Variation in Traits
Lesson 4a: Organizing Our Data

Grade 3	**Length of lesson:** 50 minutes	**Placement of lesson in unit:** 4a of 7 two-part lessons on variation in traits
Unit central question: Do all of the mice living in the same environment, such as a field or forest, have an equal chance of surviving?		**Lesson focus question:** How can data help us explain why trait variations among desert beetles matter?
Main learning goal: Data from a model can be used as evidence to support ideas that explain why trait variations affect which individuals are more likely to survive longer than others in their environment.		
Science content storyline: Variations among individuals of the same kind of living thing mean that some individuals are more likely to survive longer than others in their environment. Data from a model can be used as evidence to support an explanation of how trait variations affect which individuals are more likely to survive. Critiquing and asking questions about one another's ideas can help us develop the best explanation possible. Based on the data and evidence from a model, we can conclude that better-camouflaged individuals are most likely to survive longer in their environment.		
Ideal student response to the focus question: Data from the desert simulation can help us figure out which beetles will survive longer than other beetles in their environment. We can use this data to calculate how many of each color of beetle were eaten and how many survived. Then we can represent on a bar graph the number of beetles of each color that survived.		

Preparation

Materials Needed • Science notebooks • Chart paper and markers • Class data table of desert-simulation results (from lesson 3b) **Student Handouts** • 4.1 Calculating the Fraction of Beetles (1 per student) • 4.2 Bar Graph of Beetles That Survived (1 per student)	**Ahead of Time** • Review the content background document, especially sections 3 and 4 on variation. • **ELL support:** This lesson is heavily language based, so ELL students will need strong support to understand the content and participate in the activities. Introduce students to the lesson materials, structure, and content in advance so they know what's expected of them and can follow along and participate. In particular, review the desert model and the simulation results. Make sure ELL students understand what the results represent, how they were derived, and what they mean. Also make sure they know how to calculate fractions and are familiar with how to construct a bar graph. Introduce the following vocabulary words and make sure students understand what they mean in general and in this lesson: *data*, *calculate*, *convince/convincing*, *evidence*, *fraction*, and *survive/survived*. As needed, review the words *represent*, *predator/prey*, *camouflage*, *model*, *simulation/simulated*, *pom-poms*, *fabric*, *lizards*, *beetles*, *desert*, *environment*, and *more/less likely*.

Lesson 4a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	**Link to previous lesson:** The teacher reviews the desert model students used in the previous lesson to investigate trait variation among beetles.	• Variation in traits among living things of the same kind affects which individuals are more likely than others to survive in their environment.
1 min	**Lesson focus question:** The teacher introduces the focus question, *How can data help us explain why trait variations among desert beetles matter?*	
8 min	**Setup for activity:** The teacher challenges students to consider how evidence can support their explanations and help them develop better answers to science questions.	• Observations and measurements are types of data we can use as evidence to support explanations and develop better answers to science questions.
20 min	**Activity:** Students use simulation data from the previous lesson to calculate and compare the fractions of beetles that were eaten and that survived in order to determine which beetles are more likely to survive in a desert environment.	• Mathematical data provides evidence that can help us determine which colors of desert beetles are more likely to survive in their environment.
10 min	**Follow-up to activity:** Students represent on a bar graph the data showing the number of beetles that survived in the desert simulation.	• Representing data in multiple ways can help us explain which desert beetles are more likely to survive in their environment.
5 min	**Synthesize/summarize today's lesson:** Students synthesize key ideas from the lesson by comparing fractions and bar graphs as different ways to represent the desert-simulation data.	• Scientists organize and represent data in many different ways so they can explain their research results more clearly.
1 min	**Link to next lesson:** The teacher announces that in the next lesson, students will use their fraction data and bar graphs to help them explain why trait variations among desert beetles matter.	

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5 min	**Link to Previous Lesson** **Synopsis:** The teacher reviews the desert model students used in the previous lesson to investigate trait variation among beetles. **Main science idea(s):** • Variation in traits among living things of the same kind affects which individuals are more likely than others to survive in their environment.	Link science ideas to other science ideas.	**Show slides 1 and 2.** In a previous lesson, we read a story about a green beetle that lived in the desert. One day, a lizard came along and ate the beetle. The ranger in the story talked about black, brown, yellow, and red beetles that live in the desert too. **Show slide 3.** Last time, we used a model to simulate what might happen to different-colored beetles in nature. What did we use to represent the desert environment where the beetles live? What did we use to represent the beetles? What did our student lizards use to grab the pom-pom beetles? What did grabbing a pom-pom represent? What did the cup represent? **ELL support:** Review this activity with ELL students in advance, including the picture and	Fabric. Colored pom-poms. Their thumbs and forefingers. Eating a beetle. The lizard's stomach.	

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			what it shows. What were the results of our desert simulation? **ELL support:** Review the desert model and simulation results with ELL students in advance, including what the results represent, how they were derived, and what they mean. Today we'll learn how we can use these results like scientists to explain our ideas about trait variations in desert beetles more clearly.	The *[X color]* beetles got eaten most. A lot of *[X color]* beetles survived.	What would that mean in a real desert environment? What would that mean in a real desert environment?
1 min	**Lesson Focus Question** **Synopsis:** The teacher introduces the focus question, *How can data help us explain why trait variations among desert beetles matter?*	Set the purpose with a <u>focus question</u> or goal statement.	**Show slide 4.** In our last lesson, we investigated the focus question, *Why do trait variations among desert beetles matter?* Today, we'll think about a related question: *How can data help us explain why trait variations among desert beetles matter?* Write this new focus question in your science notebooks and draw a box around it. **NOTE TO TEACHER:** *Write the focus*		

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			question on the board for students to refer to throughout the lesson. To help us answer this question, we'll explore how we can organize and represent the data from our desert simulation in a more scientific way. **NOTE TO TEACHER:** *Make sure to use the correct form of the word* data *throughout this lesson.* Data *is the plural form, and* datum *is the singular form. When referring to multiple* datum*, use the appropriate verb. "How **do** the data help us?" is the correct usage, not "How **does** the data help us?" Initially, using the proper form might not sound right, but you and your students will get used to it over time.*		
8 min	**Setup for Activity** **Synopsis:** The teacher challenges students to consider how evidence can support their explanations and help them develop better answers to science questions. **Main science idea(s):** • Observations and measurements are types of data we can use as evidence to support		**Show slide 5.** Let's think for a moment about how we answer questions. Imagine hearing about a new movie and asking two friends what they think about it. One friend says, "You should see this movie because I liked it." The other friend says, "You should see this movie because it has a lot of action. It also has a good actor and a lot of really funny parts."		

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	explanations and develop better answers to science questions.		Which friend's answer is more likely to convince you to see the movie? Why?	The second person would convince me to go because that person said more about the movie.	Did the second person say anything specific to convince you?
				The person gave me reasons why I should see it.	What were some of those reasons?
			So when someone gives us clear facts and reasons for seeing a particular movie, it helps convince us that it's good, doesn't it? The same is true when it comes to answering questions in science. **Show slide 6.**		
		Highlight key science ideas and focus question throughout.	Scientists want to come up with convincing answers to questions they're investigating, so they use *evidence* to help them explain and support their ideas. When scientists explain their ideas, they try to include as much evidence as they can. Evidence makes it easier for other scientists to		

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			understand and trust the results of an investigation. Scientists gather evidence from observations and the measurements they take during an investigation. They may also gather evidence using their senses, such as seeing, hearing, or smelling. Like scientists, we can use the data we recorded from our desert simulation as evidence to help us come up with a convincing scientific answer to the focus question, *Why do trait variations among desert beetles matter?* We can also use this evidence to explain why color variations in the beetles affect their survival in a desert environment. Let’s look at the results we recorded on our class data table last time. **NOTE TO TEACHER:** *Make sure the class data table from the previous lesson is displayed where everyone can see it.* **ELL support:** Review the class data table and simulation results with ELL students before the lesson. **Show slide 7.**		

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			What do you think would help you explain to someone what happened to the desert beetles in our model? In other words, what evidence from our simulation can help you explain why color variations among desert beetles matter? How would you explain which beetles in our model were eaten by the lizards and which beetles survived?	In our model, *[all/most]* of the *[X color]* beetles were eaten. *[None/few]* of the *[X color]* beetles were eaten. The *[X color]* beetles blended in with the fabric.	How do you know? What is your evidence? How do you know? What is your evidence? Tell me more about what that means for the beetles in our model and for beetles in the real world.
20 min	**Activity**		**Show slide 8.**		

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	Synopsis: Students use simulation data from the previous lesson to calculate and compare the fractions of beetles that were eaten and that survived in order to determine which colors of beetles are more likely to survive in a desert environment. **Main science idea(s):** • Mathematical data provide evidence that can help us determine which desert beetles are more likely to survive in their environment.	Make explicit links between science ideas and activities. Engage students in analyzing and interpreting data and observations. Select content representations and models matched to the	Today you'll use your math skills to present the evidence from our desert simulation in a more scientific way. First, we'll calculate some fractions that will help us compare our data so we can explain more clearly how many of the beetles of each color were eaten. One way we could explain this is to say that three out of nine of one color and four out of nine of another color of beetle were eaten. But it's easier if we calculate the fraction of beetles of each color that were eaten. Using fractions also means that someone could try the same investigation with a different number of beetles and see if they get the same result. So we want to compare the fraction of each color of beetle that was eaten with the fraction of each color of beetle that survived. To do this, we need to fill out a data table. For this activity, you'll work with an elbow partner. **NOTE TO TEACHER:** *Distribute handout 4.1 (Calculating the Fraction of Beetles) Then have students pair up with an elbow partner and walk them through the process of calculating the fraction of beetles eaten and*		

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		learning goal and engage students in their use.	*the fraction that survived. Partners can help each other, but each student should complete her or his own handout.* **ELL support:** Introduce the handout and walk ELL students through the activity ahead of time to make sure they understand the purpose of the activity, what each part of the handout means, and how to complete the handout. You may want to complete the first calculation together and then have students work with a partner to finish the remaining calculations. **Show slide 9.** **NOTE TO TEACHER:** *This slide is animated. Click once to show the arrow pointing at the "Color of Beetle."* First, write the colors of the beetles under the column on your handout that says "Color of Beetle." Write the colors in the same order as the colors listed on our class data table: red, yellow, brown, green, and black. **NOTE TO TEACHER:** *It will be easier for students if they list the colors in the order they appear on the class data table from lesson 3b (red, yellow, brown, green, and black). Assist students in using the data from the class data table to construct the fractions on their handouts.*		

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			Next, we need to calculate how many beetles of each color we had as a fraction of the total number of beetles. We started out with 45 pom-poms beetles in five different colors. Assuming we had an equal number of beetles of each color, how many beetles of each color did we have? **NOTE TO TEACHER:** *Use a strategy appropriate for your students to perform this calculation. By dividing 45 by five (45/5), students should figure out that there are nine pom-poms beetles of each color. They could simply find this information on the class data table, but helping them calculate the number will prepare them for thinking about fractions and completing the handout. Have students record the total number of beetles of each color (total number of the color) in the second column ("Beetles Eaten").* Write that number in the second column that says "Beetles Eaten" below the line next to the heading that says "Total number of the color." Do this for each row or color. Then above each line in that column, write down the number of beetles of each color that were eaten. You can find that information by looking at the last row of our class data table. **NOTE TO TEACHER:** *Click once on the*	Nine!	

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			PowerPoint slide to show the first example for the red beetle. Remember that we had a total of nine beetles of each color *before* the hunt, so if four red beetles were eaten, you would write the number 4 above the line in the first row of the second column. You already wrote the number 9 below the line, so in this example, the fraction for that cell would be 4/9, representing four beetles eaten out of a total of nine red beetles. Skip over the third column for now, and let's complete the fourth column in the first row. Write the number of red beetles not eaten above the line and the total number of beetles of that color below the line. Remember to look at the class data table for the information you need. To find the number of beetles *not* eaten for each color, you'll look at the second row of the table that shows the number of pom-pom beetles *after* the hunt. **NOTE TO TEACHER:** *Click once on the PowerPoint slide to show the next example for the red beetle.* For example, if five beetles were left on the fabric after the hunt, you would write the number 5 above the line in the first row of column 4 and the number 9 below the line.		

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			Now let's focus on the third column. After completing columns 2 and 4, you'll compare the number of beetles eaten from column 2 with the number of beetles not eaten from column 4 and decide whether the number of beetles eaten is greater than, less than, or equal to the number of beetles not eaten. For example, if four red beetles were eaten and five red beetles survived, would the number of beetles eaten be greater than, less than, or equal to the number of beetles not eaten? **NOTE TO TEACHER:** *Click once on the PowerPoint slide to show the less-than symbol in column 3 that completes the example for the red beetle.* Great job! Now that we've calculated the fractions for the first row, work with your partner to finish calculating the fractions for the remaining rows. Then complete the third column using greater than, less than, or equal signs to show whether more beetles were eaten or not eaten for each color. **NOTE TO TEACHER:** *Again, use the strategies appropriate for your students as you help them work with the symbols in column 3 (>, <, =). Encourage pairs to complete the third column on their own, but if students are*	The number of beetles eaten would be less than the number of beetles not eaten.	

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			struggling with the comparisons, you may complete it as a class.		
10 min	**Follow-Up to Activity** **Synopsis:** Students represent on a bar graph the data showing the number of beetles that survived in the desert simulation. **Main science idea(s):** • Representing data in multiple ways can help us explain which desert beetles are more likely to survive in their environment.	Engage students in analyzing and interpreting data and observations.	In an earlier lesson, we made a bar graph to show the number of spots on our ladybugs. We decided this was a better way to share and explain our data than to randomly call out the numbers of spots. The same thing is true for this investigation. Sometimes it's better to use a graph to share data and explain the results. You've already calculated the fraction of beetles that weren't eaten and compared that to the number of beetles that were eaten. Now let's represent this data in a visual way using a bar graph. **ELL support:** Explicitly preview the purpose and meaning of the graph before the lesson and walk ELL students through how to complete it. **NOTE TO TEACHER:** *Distribute handout 4.2 (Bar Graph of Beetles That Survived) and orient students to the various parts of the graph.* **Show slide 10.** The bar graph on this handout shows the beetle colors along the *x*-axis and the number of		

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			beetles that survived along the *y*-axis. First, write the color of each pom-pom beetle in the space below each bar. Make sure to write the colors in the same order as the data table and our fraction handout: red, yellow, brown, green, and black. **NOTE TO TEACHER:** *Give students time to write in the colors. For consistency, make sure they list the colors in the order they appeared on the class data table and in handout 4.1.* Now let's complete the first bar together. To do this, we need to know how many beetles survived, or weren't eaten, and then we can shade in that number of bars. Where can you find the data you need to shade in the first bar? **NOTE TO TEACHER:** *Give students time to find the data they need by looking at column 4 of the first row on their fraction handout or in the second row of column 2 on the class data table from lesson 3b. After students have shaded in the first bar, invite one student to show how the bar was shaded and explain how it matches the data on the fraction handout.* Let's see how one of you shaded in the first bar on the graph. Make sure to explain how this		

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			matches the data on our fraction handout. Now I'd like you to shade in the bars for the other four colors. Remember that you're showing how many beetles survived or were *not* eaten. You may work with an elbow partner, but each of you should complete your own graph. **NOTE TO TEACHER:** *Make sure to give students adequate time to shade in the other four bars. Encourage them to work with a partner on this activity to ensure success.* Next, let's look at the row below the graph that says "Fraction that survived." Where can you find data on the fraction of beetles of each color that survived? **NOTE TO TEACHER:** *Complete the fraction for the first color together; then give students time to complete the other four fractions. Remind them to refer to the data in column 4 of handout 4.1 (Calculating the Fraction of Beetles).* Finally, calculate a fraction that represents the *total* number of beetles that survived and write that number at the bottom of the handout. Where can you find data to help you figure this		

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			out? **NOTE TO TEACHER:** *If you want students to use a particular method for calculating this number, share it with them now. Otherwise, allow students to determine the fraction on their own and then have a brief class discussion to review the methods they used to calculate the fraction.* **ELL support:** Discuss in advance with ELL students the various methods they can use to calculate this fraction. Let them know which method you want them to use during the actual activity or whether they're free to choose their own method for calculating the fraction.		
5 min	**Synthesize/Summarize Today's Lesson** **Synopsis:** Students synthesize key ideas from the lesson by comparing fractions and bar graphs as different ways to represent the desert-simulation data. **Main science idea(s):** • Scientists organize and represent data in many different ways so they can explain their research results more	Highlight key science ideas and focus question throughout. Engage students in making connections by synthesizing and summarizing key science	**Show slide 11.** Today's focus question is *How can data help us explain why trait variations among desert beetles matter?* To help us think about this question, we used two different methods to represent the data from our desert simulation. First, we calculated the fractions of beetles eaten and not eaten, and then we made a bar graph showing the number of beetles that survived.		

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	clearly.	ideas.	**Show slide 12.** Which method makes it easier for you to understand the data from our desert model? Why? **Think-Pair-Share:** Think about these questions and then share your answers with an elbow partner. Explain why you think the method you chose makes it easier to understand the data. Use the sentence starter on the slide to help you construct your explanation: *[Fractions/bar graphs] make it easier for me to understand the data from our desert model because* ____________. Make sure to include evidence from today's handouts to support your explanations and ideas. **ELL support:** ELL students will benefit from an opportunity to practice completing the sentence starter before the lesson.		
1 min	**Link to Next Lesson** **Synopsis:** The teacher announces that in the next lesson, students will use	Link science ideas to other science ideas.	**Show slide 13.** Next time, we'll use our fraction data and bar graphs to help us explain why trait variations among desert beetles matter.		

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	their fraction data and bar graphs to help them explain why trait variations among desert beetles matter.				