers. Then the older students can use spreadsheets as described on pages 16 & 17 to analyze the data.

Name \_\_\_\_\_



What  
beak is  
best?

# Bird Beaks

Station 1:

Tool \_\_\_\_\_ Count \_\_\_\_\_

Tool \_\_\_\_\_ Count \_\_\_\_\_

Station 2:

Tool \_\_\_\_\_ Count \_\_\_\_\_

Tool \_\_\_\_\_ Count \_\_\_\_\_

Station 3:

Tool \_\_\_\_\_ Count \_\_\_\_\_

Tool \_\_\_\_\_ Count \_\_\_\_\_

Station 4:

Tool \_\_\_\_\_ Count \_\_\_\_\_

Tool \_\_\_\_\_ Count \_\_\_\_\_

Station 5:

Tool \_\_\_\_\_ Count \_\_\_\_\_

Tool \_\_\_\_\_ Count \_\_\_\_\_

Station 6:

Tool \_\_\_\_\_ Count \_\_\_\_\_

Tool \_\_\_\_\_ Count \_\_\_\_\_

### Option 3: Grades 2 and up

Give each group of students or each student a single tool. They can only use that tool in their exploration. Then they go to each station and try to get food. Their tool might work great at one station, moderately well at others, and not at all at some.

Because their tool will not work at some stations, they may experience some frustration. To alleviate this, let them know in advance that their tool may not always work. Tell them they are searching for their best and proper food source. You could give them their tool and their bird picture and send them on a quest to find their proper food source.

Now students are thinking at much deeper levels. They are not only evaluating the effectiveness of their tool, they are starting to see why birds have adapted to the available food supply.

They can also begin to represent their data graphically. A bar graph is best for these types of comparisons.

You could also have older students record the range of the data at each station. For example, the dropper might gather zero grains of rice, the net might gather more, and the tweezers might gather a dozen. The results can also be averaged using modes, medians, and means.

Range:						
Median:						
Mode:						
Mean:						

An activity page is provided for that. Extra lines have been provided so that these central tendencies can be added at the end of the table as shown.

If you want to incorporate technology to make this a true S.T.E.M. lesson, instructions are also provided on the following pages for students to make a spreadsheet using Google Sheets. Two versions are provided: a simple one and a more advanced spreadsheet.

Name \_\_\_\_\_

# Bird Beaks



My group members are: \_\_\_\_\_

\_\_\_\_\_

Our tool is: \_\_\_\_\_

Record how much food you captured at each station:

Station 1: \_\_\_\_\_ Station 2: \_\_\_\_\_

Station 3: \_\_\_\_\_ Station 4: \_\_\_\_\_

Station 5: \_\_\_\_\_ Station 6: \_\_\_\_\_

Which food source best suits your "beak"?

\_\_\_\_\_

Explain why your "beak" worked so well for that food.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

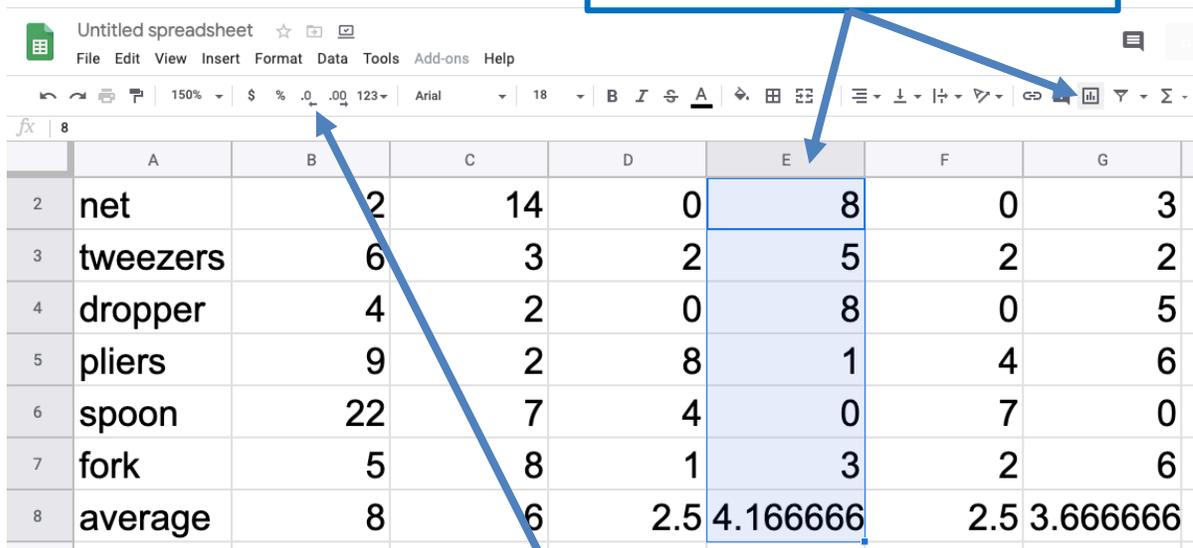
\_\_\_\_\_



## Simple spreadsheet instructions:

1. Open Google Sheets
2. In cell A1, type **Tool**
3. In cell B1, type **Station 1**
4. In cell C1, type **Station 2**
5. In cell D1, type **Station 3**
6. In cell E1, type **Station 4**
7. In cell F1, type **Station 5**
8. In cell G1, type **Station 6**
9. In cell A2, type the name of your first tool.
10. Repeat this for the other tools in column A.
11. For the remainder of the instructions, we will assume that you have typed six tools in cells A2, A3, A4, A5, A6, and A7. *If you have typed more tools you will need to adjust the instructions.*
12. In cell A8, type **Average**
13. In cell B8, type **=AVERAGE(B2:B7)** Don't forget to type the "=" sign first. This is a command telling the spreadsheet that you want it to do the math for you.
14. Highlight cells B8 through G8.
15. Fill right. This can be done by holding down CTRL+R. This spreads your formula from cell B8 across the other cells in that row so that you don't have to retype it.

You can now enter the data into your spreadsheet. It will look like the one shown below.

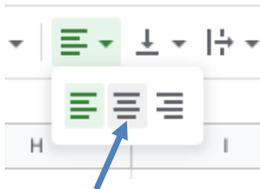
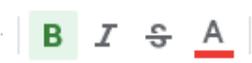


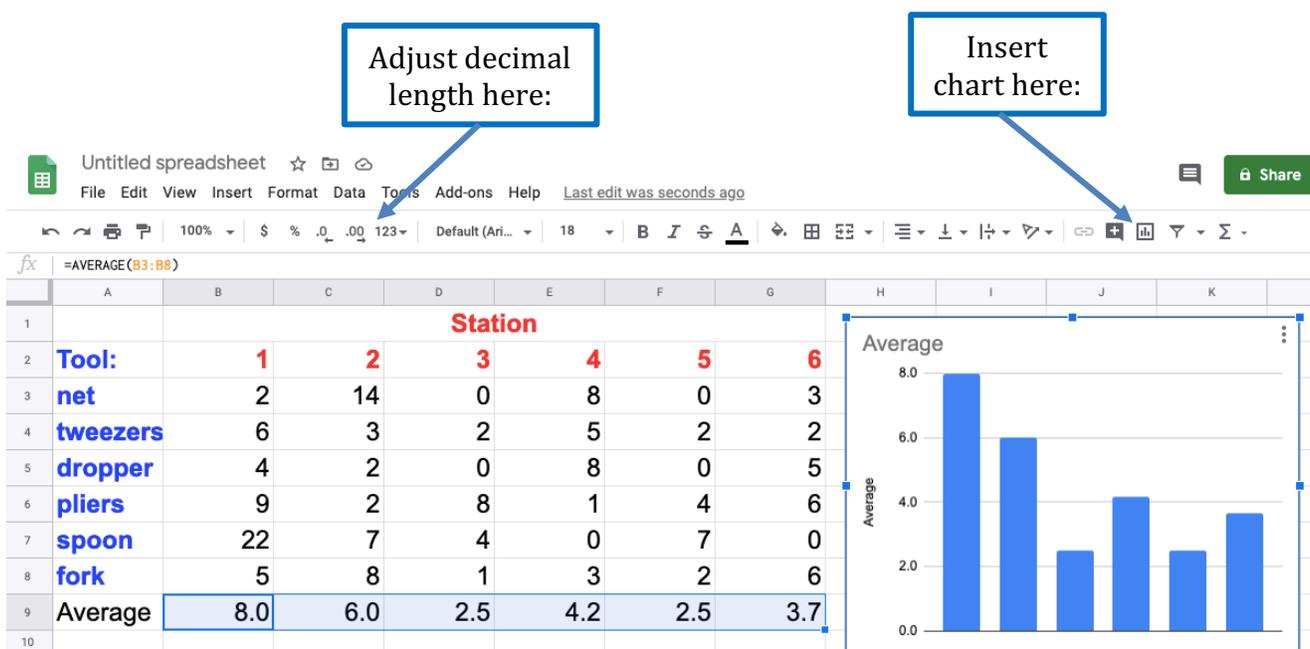
If you highlight cells as shown and click the "Insert Chart" button, you can make a graph of your data.

	A	B	C	D	E	F	G
2	net	2	14	0	8	0	3
3	tweezers	6	3	2	5	2	2
4	dropper	4	2	0	8	0	5
5	pliers	9	2	8	1	4	6
6	spoon	22	7	4	0	7	0
7	fork	5	8	1	3	2	6
8	average	8	6	2.5	4.166666	2.5	3.666666

If you don't like these repeating decimals, highlight the cell and then adjust the decimal length with these tools.

## Advanced spreadsheet instructions:

1. Open Google Sheets
2. Highlight cells B1 through G1.
3. Go to “Format, then “Merge Cells”, and select “Merge All”.
4. In the new large cell, which is technically B1, type **Station**
5. Center this word by going to this tool and selecting the middle icon. 
6. In cell A2, type **Tool**
7. In cell B2, type **1**
8. In cell C2, type **2**
9. In cell D2, type **3**
10. In cell E2, type **4**
11. In cell F2, type **5**
12. In cell G2, type **6**
13. Highlight cells B2 through G2 and select Bold and change their color. 
14. Type the names of your tools in cells A3 through A8.
15. Highlight cells A2 through A8 and select Bold and change to another color.
16. In cell A9, type **Averate**
17. In cell B9, type **=AVERAGE(B3:B8)** Don't forget to type the “=” sign first. This is a command telling the spreadsheet that you want it to do the math for you.
18. Highlight cells B9 through G9 and fill right. This can be done by holding down CTRL+R. This spreads your formula from cell B9 across the other cells in that row so that you don't have to retype it.
19. You can then enter your data. Some decimals may show up as repeating decimals. To fix this, click the “123” button at the top and select “Number”. Then use these arrows to adjust the number of decimal places you want.
20. If you'd like to graph your data, select a set of rows as shown and click the “Insert Chart” button. You can also customize this chart according to your needs.



# A Complete S.T.E.M. Activity!

This activity can be used as a fully integrated S.T.E.M lesson. Below you will see the Common Core Math and Next Gen Science Standards along with ideas for incorporating technology and engineering.

## **The N.G.S.S. Connection**

### 3-LS3-1 Heredity: Inheritance and Variation of Traits

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

### 3-LS3-2 Heredity: Inheritance and Variation of Traits

Use evidence to support the explanation that traits can be influenced by the environment.

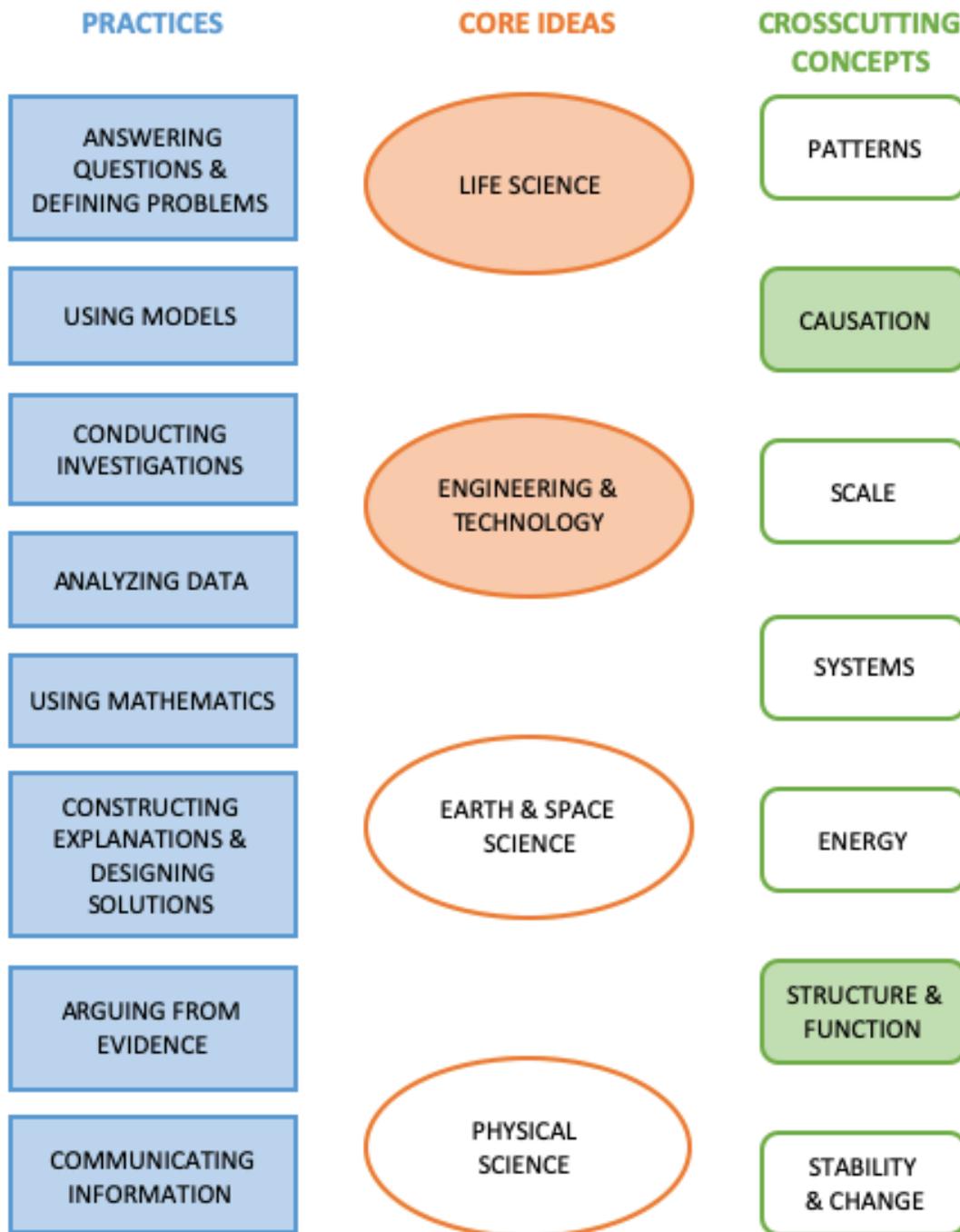
### 3-LS4-3 Biological Evolution: Unity and Diversity

Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

### MS-LS4-6 Biological Evolution: Unity and Diversity

Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Here is an N.G.S.S. alignment model to help see how this lesson can address not only the core Ideas of life science and technology, but also the scientific practices and cross-cutting concepts. Notice that if taught properly, *all eight* of the scientific practices are met.



## **Technology Options:**

Implementing technology will depend upon the grade level of the students.

Primary students can do an internet search for images of bird beaks to further explore how different species have adapted.

Students can watch online videos about bird beak adaptations.

Elementary students can graph their data (of the quantity of food samples gathered) in online graphing software such as found at [desmos.com](https://www.desmos.com).

Students can create a slideshow using Google Slides, PowerPoint, or Apple Keynote. The slides can include pictures of the birds and a text box explaining the food associated with the bird. Further online research could indicate the range and habitat of the birds.

Also, two sets of spreadsheet instructions are provided so that older students can practice this skill.

## **Engineering Ideas:**

Ask students to design a tool, technique, or process to pick up food samples more effectively. For example, smear some peanut butter into the crevices of a pine cone and then sprinkle it with some bird seeds or rice. What is the best way to get out the seeds that are stuck between the pine cone's scales?

You could also place some small seeds or rice in the bottom of a test tube. The students have to figure out how to get the seeds out without tipping the test tube. Then show them pictures of the Sword-billed Hummingbird. This bird is able to feed on the nectar found at the base of deep, trumpet shaped flowers that shorter beaks could not reach.

## The Common Core Math Connection

The options for integrating math will depend of course on the grade level of the students. Here are some options and the Common Core Standards to which they relate.

**Primary grades:** Ask students to count the number of food samples gathered in a given time. Then they can compare the two numbers as greater and lesser. These numbers can be represented graphically using appropriate graphs and graphing tools.

Kindergarten:

CCSS.MATH.CONTENT.K.CC.A.3

Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).

CCSS.MATH.CONTENT.K.CC.B.4.A

When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.

Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1-20, count out that many objects.

CCSS.MATH.CONTENT.K.CC.C.6

Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.

CCSS.MATH.CONTENT.K.CC.C.7

Compare two numbers between 1 and 10 presented as written numerals.

CCSS.MATH.CONTENT.K.MD.B.3

Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.

First:

CCSS.MATH.CONTENT.1.NBT.B.2

Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:

CCSS.MATH.CONTENT.1.NBT.B.2.A

10 can be thought of as a bundle of ten ones — called a "ten."

CCSS.MATH.CONTENT.1.NBT.B.2.B

The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.

Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols  $>$ ,  $=$ , and  $<$ .

**CCSS.MATH.CONTENT.1.MD.C.4**

Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

**Elementary grades:**

By second grade, the numbers of food samples gathered will be small compared to the number sense the students encounter. For example, a student is not likely to gather a sample that measures in the hundreds or thousands. For this reason, the shift moves from counting and number sense to measurement of data sets and graphical representations.

Second:

**CCSS.MATH.CONTENT.2.MD.D.10**

Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

Third:

**CCSS.MATH.CONTENT.3.MD.B.3**

Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.*

**Middle grades:**

Though this activity lends itself to very young learners, the mathematics can be extended well into the upper grades. Middle school students can use these data sets along with online graphing software to create and interpret advanced statistical displays such as stem-and-leaf plots and box plots.

Sixth:

**CCSS.MATH.CONTENT.6.SP.A.1**

Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How OLD are the students in my school?" is a statistical question because one anticipates variability in students' ages.*

**CCSS.MATH.CONTENT.6.SP.A.2**

Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

**CCSS.MATH.CONTENT.6.SP.A.3**

Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

**CCSS.MATH.CONTENT.6.SP.B.4**

Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

**CCSS.MATH.CONTENT.6.SP.B.5**

Summarize numerical data sets in relation to their context, such as by:

**CCSS.MATH.CONTENT.6.SP.B.5.A**

Reporting the number of observations.

**CCSS.MATH.CONTENT.6.SP.B.5.B**

Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

**CCSS.MATH.CONTENT.6.SP.B.5.C**

Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

**CCSS.MATH.CONTENT.6.SP.B.5.D**

Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

## **How to use the bird cards:**

These can be used at any time before, during, or after the activity on bird beaks. Some ideas are listed here. Print them in color and on card stock if possible and/or laminate them to make them last longer in student hands.

**Before:** Show the cards to the students and have them notice the variety of beaks. Ask them why they think birds have different types of beaks. Ask them what foods the birds might eat?

**During:** Post the pictures on the wall or at the stations so that students can refer to them during the activity.

**After:** Show the pictures to the students again and ask them about the different types of beaks and how they are suited to collecting different types of foods. Use this as an assessment to measure how the students' understanding of adaptation has grown.

You could also ask questions such as these:

- Which of these beaks could get a worm out of the ground?
- Which of these beaks might be able to crack open a nut?
- Which of these birds might eat insects?
- Which of these birds could scoop up food?
- Which of these birds might prefer to eat meat?

## **Bird pictures answer key:**

The bird's predominant diet is listed first. You may wish to cut out these cards and attach them to the backs of each card.

<p style="text-align: center;">1 Bluebird Worms, fruit, seeds</p>	<p style="text-align: center;">2 Blue jay Nuts and seeds, bugs</p>
<p style="text-align: center;">3 Cardinal Seeds, suet, berries</p>	<p style="text-align: center;">4 Cedar waxwing Berries, insects</p>
<p style="text-align: center;">5 Chickadee Seeds, insects</p>	<p style="text-align: center;">6 Duck Aquatic plants and animals</p>
<p style="text-align: center;">7 Eagle Meat</p>	<p style="text-align: center;">8 Goose Aquatic plants and animals</p>

<p>9 Grosbeak Nuts, seeds, insects</p>	<p>10 Hummingbird Nectar</p>
<p>11 Nuthatch Insects, seeds</p>	<p>12 Pelican Fish</p>
<p>13 Robin Insects, worms, seeds</p>	<p>14 Sparrow Seeds</p>
<p>15 Woodpecker Insects, nuts, seeds</p>	<p>16 Toucan Fruit, insects, eggs</p>

1





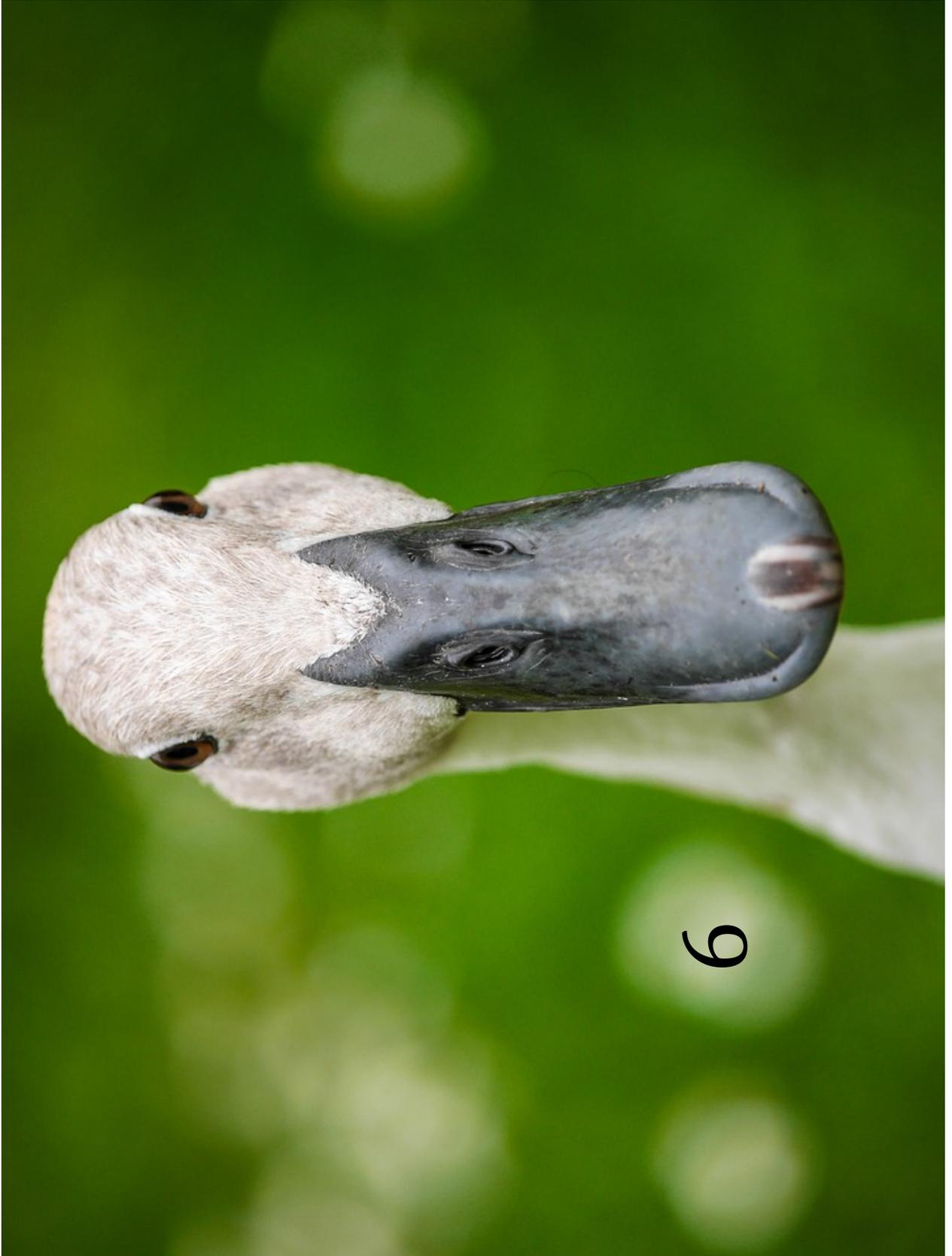
2







5



7







6





11



12



13





15



16

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You can also find many free and inexpensive resources on my personal website, [www.tttpress.com](http://www.tttpress.com). **Be sure to subscribe to receive monthly newsletters and FREE activities.**

Similar *S.T.E.M. ON A SHOESTRING* activities include:

- *3-2-1 Launch: Designing Catapults* - This popular STEM lesson contains adaptations for primary through high school students.
- *Drop Zone: Parachute Lesson* - Another engaging lesson that is highly adaptable and contains all the elements of science, technology, engineering, and math.
- *Ramp Races* - An engaging and exciting way to teach students the principles of physics: forces, motion, speed, friction, and more!

Feel free to contact me if you have questions or comments or would like to discuss a staff development training or keynote address at your site.

Happy teaching,

*Brad*