In the context of the classroom, talk is not an add-on. It addresses important academic content and is a critical component of the lesson, including whole class, small group, and pair or partner discussions. Through talk, teachers and students explore ideas and use evidence to build and critique academic arguments. There is solid research evidence and widespread agreement that academically productive talk is critical for learning in science.

Sarah Michaels and Cathy O’Connor, Talk Science Primer

INTRODUCTION—GRADE 3

In FOSS, sense-making discussion is a prominent part of active investigation. The sense-making discussion follows the context setting, activity, data acquisition and management, and is a critically important part of the analysis process. The following vignette describes a sense-making discussion.

Students have conducted an investigation testing how water interacts with different surfaces. After sharing their observations, students bring their notebooks to the discussion area and stand shoulder to shoulder next to someone from another group. The teacher asks if water does the same thing on all surfaces and students turn and talk to a partner while another pair of students add their observations to the class notebook. A few students share that water beaded up on some surfaces and was absorbed by others. Other students agree and others ask questions. The teacher listens and asks questions to guide the discussion or encourages communication between all students, careful to facilitate rather than lead. Students collaboratively develop models about why some surfaces are waterproof and others are not. Data from the class notebook are compared to those in student notebooks and used as evidence to support student models and explanations. A few
students share their models in the class notebook. Students all work to refine their models and construct explanations about why some surfaces are waterproof and others are not. Using this understanding, students consider how water interacts with surfaces outside of the classroom. Before heading back to their seats and responding to the focus question individually in their notebook, students summarize their current understanding with a partner.

A sense-making discussion, like the one described above, has two purposes. First, it helps students review and confirm information accrued from the active investigation, and to organize information for processing. It is more than just sharing what they did or observed; more importantly, it is analysis—finding connections and relationships in the data in an effort to construct conceptual knowledge. Second, this discussion helps students organize and communicate their thinking in collaboration with their peers. The sense-making discussion allows all students to develop conceptual models about phenomena and prepares them to respond to the FOSS focus question.

This chapter describes a professional learning process to enhance your abilities to facilitate sense-making discussions of science phenomena with grade 3 students. This chapter will be most useful after you have taught a FOSS module.
PLANNING AND PREPARING FOR SENSE-MAKING DISCUSSIONS

We have identified six planning steps to prepare for a sense-making discussion. We will describe each step and then provide a typical planning schematic that summarizes the process. At the end of this chapter are seven samples of model sense-making planning guides for grade 3 investigation discussions. References to these planning guides are found in the sidebars of the Investigations Guide.

1. Review the Investigations Guide

Look closely at the disciplinary core ideas, science and engineering practices, and crosscutting concepts associated with a particular lesson. These are stated on the first page of the investigation and discussed in the Teaching Children about . . . section. Review the guiding questions for the investigation (on the first page and in the at-a-glance chart), the Background for the Teacher, and the Teaching Children about . . . sections for cognitive engagement that is critical for student understanding. Note relevant questions or talking points in these sections, and pay particular attention to common emerging conceptions that can be used to generate argumentation.

**BACKGROUND for the Teacher**

Weather is a product of complicated interactions between the gases that constitute the air, heat from the Sun, and water, both in the ocean and in the atmosphere. The Sun is primarily responsible for making weather happen on our planet. The energy from the Sun, influenced by Earth’s rotation, the tilt of Earth’s axis, and the arrangement of land and water, produces the uneven heating that drives Earth’s weather.

What Does the Weather Forecast Tell Us?

Scientists who use weather instruments to study the weather and atmosphere are meteorologists. Meteorologists make forecasts of the weather based on measurements and patterns. Weather has three major components that continually concern people: the amount of heat energy in the air, the amount of motion of the air, and the amount of water in or precipitation from the air.

One way to monitor and record the weather is to describe the conditions in words. Students will also use instruments, such as thermometers, wind vanes, and rain gauges.

A thermometer is the instrument that measures the kinetic energy in the air. The kinetic energy in the air determines the amount of heat energy. Most weather reports in the United States give temperature in degrees Fahrenheit, but scientists and most of the rest of the world use the Celsius scale.

Wind vanes are one of the oldest meteorological instruments. Wind vanes are often arrow-shaped, with the feather end much larger in surface area than the pointed end. When wind blows against the arrow, the feather end catches more wind and is pushed back, bringing the point into the wind. Winds are always named for the direction from which they come. If a wind vane is pointing north, the wind is blowing from the north, and we call it a north wind. Wind vanes usually include horizontal crosses on their bases to show the four cardinal compass directions. When students use the FOSS wind vane, they will use a compass to determine the direction.

A rain gauge gathers and measures the amount of precipitation over a given period of time. Most rain gauges measure precipitation in millimeters, although it can also be reported in inches or centimeters. Rain gauges need to be placed in open areas where there is no obstruction to interference with rain falling into the gauge.
Sense-Making Discussions for Three-Dimensional Learning

The Teaching Children about . . . section provides information about the disciplinary core ideas, science and engineering practices, and crosscutting concepts emphasized in the investigation.

INVESTIGATION 3 – Weather and Water

TEACHING CHILDREN about Weather and Water

Developing Disciplinary Core Ideas (DCI)

When young students observe wet objects change into dry objects, they often attribute it to the name of reason—air just dried up. Around age 8 or 9, when they acknowledge that matter is conserved—matter created nor destroyed—students attempt to account for the vanished water using “The water went somewhere.” But their idea of “somewhere” is some unspecified place in the air. And that unspecified place is test.

Steam seems to come and go on windows and bathroom mirrors. How does that phenomenon happen? And what does that have to do with weather?

The water cycle is an artifact of weather. Weather is the condition of the atmosphere, and when conditions are right, water evaporates from Earth’s surface here, condenses in the atmosphere there, and falls back to Earth’s surface, producing a water cycle. This relationship is difficult to approach, but middle school will start to piece it together in this investigation, and will revisit the phenomena and improve their water cycle model in grade 5. Students will also be introduced to the foundational concepts in meteorology. Students measure weather, investigate evaporation and condensation, and learn that both processes are part of the water cycle. The idea that the Sun drives all weather on Earth is the biggest idea. A companion concept is that the massive presence of water on the planet also plays a central role in creating weather.

These foundational experiences with evaporation and condensation are important to an understanding of water in its role in weather and climate—ESS2.D: Weather and climate. These experiences also set up students’ understanding of the core idea PS1.A: Structures and properties of matter and the role that temperature and surface area play in phase changes of matter from liquid to gas.

Connections: Understandings about the Nature of Science

• Scientific knowledge is based on empirical evidence. As findings are based on recognizing patterns. Science investigations use a variety of methods, tools, and techniques.

Engaging in Science and Engineering Practices (SEP)

In this investigation, students engage in these practices:

- Asking questions about the moisture that forms (condense) on the outside of a cup.
- Developing and using models to describe how the processes of evaporation and condensation work.
- Planning and carrying out investigations to organize weather forecasts and compare the data to observed and actual weather data, and to determine the variables involved in evaporation (surface area and temperature).
- Analyzing and interpreting data to compare forecasts and observed weather data, to explore the cause-and-effect relationships between amount of evaporation and variables of surface area and temperature.
- Using mathematics and computation thinking to determine the relationship between surface area and evaporation of water.
- Constructing explanations using evidence to explain how evaporation, condensation, and precipitation are the main processes in the water cycle.
- Engaging in argument from evidence concerning the processes of evaporation and condensation.
- Obtaining, evaluating, and communicating information about weather instruments and how meteorologists collect data.

Exposing Crosscutting Concepts (CC)

In this investigation, the focus is on these crosscutting concepts:

- Patterns. Patterns in weather data can be used to make forecasts.
- Cause and effect. Heating and cooling of water causes predictable changes that can be observed. Increased surface area and higher temperatures cause liquid water to evaporate and become water vapor (gas). When water vapor cools, it can condense on surfaces and form liquid water.
- Scale, proportion, and quantity. Evaporation and condensation can be observed on a macro-scale in the classroom and on a large scale in the water cycle on Earth.
BACKGROUND for the Teacher
Weather is a product of complicated interactions between the gases that constitute the air, heat from the Sun, and water, both in the ocean and in the atmosphere. The Sun is primarily responsible for making weather happen on our planet. The energy from the Sun, influenced by Earth’s rotation, the tilt of Earth’s axis, and the arrangement of land and water, produces the uneven heating that drives Earth’s weather.

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Teaching Children about Weather and Water

Knowing where concepts are addressed and how they are related helps determine what ideas to pursue during the discussion and which ones can be addressed during the next part.
2. Identify When and Why to Have the Discussion

Most investigation parts have a step where the class discusses the body of acquired information. The step may not always instruct you to organize students in a circle, but that is generally advisable. The sense-making discussion may be contained within a step, or may take place over several steps. Consider doing this when students have acquired sufficient experience and information and are ready to think about and answer the focus question. A sense-making discussion should happen after data acquisition in preparation for generating an answer to the focus question. For grade 3, plan about 10 minutes for the sense-making discussion.

To illustrate this process we will use an example from the Water and Climate Module, Investigation 1, Drops of Water. The page below shows the location of the sense-making discussion after the data collection.

During the sense-making discussion, the role of the teacher is to facilitate the discussion. The teacher asks questions, listens to students, and adjusts depending on the discussion. In the Investigations Guide, certain steps have detailed questions to help students analyze data. Other steps help to identify important ideas that need to come out during the discussion. Review those questions and the important ideas and plan additional questions that will guide students toward the desired understandings (disciplinary core ideas).

10. Clean up
Have Getters return the materials and discard the wet papers.
Have Starters wipe the tables.

11. Have a sense-making discussion
Ask students to talk in their groups for 3 minutes about water on different surfaces. To get the discussion going, suggest they
- share their drawings;
- identify similarities and differences between the appearance of water on different surfaces;
- describe what the water looks like on the different surfaces and describe patterns they observe.

Ask Reporters to report what happened to the drops of water on each of the surfaces. Keep track of their observations on the board. When students report that the water soaked into some materials, tell them,

When water soaks into a surface, like the paper towel, we say the towel absorbs the water. When water sits on top of a surface in drops, we call the drops beads and say the water beads up on a waterproof surface. These are different ways water interacts with surfaces.

12. Review vocabulary
Review vocabulary introduced in this part. If those words are not on the word wall, add them now. Give students time to label their drawings with the new vocabulary words.
3. Plan What to Ask and What to Listen For

There are different levels of questions that will facilitate the discussion. If data have not been shared prior to the sense-making discussion, start with data questions. Plan on asking for observations and have students display those observations in the class notebook. After asking questions about observations, plan questions targeted to the content (disciplinary core ideas) that build on complexity.

Other questions should utilize a crosscutting concept. For example, “What is the function of the claw structure?” or “What causes a canyon to form?” Some of these questions might be found in the Background for the Teacher and the Teaching Children about . . . sections. The focus question might be an analysis question. Generating this list of possible questions to ask during the sense-making discussion keeps the discussion focused and students engaged. See the list of teacher-generated sample questions in the sidebar.

In addition to the questions, develop a list of the ideas or responses to these questions. This is what you will listen for during the discussion. Look at the What to Look For section for possible anticipated responses, including common emergent conceptions.

Some teachers identify the “What to Listen For” first and then develop questions to elicit those ideas. Be certain the questions and the desired ideas match the goals or outcomes for the lesson. See the list of teacher-generated responses to questions in the sidebar.

What to ask

- What happens to the water when dropped on different surfaces?
- Does water do the same thing on all surfaces?
- What do the waterproof surfaces have in common?
- What happens to the water when it is absorbed by a material?
- What happens to the water when it beads up on a surface?
- What makes water bead up on some surfaces and be absorbed on others?

What to listen for

- Water beads up on wax paper, aluminum foil, and paper (initially).
- Water is absorbed by the paper towel and paper (over time).
- Water spreads out into the material when it is absorbed.
- Waterproof surfaces are smooth and don't have spaces for the water to soak into them.
4. Plan for Adjustments

Since students might address ideas before questions are asked, there is not always a linear line of questions and answers. The sense-making discussion is not a question-and-answers session, but rather a student discussion about the data, managed but not led by the teacher. Having a list of the ideas you are listening for helps determine if students’ ideas are heading in a productive direction.

**Scaffolding questions.** If the discussion needs to be further guided or redirected, adjust as necessary using scaffolding questions. As part of your planning, develop questions to scaffold the discussion, and be prepared to redirect the discussion if it is heading in an unproductive direction. Use questions that ask for data to support students’ conclusions. It is always helpful to ask students to support their thinking or the thinking of others with supporting data (evidence).

**Application questions.** Next, plan application or extending questions. In some contexts, these questions connect student thinking to the guiding question for the investigation, bigger ideas, or a new context. For example, “You claim that brine shrimp have a range of tolerance for salinity. What other environmental factors might the brine shrimp have a range of tolerance for?” or “Jenny said that the sound travels from the spoon, through the string, into the cup, and finally into her ear. Did anyone ask Jenny why when she hit the spoon, you can hear it, without a string and a cup?” When appropriate, revisit the phenomenon or guiding questions for the investigation and raise culturally relevant questions that connect concepts to students’ experiences. Look at the Wrap-Up/Warm-Up section for some of these questions. These questions push students’ conceptual models. At times it is appropriate for students to be thinking about these application questions well after the sense-making discussion takes place.

**Other instructional strategies.** Depending on the focus crosscutting concepts and science and engineering practices, other instructional strategies can be incorporated into the discussion. For example, the teacher can provide a claim that differs from the claim students are making in the discussion. This claim serves as a critical competitor, an argumentation strategy designed to fine tune the students’ claim. Additionally, an effect-and-cause chart could be made to help students look at specific relationships between variables. Examples of these instructional strategies can be found in the Science and Engineering Practices and Crosscutting Concepts chapters. The next-step strategies found in the Assessment and Science Notebooks in Grades 3–5 chapters can also be incorporated into sense-making discussions when appropriate.

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**NOTE**

Ways to adjust the discussion include:

- Using scaffolding questions
- Using application questions
- Using other instructional strategies
- Using talk moves
## Module
Water and Climate

### Investigation 1: Water Observations, Part 1: Drops of Water

**Guiding question:** How does water interact with other materials?

**Focus question:** What happens when water falls on different surfaces?

### NEXT GENERATION SCIENCE STANDARDS

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### Questions and Intended Responses

**Step 11:** Have a sense-making discussion

**What to ask**

- What happens to the water when dropped on different surfaces? (Analyzing and interpreting data)
- Does water do the same thing on all surfaces? (Analyzing and interpreting data; patterns)
- What do the waterproof surfaces have in common? (Analyzing and interpreting data; patterns)
- What happens to the water when it is absorbed by a material? (Developing and using models)
- What happens to the water when it beads up on a surface? (Developing and using models)
- What makes water bead up on some surfaces and be absorbed on others? (Developing and using models, Constructing explanations; patterns)

**What to listen for**

- Water beads up on wax paper, aluminum foil, and paper (initially).
- Water is absorbed by the paper towel and paper (over time).
- Water spreads out into the material when it is absorbed.
- Waterproof surfaces are smooth and don’t have space for the water to soak into them.

**Scaffolding questions**

- What are the properties of wax paper? What are the properties of the paper towel?

**Application questions**

- What would happen if we placed a drop of water on <other surface>?
- What ‘rule’ are you using to make these predictions?
- What does this investigation tell you about how water interacts with other materials?

These are questions that help students process the data to extract meaning.

These are the intended responses to the content questions. As these ideas come forward, talk moves are used to engage all students.

These are questions to ask if students need guidance when processing data and the intended responses are not being heard.

These questions are designed to extend knowledge beyond the discreet experience for the lesson.
**Talk moves.** Talk moves serve to help all students communicate with each other and advance their models. Several talk moves are possible. Two talk moves can be used to help begin a sense-making discussion.

- Use partner talk when starting the discussion or when there is a lull in the action. Always start the group discussion with a quick “turn and talk to your neighbor.” This will loosen students up and give them oral practice. This move is very beneficial for students who need more support with language. It often makes sense to have students stand next to and talk with someone they did not work with in their group. You can also use a protocol such as an A/B partner talk dyad or a group sentence starter (see the Science-Centered Language Development chapter for more information). Let students know how long the partner discussion will be and the importance of listening and responding to each other.

- Wait time often works well with students. Initially some students might find these discussions very uncomfortable, but don’t interrupt this struggle too soon. Students need time to process, reflect, and mount the courage to speak up.

Some talk moves are most useful when adjusting the discussion so students discuss the ideas of others. *Talk Science Primer* explains how talk moves progress from pushing individual thinking, to listening to others, to deepening reasoning, and to engaging with others’ reasoning. Try to move beyond having students listening to others just so they know when it is their turn to talk. Students should listen actively and critically and link their ideas to the ideas of others. As you prepare for using the talk moves, start with just a few. *Talk Science Primer* describes two examples that are very effective talk moves to use when students start thinking about analysis and application questions. The first one is Say More and Explain What Someone Else Means; the second move is to Agree/Disagree and Why. Using Asking for Evidence or Reasoning is an effective talk move in which students are asked to reference specific observations or explain a line of thinking.

Talk moves should be considered thoughtfully and selectively, and applied strategically to get students engaged in productive discourse.
5. Consider Language and Vocabulary
Sometimes it is advisable to formally develop precise vocabulary during the sense-making discussion. At other times, students develop those vocabulary words in the context of active investigation. Having these vocabulary words in mind and publicly displayed in the classroom can be helpful. If students are not using academic science vocabulary, adjust the discussion by asking them to rephrase statements, using the academic vocabulary.

With English learners, provide sentence frames to share data or share their thinking. You could use sentence strips for starters that connect with the talk moves. This could become a focus during the discussion. For example, give a sentence starter, such as “What I hear you saying is ______,” when a student is responding to other students. Incorporate accommodations and modifications as necessary to provide all students equal access to and participation in the discussion. See the Access and Equity chapter for more information on ways to support all students.

6. Use a Class Notebook
Students should bring their science notebook and a pen or pencil to the sense-making discussion. For efficiency, you can use a large class notebook during the discussion, typically on a flip chart. Plan a position for the class notebook so that everyone has access to the content. For more information, refer to the Science Notebooks in Grades 3-5 chapter in Teacher Resources. Think about what data should be recorded in the class notebook for display during the sense-making discussion. Try to find time for a few students to record their data in the class notebook. This could be done during the initial partner talk or when students are collecting their data during the active investigation. Allow students to use the class notebook when discussing data. The class notebook can be used to reorganize data to determine patterns or describe cause-and-effect relationships.

The teacher might interact with the class notebook to model a particular data processing technique or call attention to a specific detail.
CONDUCTING A SENSE-MAKING DISCUSSION

Gathering in a circle is critical for sense-making discussions. Students should sit on the floor or in chairs or stand shoulder to shoulder so everyone can see each other and the class notebook. You should be part of the circle. Depending upon the need for the class notebook, you might stand near it, but not next to it. One goal of the circle is to remove you from the position of “teacher” and the one who “runs” the discussion and has all the answers.

Additionally, you should encourage students to look at and talk to each other rather than to you.

Work with students to generate a list of their responsibilities and ways they should contribute to the conversations. Examples are displayed on the posters below.

Make sure students have visual access to the established class norms, sentence frames, word wall, class notebook, equipment photo cards, and, when appropriate, a reference set of the materials used during the investigation.

**Frequency**

The goal is to answer the focus question with one rich sense-making discussion in every part of every investigation. This might take time to achieve, so don’t feel you need to do this as a new FOSS user. Start with one for each investigation and add more as you

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**My Responsibilities**

I agree that I will...
- explain my ideas.
- listen to others and show that I am listening.
- ask questions when I am confused or can’t hear.
- connect my ideas to others’ (explain, add to, respectfully disagree).
- participate because all ideas lead to learning (speak loud and clear).

**Respond to other ideas**

Can you explain to me...?
Why do you think?
What evidence do you have?
Are you saying...?
I agree with... because...
respectfully disagree with... because...

---

When scientists share their own ideas, they may say...
- I observed...
- I noticed...
- My data show...
- I think... because...
- I wonder...

---

Full Option Science System
develop your facilitation skills and students develop their participation skills. In some parts, especially in life science modules, students will discuss data from long-term observations. While this might add additional time, having a rich sense-making discussion will go a long way to improving students’ conceptual understanding and decrease the need for next-step strategies.

Your Role during the Discussion

Move to the location in your classroom where everyone can sit or stand in a circle, preferably without furniture or other visual distraction in the circle. Bring your planning documents that contain the list of questions and what to listen for to the discussion. If you have any additional materials, such as a chart, or equipment, bring those as well.

Begin by reviewing with students the discussion norms and sentence starters. These should be on posters hanging on the wall near the sense-making circle. Revisit these as necessary during the discussion, especially if some students are dominating or avoiding the conversation. When you form your circle, make sure there are no “double parkers,” that is, students positioned outside the circle standing behind others.

Your biggest role in the discussion is to ask, listen, and adjust. Ask your first planned question and listen to student responses and compare those to the “what to listen for” you planned. Determine if students have provided a sufficient response, a partial response, such as one that does not contain evidence, or a response that is not accurate. Make a decision what to do next based on that response.

If students are on track, you might use a talk move such as “turn and talk with your partner, do you agree or disagree with the idea <student’s response>.

If the response is only partially developed, you might use a talk move such as “who can add more to what <student name> said?” or “what data do we have that supports <student’s response>.

If a particular student response is not accurate, you can use wait time to see if another student poses a question or adds to the conversation, ask a scaffolding question, or provide a sentence frame. Make adjustments in order to have all students engage with the question you asked.

NOTE

The next two pages show the connection between the sense-making planning guide and how this discussion might unfold in the classroom. Since each discussion will be different, this is provided as a sample.
Sense-Making Discussions for Three-Dimensional Learning

These two pages show the connection between the sense-making planning guide and how this discussion might unfold in the classroom. Since each discussion will be different, this is provided as a sample.

**SENSE-MAKING DISCUSSION PLANNING GUIDE**

**Module:** Water and Climate

**Investigation 1:** Water Observations, **Part 1**: Drops of Water

**Guiding question:** How does water interact with other materials?

**Focus question:** What happens when water falls on different surfaces?

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**Questions and Intended Responses**

**Step 1:** Have a sense-making discussion

**What to ask**

- What happens to the water when dropped on different surfaces? (Analyzing and interpreting data)
- Does water do the same thing on all surfaces? (Analyzing and interpreting data; patterns)
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**What to listen for**

- Water beads up on wax paper, aluminum foil, and paper (initially).
- Water is absorbed by the paper towel and paper (over time).
- Water spreads out into the material when it is absorbed.
- Waterproof surfaces are smooth and don’t have space for the water to soak into them.

**Scaffolding questions**

- What are the properties of wax paper? What are the properties of the paper towel?

**Application questions**

- What would happen if we placed a drop of water on <other surface>?
- What rule are you using to make these predictions?
- What does this investigation tell you about how water interacts with other materials?
Content questions include data analysis, constructing explanations, and engaging in argumentation, using crosscutting concepts when appropriate.

**ASK**
- Ask question.
- Ask additional question.

**LISTEN**
- Inaccurate analysis of data
- On track conceptually; no evidence
- Sufficient from many students

**Scaffold**
- Wait time
- Add on/say more
- Clarify answer with partner
- Reference data in class notebook
- Provide claim-and-evidence frame

**REFLECT**
- Was all content discussed by all students?

**ADJUST**
- Listen and compare responses to “what to listen for.” What type of response was given?
- No
- Yes

**Decision Map**—This is for an introductory sense-making discussion.

**COLOR KEY**
- Question
- Decision
- Student action
- Talk move
- Instructional strategy
Before asking the next question on the list, decide what other ideas on the What to Listen For list came forward. If so, revisit the idea by saying something like, “An idea that <student’s name> mentioned was <student’s idea>” before asking the related question. This places value on student ideas and makes the conversation appear more student centered.

Continue asking your planned questions, listening and comparing to the “What to Listen For” list, and adjusting as needed until all the ideas come forward. Before moving on to the application questions, have students discuss the focus question. As time and student attention permits, ask the planned application questions following a similar sequence of ask, listen, and adjust. Application questions can be asked in a separate discussion as a wrap-up after students answer the focus question or at the start of the next lesson as a warm-up.

**After the Discussion**

After a sense-making discussion, you want students to write about their new knowledge in their science notebooks. After they answer the focus question in their notebooks, you can review their responses for embedded assessment. See the Assessment chapter for more information on embedded assessment. It’s ok to let some incomplete ideas or student questions linger when you know that the next lesson will continue to address those ideas. Resist resorting to telling students the answer as this rarely results in students adjusting their conceptual models. Instead, think of additional questions or experiences, such as engaging in argument, to address areas that warrant further consideration.

Last, and most important, have fun! Enjoy the intellectual struggle. This is the part where you never know what ideas students may trot out. Some discussions will be rich and rewarding, and others might not go so well, but it’s important to reflect on your practice and make incremental adjustments as needed to keep students striving to understand.
SENSE-MAKING SAMPLES—GRADE 3

On the next eight pages are samples of sense-making discussion planning guides from the three grade 3 FOSS Next Generation Modules—Water and Climate, Structures of Life, and Motion and Matter. As you read the Investigations Guide to prepare for instruction, you will see a teaching note in the sidebar with red text, which tells you to refer to this chapter to find the sense-making sample for the specific investigation and part. The red-text teaching notes are found in the latest FOSS Investigations Guide which is available to registered users on FOSSweb.

These are offered as samples, and should be customized to meet the needs of your students. As you become proficient facilitating sense-making discussions, you can use the template to create new planning guides for other discussions. A blank template of the Sense-Making Discussion Planning Guide can also be downloaded from FOSSweb.

TEACHING NOTE

Refer to the Sense-Making Discussions for Three-Dimensional Learning chapter in Teacher Resources on FOSSweb for more information about how to facilitate this with students.
### Module: Water and Climate

**Investigation 1:** Water Observations, Part 1: Drops of Water

**Guiding question:** How does water interact with other materials?

**Focus question:** What happens when water falls on different surfaces?

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<td>The roles of water in Earth’s surface processes (ESS2.C)</td>
<td>Develop models to describe phenomena.</td>
<td>Patterns</td>
</tr>
</tbody>
</table>

### Questions and Intended Responses

**Step 11: Have a sense-making discussion**

<table>
<thead>
<tr>
<th>What to ask</th>
<th>What happens to the water when dropped on different surfaces? (Analyzing and interpreting data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Does water do the same thing on all surfaces? (Analyzing and interpreting data; patterns)</td>
</tr>
<tr>
<td></td>
<td>What do the waterproof surfaces have in common? (Analyzing and interpreting data; patterns)</td>
</tr>
<tr>
<td></td>
<td>What happens to the water when it is absorbed by a material? (Developing and using models)</td>
</tr>
<tr>
<td></td>
<td>What happens to the water when it beads up on a surface? (Developing and using models)</td>
</tr>
<tr>
<td></td>
<td>What makes water bead up on some surfaces and be absorbed on others? (Developing and using models, Constructing explanations; patterns)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What to listen for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water beads up on wax paper, aluminum foil, and paper (initially).</td>
</tr>
<tr>
<td>Water is absorbed by the paper towel and paper (over time).</td>
</tr>
<tr>
<td>Water spreads out into the material when it is absorbed.</td>
</tr>
<tr>
<td>Waterproof surfaces are smooth and don't have space for the water to soak into them.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scaffolding questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the properties of wax paper? What are the properties of the paper towel?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application questions</th>
</tr>
</thead>
</table>
| What would happen if we placed a drop of water on <other surface>?
| What 'rule' are you using to make these predictions?
| What does this investigation tell you about how water interacts with other materials? |
## Module
Water and Climate

### Investigation 3: Weather and Water, Part 3: Surface Area

**Guiding question:** Steam seems to come and go on windows and bathroom mirrors. How does that happen and what does it have to do with weather?

**Focus question:** How does surface area affect evaporation?

### NEXT GENERATION SCIENCE STANDARDS

<table>
<thead>
<tr>
<th>Focus DCI(s)</th>
<th>Focus SEP(s)</th>
<th>Focus CCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather and climate (ESS2.D)</td>
<td>Analyze and interpret data to make sense of phenomena using logical reasoning. Use evidence to construct or support an explanation.</td>
<td>Cause and effect</td>
</tr>
</tbody>
</table>

### Questions and Intended Responses

**Step 7:** Have a sense-making discussion

**What to ask**

- Which container had the most evaporation? Which one had the least? *(Analyzing and interpreting data)*
- Which container has the largest surface area? Which one has the smallest? *(Analyzing and interpreting data)*
- As the surface area increases, what is the effect on the evaporation? *(Constructing explanation; cause and effect)*
- What evidence do you have? *(Constructing explanation)*
- What is causing the evaporation to increase as the surface area increases? *(Constructing explanation; cause and effect)*

**What to listen for**

- The flat lid had the most evaporation and the largest surface area. The graduated cylinder has the least.
- As the surface area increases, the evaporation also increases.
- Specific data of water evaporated is used as evidence.
- The larger the surface area, the more water is exposed to air (and is heated at one time). This increases the amount of water that can go into the air (advanced).

**Scaffolding questions**

- When the container has a large amount of water left inside, what does that tell us about the evaporation?
- When the container has a small amount of water left inside, what does that tell us about the evaporation?
- Air is important to evaporation. In which container is the air touching the water the most? The least?

**Application questions**

- If we wanted to dry a wet shirt quickly, what could we do?
- Why might it be important to know about evaporation?
- What are ways we could reduce evaporation?
- How does evaporation affect places near you?
SENSE-MAKING DISCUSSION PLANNING GUIDE

Module: Water and Climate

Investigation 3: Weather and Water, Part 5: Condensation

Guiding question: Steam seems to come and go on windows and bathroom mirrors. How does that happen and what does it have to do with weather?

Focus question: What causes moisture to form on the side of a cup?

NEXT GENERATION SCIENCE STANDARDS

<table>
<thead>
<tr>
<th>Focus DCI(s)</th>
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<th>Focus CCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather and climate (ESS2.D)</td>
<td>Develop models to describe phenomena and predict phenomena. Construct an argument with evidence, data, and/or a model.</td>
<td>Cause and effect Scale, proportion, and quantity</td>
</tr>
</tbody>
</table>

Questions and Intended Responses

Step 21: Have a sense-making discussion

What to ask

- After water evaporates from a body of water, where does the water go? (Developing and using models; cause and effect)
- When the water vapor in the air cools, what is the effect? (Developing and using models; cause and effect)
- What are clouds and fog? (Developing and using models)
- How does water in clouds get back to Earth? (Developing and using models; cause and effect)
- (After modeling particles in condensation) How does your model show what happens to the water particle? What is different in your drawing than in real life? (Developing models, Constructing explanations; Scale, proportion, and quantity)

Use the argumentation strategy in the Investigations Guide in Step 21 after this discussion.

What to listen for

- The liquid water becomes water vapor when evaporated (the water goes into the air).
- The water vapor condenses on dust particles in the air.
- Clouds and fog are made of liquid water or condensed water vapor.
- Water falls back to Earth as precipitation.
- In real life, water vapor isn't visible. Water particles are much smaller.

Scaffolding questions

- How do you show a water particle if you can't see it?
- How does the size of your model compare to the size of a water particle?
- How can you show cause and effect in your model?

Application questions

- How does the condensation chamber model the water cycle?
- How is the condensation chamber different than real life?
- What does evaporation and condensation have to do with weather?
- Where can we see part of the water cycle around us?
# Sense-Making Discussion Planning Guide

**Module:** Motion and Matter

**Investigation 1: Forces, Part 2: Magnetic-Force Investigation**

**Guiding question:** How can some objects push or pull one another without touching?

**Focus question:** How is the magnetic field affected when more magnets are added?

## NEXT GENERATION SCIENCE STANDARDS

<table>
<thead>
<tr>
<th>Focus DCI(s)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Forces and motion (PS2.A) Types of interactions (PS2.B)</td>
<td>Develop models to describe and predict phenomena. Analyze and interpreting data to make sense of phenomena. Use evidence to construct or support an explanation.</td>
<td>Patterns Cause and effect</td>
</tr>
</tbody>
</table>

## Questions and Intended Responses

### Step 8: Have a sense-making discussion

**What to ask**

- What pattern do you notice about the distance the paper clip is being attracted (or the snap distance)? (Analyzing and interpreting data; patterns)
- What is the effect on the snap distance when more magnets are added? (Analyzing and interpreting data; cause and effect)
- What causes the paper clip to move toward the magnet? (Analyzing and interpreting data; cause and effect)
- What is causing the snap distance to increase as more magnets are added? (Analyzing and interpreting data; cause and effect)
- Explain the effect on the magnetic field when more magnets are added. (Developing models, Constructing explanations; cause and effect)
- What evidence do you have? (Constructing explanations)

**What to listen for**

- The snap distance increases as the number of magnets increases.
- The paper clip moves because it is in the magnetic field of the magnet. When it is in the magnetic field, the paper clip is attracted to the magnet.
- The forces are unbalanced when the paper clip enters the magnetic field of the paper clip (more advanced)
- The size (or strength) of the magnetic field increases when more magnets are added.

**Scaffolding questions**

- When the number of magnets is low, what is the snap distance?
- When the number of magnets is large, what is the snap distance?
- If the snap distance increases, what has to be increasing for the paper clip to move?

**Application questions**

- If we continued to add more magnets, what would be the effect on the snap distance?
- Some magnets are much stronger than others. How does a magnet’s strength affect the snap distance?
- Why might it be important to know the snap distance?
- How can some objects push and pull one another without touching?
### SENSE-MAKING DISCUSSION PLANNING GUIDE

**Module:** Motion and Matter  
**Investigation 3:** Engineering, Part 3: Investigating Start Position  
**Guiding question:** How can we use observed patterns of motion to design solutions to engineering problems?  
**Focus question:** How does start position on a ramp affect how far a cart rolls?

### NEXT GENERATION SCIENCE STANDARDS

<table>
<thead>
<tr>
<th>Focus DCI(s)</th>
<th>Focus SEP(s)</th>
<th>Focus CCs</th>
</tr>
</thead>
</table>
| Forces and motion (PS2.A) | **Analyze and interpret data** to make sense of phenomena using logical reasoning. **Use evidence** to construct or support an explanation. | Patterns  
Cause and effect |

### Questions and Intended Responses

**Step 11:** Have a sense-making discussion

**What to ask**

- What pattern do you notice about the distance the cart travels when the starting position increases? *(Analyzing and interpreting data; patterns)*
- What is the effect on the distance when the starting position increases? *(Analyzing and interpreting data; cause and effect)*
- What causes the cart to move down the ramp? *(Analyzing and interpreting data; cause and effect)*
- What is causing the distance to increase as the starting position increases? *(Constructing explanations; cause and effect)*
- When we moved the chair in the first investigation, we could make the cart move farther by giving it a strong push or by pushing it for longer. What is pushing or pulling on the cart? How does that change when the starting position increases? *(Developing models, Constructing explanations; cause and effect)*
- What evidence do you have? *(Constructing explanations)*

**What to listen for**

- The distance increases as the starting position increases.
- The cart moves because the forces on the cart are unbalanced.
- From 24 cm, the cart traveled <student data>, from 8 cm, the cart traveled <student data>.
- The forces are unbalanced for a longer time when the starting position is higher OR gravity pulls on the cart at the highest starting position for a longer time than the lower cart. (more advanced)

**Scaffolding questions**

- When the starting position of the cart is low (8 cm), how far does the cart travel?  
- When the starting position of the cart is high (24 cm), how far did the cart travel?

**Application questions**

- If we continued to increase the starting position, what would be the effect on the distance the cart travels?  
- Where would you need to start on a hill if you wanted to travel a short distance?  
- Would we notice a similar pattern if we roll a ball instead of a cart?
### SENSE-MAKING DISCUSSION PLANNING GUIDE

#### Module
- **Structures of Life**

#### Investigation 2: Growing Further, Part 1: Germination and Growth

**Guiding question:** How do plants grow and survive?

**Focus question:** What structures does a seedling have to help it grow and survive?

#### NEXT GENERATION SCIENCE STANDARDS

<table>
<thead>
<tr>
<th>Focus DCI(s)</th>
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<th>Focus CCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure and function (LS1.A)</td>
<td>Analyze and interpret data</td>
<td>Structure and function</td>
</tr>
<tr>
<td></td>
<td>to make sense of phenomena using logical reasoning</td>
<td>Patterns</td>
</tr>
<tr>
<td></td>
<td>Use evidence to construct or support an explanation</td>
<td>Cause and effect</td>
</tr>
</tbody>
</table>

#### Questions and Intended Responses

**Step 7:** Have a sense-making discussion

**What to ask**
- What caused the seed to begin to grow, or germinate?  *(Analyzing and interpreting data; Cause and effect)*
- What do you notice about the <structure of seedling>?
- What does the <structure of seedling> do, or what is the function of <structure of seedling> for the plant?  *(Analyzing and interpreting data; structure and function)*
- Do all of the seedlings have the same structures?  How do the cotyledons differ?  *(Analyzing and interpreting data; structure and function, patterns)*
- Does the seed coat always come off?  *(Analyzing and interpreting data; patterns)*
- Why do the roots usually grow before the leaves?  *(Constructing explanations; structure and function)*
- How do these structures work together to help the plant grow?  *(Constructing explanations; structure and function)*

**What to listen for**
- Water causes germination.
- The seed coat provides protection for the seeds.
- The roots get water (and nutrients).  The roots hold the plant in place, typically.
- The stem supports the plant.
- The cotyledons provide food until the leaves are made.
- The leaves make food for the plant.
- Summary statement of how the structures meet the basic needs.

**Scaffolding questions**
- How does a seedling get food if there are not any leaves?
- When the cotyledons are used up, what structure provides food?

**Application questions**
- Why does the seed coat come off early?
- If we were to look at the seedlings of other types of plants, would we find similar structures?
- What does this tell us about how plants grow and survive?
SENSE-MAKING DISCUSSION PLANNING GUIDE

Module | Structures of Life
---|---
Investigation 3: Meet the Crayfish, Part 5: Food Chains
Guiding question: What are characteristics that allow populations of animals to survive and reproduce in an environment?
Focus question: What is needed to sustain a food chain?

NEXT GENERATION SCIENCE STANDARDS

<table>
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<tbody>
<tr>
<td>Ecosystem dynamics, functioning, and resilience (LS2.C) Social interactions and group behavior (LS2.D)</td>
<td>Develop models to describe phenomena. Analyze and interpret data to make sense of phenomena using logical reasoning. Use evidence to construct or support an explanation.</td>
<td>Stability and change System and system models</td>
</tr>
</tbody>
</table>

Questions and Intended Responses

Step 14: Have a sense-making discussion

What to ask

- What was the population sizes of grasshoppers, frogs, and hawks produced a sustainable food chain? *(Analyzing and interpreting data; Stability and change)*
- What other things helped sustain this food chain? *(Analyzing and interpreting data; systems and system models)*
- What might happen if there were only half as many popcorn plants? No plants? Would that change happen quickly? *(Developing and using models; systems and system models; stability and change)*
- If the pond dried up and there were no frogs, what might happen to the plant population? The grasshopper population? The hawk population? *(Developing and using models; systems and system models, stability and change)*
- In real life, do you think one hawk, two frogs, and two grasshoppers is a sustainable food chain? Why or why not? *(Developing and using models; systems and system models)*
- The food chain activity is a model that we can use to help us study food chains in nature, how is the model similar and different than real life? *(Developing and using models)*
- What general rule describes how to sustain a food chain and keep the system stable? *(Constructing explanations; systems and system models, stability and change)*

What to listen for

- More grasshoppers than frogs, more frogs than hawks, only one or two hawks.
- Safety zones, timed releases, and a lot of plants helped sustain the food chain
- There would be nothing for the grasshoppers to eat if the plants were gone (or reduced) and therefore nothing for the frogs to eat.
- With no frogs, the grasshopper population might get large and eat all the plants. The hawks would have to find something else to eat.
- In nature, populations need to be larger. Hawks need to have a mate to reproduce.
- In nature, there would be more types of animals and plants in the food chain.
- There must be many more plants than organisms that eat plants. Along the food chain, the population size of the organisms that are doing the eating must be smaller than the population size of the organisms getting eaten.

Scaffolding questions

- How does the number of grasshopper compare to the number of frogs?
- How does the number of hawks compare to the number of frogs?
- What was the effect when the hawks ate too quickly?

Application questions

- If we think back to the food chain with elodea, crayfish, raccoons, and coyotes, how many coyotes do you think it would take to sustain that food chain?
- How does this model help us understand how organisms interact with their environments?
- Why is a sustainable food chain important for organisms’ survival?