

Communicating in Scientific Ways

Grades: Any	Length of lesson: 45 minutes	Placement of lesson in unit: Stand-alone lesson
Lesson focus question: How do scientists think and talk together?		Main learning goal: How scientists think and talk is an important part of what it means to be a scientist.
<p>Science content storyline: Scientists do a lot of things to figure out how the world works, but how they think and talk together is an important part of what it means to be a scientist. The following list shows ways that scientists think and talk with one another to help them better understand their own ideas and the ideas of other scientists. When scientists communicate in scientific ways, they do these things:</p> <ul style="list-style-type: none"> • Ask how and why questions. • Observe phenomena. • Think of ideas to explain what they see. • Give evidence and reasons for their ideas. • Agree or disagree with someone else’s idea. • Add to someone else’s idea. • Let their ideas grow and change. 		
<p>Ideal student response to the focus question: Scientists think and talk together about their ideas, questions, and evidence. They also listen to one another and build on each other’s ideas. Sometimes they agree, and sometimes they disagree with one another, but they always give reasons or evidence for why they agree or disagree. The job of a scientist is to explain how the world works. Communicating in scientific ways helps scientists make sense of the world around them.</p>		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Communicating in Scientific Ways poster • Chart paper or whiteboard; markers • Video of boiling water (or a beaker of water and a hot plate for actual demonstration) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review STeLLA strategy 8 in the STeLLA strategies booklet: Engage students in communicating in scientific ways. • Watch the boiling-water video and decide how much of it you want to show to your students. <i>Alternatively</i>, you can set up an actual demonstration of a beaker of water boiling on a hot plate for students to observe. • Plan the seating arrangement for the demonstration. Ideally, students should be sitting in a configuration that encourages them to speak to one another, not just to you.
--	--

Communicating in Scientific Ways General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	Lesson focus question: The teacher introduces the focus question, <i>How do scientists think and talk together?</i> and elicits student ideas about what scientists do.	
15 min	Setup for activity: The teacher introduces students to the Communicating in Scientific Ways poster and helps them model each of the strategies in the context of observing and explaining a rainbow.	<ul style="list-style-type: none"> • Scientists make observations, think and talk with one another about their observations, and come up with ideas to explain what they're observing.
15 min	Activity: Students watch a video of boiling water (or observe water boiling in a beaker on a hot plate). Using the sentence starters on the Communicating in Scientific Ways poster, they participate in a scientific discussion about what happens when water boils and why.	<ul style="list-style-type: none"> • First, scientists observe and think about their observations. Then they talk with one another in scientific ways about their observations and ideas. Working together, they can come up with better ideas to explain what they're observing (in this case, what happens when water boils and why).
5 min	Follow-up to activity: Students reflect on the ways they communicated scientifically during the discussion.	<ul style="list-style-type: none"> • When scientists communicate in scientific ways, they engage in these actions: <ul style="list-style-type: none"> • Ask how and why questions. • Observe phenomena. • Think of ideas to explain what they see. • Give evidence and reasons for their ideas. • Agree or disagree with someone else's idea. • Add to someone else's idea. • Let their ideas grow and change.
5 min	Synthesize/summarize today's lesson: Students talk about what they learned about thinking and talking like a scientist, and the teacher summarizes the lesson.	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
5 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher introduces the focus question, <i>How do scientists think and talk together?</i> and elicits student ideas about what scientists do.</p>	<p>Ask questions to elicit student ideas and predictions.</p> <p>Set the purpose with a <u>focus question</u> or goal statement.</p>	<p>Show slide 1.</p> <p>Today we’re going to learn about how to think and talk like scientists. You probably already have some ideas about what scientists do and how they think and talk together.</p> <p>Let’s start our discussion with this question: <i>What do scientists do?</i></p> <p>Mostly you’ve been talking about what scientists do. <i>But how do scientists think and talk together?</i> That’s our focus question today.</p> <p>Write this question in your science notebooks and draw a box around it.</p>	<p>They do experiments.</p> <p>They try to figure things out.</p> <p>They measure things.</p> <p>They work by themselves, mostly in a lab.</p> <p>They study about space and dinosaurs.</p>	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>NOTE TO TEACHER: <i>Also write the focus question on the board for the class to see and refer to throughout the lesson.</i></p> <p>In this lesson, we'll pay attention to how scientists think and talk together, not just what they do.</p>		
15 min	<p>Setup for Activity</p> <p>Synopsis: The teacher introduces students to the Communicating in Scientific Ways poster and helps them model each of the strategies in the context of observing and explaining a rainbow.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Scientists make observations, think and talk with one another about their observations, and come up with ideas to explain what they're observing. 	<p>Make explicit links between science ideas and activities before the activity.</p>	<p>NOTE TO TEACHER: <i>If you're going to show an actual beaker of water boiling instead of the video, be sure to start heating the water about 3–5 minutes before students will make their observations.</i></p> <p>Many times when we think of scientists, we imagine them working in a lab doing experiments or digging for fossils out in nature or exploring space.</p> <p>But today we're going to focus on one of the most important things all scientists do. We're going to learn how they think and talk together about their work. Then we're going to practice talking and thinking like scientists ourselves.</p> <p>Let's look at the Communicating in Scientific Ways poster and learn about the ways scientists talk and think. Pay careful attention, because after we talk about the poster, we're going to have a discussion to practice talking like scientists!</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>Show slide 2.</p> <p>Look at this picture of a rainbow and imagine we're scientists having a discussion about it. As we look at each icon or picture, we'll discover different ways we can talk scientifically about our observations of the rainbow.</p> <p>First, scientists explore how and why questions. They form sentences that start with "I wonder." See the question-mark symbol on the poster? That reminds us as scientists to ask why and how questions and to say "I wonder" Can you come up with a sentence about rainbows that starts with "I wonder ..."?</p> <p>NOTE TO TEACHER: <i>Continue through each row of the CSW poster, pointing out how each way of talking scientifically has a symbol to help students remember it and some sentence starters that students should use as they're talking.</i></p> <p>Here are some ideas of questions we could ask about the rainbow:</p>	<p>I wonder if there is a pot of gold at the end of the rainbow.</p> <p>I wonder why we don't see rainbows very often.</p> <p>I wonder why you see rainbows only after it rains.</p>	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<ul style="list-style-type: none"> • What is something we could say that we see? • Who can think of an idea about how to explain what we see? • Can you think of some evidence to support that idea? • Who has a reason to explain why we see rainbows when it's sunny after it rains? • Who can come up with an "I disagree because ..." or an "I agree because ..." statement? • Who can show they were listening by adding to what someone else said? 	<p>I can see colors in the rainbow.</p> <p>My idea is that the rainbow has colors because the Sun is shining through the raindrops.</p> <p>My evidence is that it's always sunny after it rains when you see a rainbow.</p> <p>My reason is that the sky has lots of different colors, but they show up only when the Sun shines through the raindrops.</p> <p>I agree because I've never seen a rainbow when the Sun wasn't out.</p> <p>I want to add that the raindrops are really tiny, so you can't see them. You think it</p>	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<ul style="list-style-type: none"> • And what about letting your ideas grow and change? <p>NOTE TO TEACHER: <i>Emphasize the importance of disagreeing and giving evidence to support disagreements. Make sure students understand that this kind of disagreeing is different from fights kids get into on the playground. Scientists challenge each other to come up with the best solution to a problem or the best reason to explain something they observe.</i></p> <p><i>It's good for scientists to disagree, because they're helping one another come up with the best possible answers to their questions. All scientists want the same thing: to figure out the mysteries of our natural world. Challenging each other is really important in helping all of us figure things out.</i></p>	<p>stopped raining, but it really hasn't.</p> <p>I'm changing my idea because I like what Armando said about the tiny raindrops that you can't really see.</p>	
15 min	<p>Activity</p> <p>Synopsis: Students watch a video of boiling water (or observe water boiling in a</p>	<p>Make explicit links between science ideas and activities during the</p>	<p>We just gave examples of how to talk like scientists by using each of these different ways of communicating. [<i>Point to the CSW poster.</i>] But scientists don't talk about things one by one as they work their way</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p>beaker on a hot plate). Using the sentence starters on the Communicating in Scientific Ways poster, they participate in a scientific discussion about what happens when water boils and why.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • First, scientists observe and think about their observations. Then they talk with one another in scientific ways about their observations and ideas. Working together, they can come up with better ideas to explain what they're observing (in this case, what happens when water boils and why). 	<p>activity.</p> <p>Select content representations and models matched to the learning goal and engage students in their use.</p>	<p>down this list. So now we're going to practice using these ways of talking like scientists in a real scientific discussion.</p> <p>Show slide 3.</p> <p>We're going to look at something you've likely seen before—boiling water—and we'll find out if we can talk about it the way scientists would.</p> <p>We'll make observations, ask how and why questions, ask each other questions, and agree and disagree with each other but give reasons or evidence to support our disagreements. Try to build on each other's ideas and talk directly to each other, not just to me. We're all scientists!</p> <p>I'll keep track of which sentence starters you use during the discussion by pointing to them on the Communicating in Scientific Ways poster.</p> <p>NOTE TO TEACHER: <i>List students' sentence starters and ideas on chart paper and bring the chart to the next study-group meeting.</i></p> <p>Remind students to use the icons and sentence starters from the CSW poster during the discussion.</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>Optional: You might point to the CSW poster as each student speaks to make it clear which strategy and sentence starter the student is using.</p> <p>Let’s look at the beaker of water in this video.</p> <p>Show the boiling-water video.</p> <p>NOTE TO TEACHER: <i>If students are observing an actual beaker of boiling water, gather them safely around the beaker so everyone can see.</i></p> <p>SAFETY NOTE: <i>Make sure to turn the hot plate off before the water totally evaporates out of the beaker.</i></p> <p>Notice the mark showing the level of the water on the side of the beaker before the hot plate was turned on.</p> <p>Now let’s observe as the water boils and begin our scientific conversation about what is happening. Try to use the sentence starters from the CSW poster!</p> <p>Let’s talk about this question: <i>What happens when water boils and why?</i></p>		<p><i>Ideas to keep the conversation moving and productive:</i></p> <ul style="list-style-type: none"> • Bring the

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>NOTE TO TEACHER: Write the question on the board, show the video (more than once, if needed), and start the discussion about the boiling water. Try to limit what you say and maximize student talk. Challenge students to try to keep this conversation going for at least 10 minutes.</p>		<p>conversation back to the focus question as needed.</p> <ul style="list-style-type: none"> • Refer to the poster and ask students these questions: <ul style="list-style-type: none"> • Can anyone add to what X said? • Does anyone have a question for X? • Does anyone disagree? • Can you make some new observations—something that no one has said yet? • What is your reason for that? • Do you have any evidence to support that idea?
5 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students reflect on the ways they communicated scientifically during the</p>	<p>Make explicit links between science ideas and activity after the activity.</p>	<p>Let’s look at our CSW poster and the notes on our chart paper. How many of these scientific ways of thinking and talking did we use in our conversation?</p> <p>Did we ...</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p>discussion.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • When scientists communicate in scientific ways, they engage in these actions: <ul style="list-style-type: none"> • Ask how and why questions. • Observe phenomena. • Think of ideas to explain what they see. • Give evidence and reasons for their ideas. • Agree or disagree with someone else’s idea. • Add to someone else’s idea. • Let their ideas grow and change. 		<ul style="list-style-type: none"> • Ask how and why questions? • Make observations? • Think of ideas to explain what we saw? • Give evidence and reasons for our ideas? • Agree or disagree with each other’s ideas? • Add to one another’s ideas? • Let our ideas grow and change? 		
5 min	<p>Synthesize/Summarize Today’s Lesson</p> <p>Synopsis: Students talk about what they learned about thinking and talking like a scientist, and the teacher summarizes the lesson.</p>	Engage students in making connections by synthesizing and summarizing science ideas.	<p>What did you learn today about how to think and talk like a scientist? What was an idea that was new for you?</p> <p>Think silently about these questions for a moment and raise your hand when you have in mind one example of how you thought or talked like a scientist today.</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p>Main science idea(s):</p> <ul style="list-style-type: none"> • When scientists communicate in scientific ways, they engage in these actions: <ul style="list-style-type: none"> • Ask how and why questions. • Observe phenomena. • Think of ideas to explain what they see. • Give evidence and reasons for their ideas. • Agree or disagree with someone else’s idea. • Add to someone else’s idea. • Let their ideas grow and change. 		<p>NOTE TO TEACHER: <i>If time allows, ask every student to contribute an example.</i></p>		