

Variation in Traits

Lesson 1b: A Bar Graph Shows Variation in Traits

Grade 3	Length of lesson: 45 minutes	Placement of lesson in unit: 1b 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 are living things of the same kind alike and different?
Main learning goal: The traits of individuals of the same kind of living thing can show variation.		
Science content storyline: Living things have traits that help us identify them. Among individuals of the same kind of living thing, some traits show variation and other traits don't. <i>Traits</i> are features or characteristics of an individual that may be visible or hidden. <i>Variations</i> are differences in traits among individuals of the same kind of living thing.		
Ideal student response to the focus question: Living things of the same kind, such as ladybugs, have many traits that are the same. For example, all ladybugs have six legs. But all ladybugs aren't exactly alike. Some of their traits are different, or show variation, like the number of spots they have.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Chart paper • Sticky notes (1 per student) • Laminated ladybug pictures (from lesson 1a) (1 per student) <p>Student Handouts</p> <ul style="list-style-type: none"> • 1.2 Bar Graph of Ladybug Spots (1 graph cutout per student) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review the content background document, especially sections 3 and 4 on variation. • If you haven't done so already, select one or two sets of circle maps that pairs completed in the previous lesson and prepare them for display on a document reader. • Handout 1.2 (Bar Graph of Ladybug Spots) contains two bar graphs. Make enough photocopies of the handout for half of the class. Then cut the pages in half along the dotted line so that each student will have one graph. • ELL support: Introduce ELL students to the lesson materials, structure, and content ahead of time so they can understand what's expected of them and participate. Discuss the meaning, construction, and uses of bar graphs and review vocabulary terms, including <i>trait</i>, <i>characteristics</i>, <i>variation(s)</i>, <i>ladybug</i>, and <i>bar graph</i>.
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Lesson 1b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
8 min	Link to previous lesson: Students share their completed ladybug circle maps from the previous lesson and discuss their current understandings of traits and variation in living things.	<ul style="list-style-type: none"> Living things have a variety of traits that help us identify them. Among individuals of the same kind of living thing, some traits show variation and others don't.
1 min	Lesson focus question: The teacher reviews the focus question from the previous lesson: <i>How are living things of the same kind alike and different?</i>	
4 min	Setup for activity: Students investigate trait variation by counting the number of spots on ladybugs in pictures from the previous lesson and recording the results on sticky notes.	<ul style="list-style-type: none"> Among individuals of the same kind of living thing, some traits show differences, or variation, and others don't.
15 min	Activity: Students record on bar graphs their collective data on the number of ladybug spots they counted. Then they use this data to analyze trait variations.	<ul style="list-style-type: none"> Ladybugs show trait variations in the number of spots they have. Using a bar graph can help us analyze variation in this trait.
10 min	Follow-up to activity: Students discuss how a bar graph can help them analyze data and consider whether all traits of living things show variation.	<ul style="list-style-type: none"> Among individuals of the same kind of living thing, some traits show variation and others don't.
6 min	Synthesize/summarize today's lesson: The teacher reviews the focus question and summarizes what the class discovered about trait variation in ladybugs.	<ul style="list-style-type: none"> Among living things of the same kind, some traits show variation and others don't.
1 min	Link to next lesson: The teacher links science ideas about variation in traits the next lesson.	

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8 min	<p>Link to Previous Lesson</p> <p>Synopsis: Students share their completed ladybug circle maps from the previous lesson and discuss their current understandings of traits and variation in living things.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Living things have a variety of traits that help us identify them. Among individuals of the same kind of living thing, some traits show variation and others don't. 	<p>Link science ideas to other science ideas.</p> <p>Select content representations and models matched to the learning goal and engage students in their use.</p> <p>Engage students in communicating in scientific ways.</p> <p>Highlight key science ideas and focus question throughout.</p>	<p>Show slides 1 and 2.</p> <p>In our last lesson, you drew circle maps in your science notebooks showing the ladybug traits you observed and a variation in one of the traits. Locate those circle maps now.</p> <p>NOTE TO TEACHER: <i>Display on a document reader one of the sets of circle maps you selected that pairs completed in the previous lesson.</i></p> <p>Let's look at a set of circle maps one pair of students completed last time. First, read the list of traits in the outer circle of each circle map. Then compare them with the traits you listed on your own circle maps.</p> <p>Do you agree or disagree that each item on the sample list is a trait of a ladybug?</p> <p>Remember, a <i>trait</i> is a feature or characteristic of living things of the same kind. Traits help us identify the kind of living thing we're looking at.</p> <p>Does each description on this list help you identify the living thing as a ladybug?</p>		

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		<p>Ask questions to probe student ideas and predictions.</p> <p>Ask questions to challenge student thinking.</p>	<p>Does anyone want to add onto these ideas?</p> <p>NOTE TO TEACHER: <i>Draw students' attention to the Communicating in Scientific Ways poster and review the sentence starters they can use for agreeing or disagreeing with someone else's ideas, as well as the sentence starters for adding onto others' ideas.</i></p> <p><i>As students discuss the traits on the circle maps, ask whether each one fits the definition of a trait from the previous lesson. (Point to the definition you recorded or posted in the classroom during the last lesson.) Use this opportunity to probe and challenge students' ideas about traits and variation.</i></p> <p>Now let's look at the circle maps that show <i>variation</i> in <i>one</i> ladybug trait. What variation do our sample maps show?</p> <p>What variations did you list on your circle maps?</p> <p>NOTE TO TEACHER: <i>Students may list variation in one of these traits: color, number of spots, body size, or spots or</i></p>		

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			<p><i>lack of spots on the ladybugs' heads. If they don't mention variation in color and the length of the ladybugs' legs, include them as additional trait variations to investigate. Since the number of spots is the topic of today's activity, don't focus on this trait during the discussion.</i></p> <p>In today's lesson, we'll gather data on one of the ladybug traits you've already mentioned—the number of spots.</p>		
1 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher reviews the focus question from the previous lesson: <i>How are living things of the same kind alike and different?</i></p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 3.</p> <p>Before we begin our data collection, let's review our focus question from last time: <i>How are living things of the same kind alike and different?</i></p> <p>The data we gather during today's investigation will help us answer this question at the end of our lesson.</p>		
4 min	<p>Setup for Activity</p> <p>Synopsis: Students investigate trait variation by counting the number of spots on ladybugs in pictures from the previous lesson and recording the results on</p>	Select content representations and models matched to the learning goal and engage students in their	<p>Show slide 4.</p> <p>In a moment, you'll look at the ladybug pictures from last time and collect data on the number of spots your ladybugs have. So find those pictures in your notebooks.</p> <p>NOTE TO TEACHER: <i>While students</i></p>		

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	<p>sticky notes.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Among individuals of the same kind of living thing, some traits show differences, or variation, and others don't. 	<p>use.</p> <p>Make explicit links between science ideas and activities before the activity.</p>	<p><i>are locating their pictures, give each student a sticky note for recording the number of spots.</i></p> <p>Now I'd like you to count the number of spots on the ladybug in your own picture. After you've counted the spots, write the number on the sticky note I just gave you. Make sure to write big enough so that everyone can see the number!</p> <p>We'll use your sticky notes to create a class bar graph that will help us look for patterns in the data for this one trait in all the ladybugs.</p> <p>ELL support: It may be helpful to work through this activity with ELL students ahead of time using a different trait so they can practice making and interpreting a bar graph.</p>		
15 min	<p>Activity</p> <p>Synopsis: Students record on bar graphs their collective data on the number of ladybug spots they counted. Then they use this data to analyze trait variations.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Ladybugs show trait 	<p>Select content representations and models matched to the learning goal and engage students in their use.</p>	<p>Watch as I demonstrate how to make the bar graph.</p> <p>NOTE TO TEACHER: <i>Create a class bar graph on chart paper. At the top of the graph, write the title "Bar Graph of Ladybug Spots." Label the vertical y-axis "Number of Ladybugs" and the horizontal x-axis "Number of Spots." Add the numbers 0–22 along the x-axis, allowing enough space in each</i></p>		

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	<p>variations in the number of spots they have. Using a bar graph can help us analyze variation in this trait.</p>		<p><i>numbered column to accommodate a sticky note. Add the numbers 1–20 along the y-axis.</i></p> <p>Notice the numbers across the bottom of the graph. Those numbers represent the number of spots on the ladybugs. The numbers along the left side of the graph represent the number of ladybugs.</p> <p>Each of you will come up and place your sticky note above the number that shows how many spots the ladybug in your picture has. Then we'll be able to see how many ladybugs had the same number of spots.</p> <p>Show slide 5.</p> <p>Now I'd like you to come up one at a time and place your sticky note on the chart above the number on the graph that represents the number of spots your ladybug has. If there's more than one sticky note for a particular number, make sure to post your notes in a nice, neat stack above the number.</p> <p>NOTE TO TEACHER: <i>Demonstrate how to make a neat stack of sticky notes above one number. The goal is to create a bar graph showing the number of spots, so the sticky notes should touch</i></p>		

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			<p><i>but not overlap. Wait until all students have added their sticky notes to the bar graph before moving on to the next step.</i></p> <p>Next, you'll copy our class data onto a bar graph I'll give you in a moment.</p> <p>NOTE TO TEACHER: <i>Distribute one bar graph to each student from handout 1.2 (Bar Graph of Ladybug Spots). You should already have cut each handout in half to separate the two bar graphs.</i></p> <p>Place this bar graph in your science notebooks and then copy the results from our class bar graph onto your graph. Try to be as accurate as possible as you record the data along both axes.</p> <p>Individual work time.</p> <p>NOTE TO TEACHER: <i>Give students a few minutes to copy the data onto their bar graphs. Circulate around the room and assist students with completing their graphs as needed.</i></p> <p>ELL support: During the lesson preview, walk ELL students through constructing and interpreting a practice bar graph using a different trait as suggested earlier.</p>		

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		<p>Engage students in analyzing and interpreting data and observations.</p> <p>Engage students</p>	<p>Show slide 6.</p> <p>Whole-class discussion: Now let's look at our results. Who can tell me how many spots most of our ladybugs have? How do you know?</p> <p>Come up to the class bar graph and show us what helped you figure this out.</p> <p>How many ladybugs have <i>[three]</i> spots?</p> <p>How many ladybugs have <i>[eight]</i> spots?</p> <p>NOTE TO TEACHER: <i>Point to a number column and tell students how many ladybugs had that number of spots.</i></p> <p>Look at this column. How many spots do these ladybugs have?</p> <p>NOTE TO TEACHER: <i>Continue asking questions along these lines until you're confident that students understand how to read the data on the bar graph. Then divide the class into small groups of 3 or 4 students for the next discussion.</i></p> <p>Show slide 7.</p> <p>Small-group discussion: Look at the</p>		

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		<p>in analyzing and interpreting data and observations.</p>	<p>ladybug data in your small group and come up with at least <i>two</i> more observations based on evidence from our class bar graph. Be ready to share your observations and ideas with the class.</p> <p>NOTE TO TEACHER: <i>If students are having trouble coming up with additional observations, ask questions to help them identify patterns on the bar graph.</i></p> <p>Whole-class share-out: So what other observations about the ladybugs' spots did your group come up with based on our data? Make sure to include evidence from the bar graph.</p>	<p>No ladybugs had 0 spots.</p> <p>The fewest ladybugs had <i>[X]</i> spots.</p> <p>More ladybugs had <i>[X]</i> spots than <i>[Y]</i> spots.</p>	<p>How do you know that no ladybugs had 0 spots?</p> <p>What is your evidence?</p> <p>How many more ladybugs had <i>[X]</i> spots?</p>

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10 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students discuss how a bar graph can help them analyze data and consider whether all traits of living things show variation.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Among individuals of the same kind of living thing, some traits show variation and others don't. 	<p>Make explicit links between science ideas and activities after the activity.</p> <p>Engage students in analyzing and interpreting data and observations.</p>	<p>Show slide 8.</p> <p>Whole-class discussion: Think about our bar-graph results and the observations and ideas you shared in your small groups.</p> <p>What did we learn about ladybugs from our bar graph?</p> <p>NOTE TO TEACHER: <i>Draw students' attention to the CSW poster and review the sentence starters they can use to give evidence for their ideas or claims.</i></p> <p>How did the bar graph help us learn those things?</p> <p>What if we had all just called out the number of spots? Would that have made it easier or harder to learn about the differences, or variations, in this trait among ladybugs? Why?</p> <p>What makes a bar graph a better way to share our data than calling out the number of spots?</p>	<p>We learned that there is a lot of variation in the number of spots on ladybugs.</p> <p>Because everything was lined up, we could see where there were more and fewer spots.</p> <p>You can see all the data in front of you and don't have to</p>	<p>What is the trait that shows this variation?</p> <p>What do you mean by "lined up"?</p>

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		Engage students in using and applying new science ideas in a variety of ways and contexts.	<p>ELL support: It may be helpful for ELL students if you briefly share how scientists use bar graphs.</p> <p>NOTE TO TEACHER: <i>By the end of this discussion, students should be able to see that the bar graph brought a lot of information together in a picture or visual representation that helped them see and analyze all the data at once.</i></p> <p>Show slide 9.</p> <p>Now let’s investigate another ladybug trait. Everyone count the number of legs the ladybug in your picture has.</p> <p>ELL support: Make sure to review the follow-up questions in advance so that ELL students can follow along and participate in this activity.</p> <p>Raise your hands if your ladybug has six legs.</p> <p>Did anyone come up with a different number of legs than six?</p> <p>NOTE TO TEACHER: <i>Many of the pictures of the ladybugs show only three legs, not all six. However, students should realize that if there are three legs on one side of the ladybug’s body, there</i></p>	remember the number each person called out.	<p>Did the graph help you see a pattern in the data?</p> <p>Does anyone have anything to add to this idea?</p>

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		Engage students in analyzing and interpreting data and observations.	<p><i>should be three legs on the other side. All students should either observe directly or infer that a ladybug has six legs. If any students think their ladybugs have a different number of legs, discuss it with them to make sure they realize that all of the ladybugs in their pictures have six legs.</i></p> <p>Show slide 10.</p> <p>Small-group discussion: In your small groups, talk about the questions on the slide:</p> <ul style="list-style-type: none"> • Do ladybugs show variation for the number-of-legs trait? • What would a class bar graph look like for the number of legs our ladybugs have? Sketch the graph in your notebooks to help you imagine what it would look like. As you create your graph, think about a few ladybugs and the number of legs they have. <p>Whole-class discussion: Let's hear your ideas for answering these questions.</p>		
6 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: The teacher</p>	Highlight key science ideas	<p>Show slide 11.</p> <p>Today's focus question is <i>How are living things of the same kind alike and</i></p>		

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		Engage students in making connections by synthesizing and summarizing key science ideas.	<p>notebooks.</p> <p>Show slide 13.</p> <p>Using everything you've learned so far about traits and variation, write an answer to our focus question in your science notebooks. Make sure to include evidence from our investigations today and last time to support your ideas.</p> <p>Whole-class share-out: Let's hear some of your ideas for answering these questions. Make sure to include evidence from our bar graph.</p>		
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher links science ideas about variation in traits to the next lesson.</p>	Link science ideas to other science ideas.	<p>Show slide 14.</p> <p>In our next lesson, we'll look at other living things, like plants, and see if they show variation in some traits and not in others.</p>		