INTRODUCTION—GRADE 1

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 investigations to determine what air can do using a plastic bag, balloon, straw, paper, feather, cotton ball, and plastic-foam ball. Students make observations and draw them in their notebook. Students bring their notebooks to the discussion area and stand shoulder to shoulder next to someone from another group. The teacher asks what they observed about what air can do and students turn and talk with a partner while another pair of students add their observations to the class notebook. A few students share that when you blow through the straw you can make the feather move. 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 report other observations. A few students share that they blew up the balloon and could push the plastic-foam ball across their table, but the cotton ball didn’t go as far. Students also share they can ‘catch’ air inside the plastic bag. 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 first-grade 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 eleven samples of model sense-making planning guides for grade 1 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 (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCs) 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), the Background for the Teacher, and the Teaching Children about... section 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.

   **INVESTIGATION 1 — Exploring Air**

   **BACKGROUND for the Teacher**

   The anchor phenomenon for this module are air that surrounds us and the natural objects that we see in the sky. The driving question for the module is what is air all around us and what do we observe in the sky above us?

   As described in the Framework chapter, there are three conceptual frameworks for the disciplinary core ideas in the Air and Weather Module for grade 1—two with a focus on earth science and one on engineering design. As curriculum developers, we felt that focusing only on Earth in the universe is limiting for grade 1 students in that it doesn’t provide an age-appropriate context for students to have opportunities for engaging in science and engineering practices. To provide experiences that related to the interests of the students and were more teachable and learnable, we integrated the dynamic atmosphere framework. The core ideas in this framework extend from kinesthetic and provide foundational experiences for grade 2.

   In Investigation 1, students investigate air’s role in several everyday phenomena. The guiding question is where is air and what can it do? “It’s easy—there’s nothing in it.” That is the predictable first response from students when they are asked an “empty” bottle, glass, or plastic bag. This investigation is designed to help them understand that, unlike its go to considerable lengths, there is always something everywhere. In many cases, that something is air. Air is a form of matter called gas.

   **What Can Air Do?**

   Air is difficult to pin down in order to verify its existence. It is, for all intents and purposes, invisible and has no taste or odor. Air can only be overlooked. But you can observe air interacting with objects. Air can move from place to place (shown through a straw or tube), it can make light objects move (a piece of paper, a cotton ball, or feather), and you can feel it when it hits your skin. Moving air is wind.

   The best way to find out about air is to capture some in an upright container and conduct some investigations. If the container is flexible, like a plastic bag or rubber balloon, you can feel the air inside. If you try to push the sides of the bag together, the air inside will prevent you from doing so. If you puncture and apply enough force, the air inside will push out on the sides of the bag until the plastic ruptures, allowing the air inside to escape. Similarly, the rubber balloon, which is more flexible,

   **Steps for planning and preparing for sense-making discussions**

   1. Review the Investigations Guide
   2. Identify when and why to have the discussion
   3. Plan what to ask and what to listen for
   4. Plan for adjustments
   5. Consider language and vocabulary
   6. Use a class notebook
The Teaching Children about . . . section provides information about the SEPs, CCs, and DCIs emphasized in the investigation.

Teaching Children about Properties of Air

Exposing Crosscutting Concepts (CC)

The third dimension of instruction involves the crosscutting concepts, sometimes referred to as unifying principles, theories, or big ideas, that are fundamental to the understanding of science and engineering. These concepts should become common and familiar touchstones across the discipline and grade levels. Explicit reference to the concepts, as well as their relevance to multiple disciplinary contexts, can help students develop a connected, coherent, and usable understanding of science and engineering. [NRC Framework page 63]

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

- **Cause and effect**: Air can interact with things to make them move or to slow them down (air resistance).
- **Systems and system models**: Many different systems use air as one of their parts: air works with the solid and liquid parts to cause change (pneumatics, balloon rockets, syringe-tube systems).
- **Structure and function**: A parachute has designed properties that makes it useful for certain functions.

Developing Disciplinary Core Ideas (DCI)

Primary students know some basics about air. They know that they breathe it, that it is in balloons and bubbles. When pressed to think about it, they will report that air is all around and that wind is air in motion. Still primary students have difficulty understanding that air is invisible. Their position often is that, if you can’t see, feel, hear, smell, or taste it, it is not real. Primary students who depend on firsthand personal experience will question the assertion that air is invisible.

A gas is a gas is not important in early instruction. It should be introduced to matter in the commonplace. In this investigation, students manipulate and observe gasses directly and infer air, compress air, and move air they do not get to contribute to the idea of a gas as a real thing, students have experiences with in which they develop their knowledge of gases.

In this investigation that is gases can be smaller than they would normally have been perceived. Only gases can be used to suggest telling students this fact. The gas through this investigation will contribute to the air as a scientific studies. This will be an opportunity to think about the world in which it is a place.

The designing of the design solution

- **Cause and effect**: Events have causes that generate observable patterns; simple tests can be designed to gather evidence to support or refute student ideas about causes.
- **Systems and system models**: Systems in the natural and designed worlds have parts that work together.
- **Structure and function**: The shape and stability of structures of natural and designed objects are related to their functions.
Planning and Preparing for Sense-Making Discussions

INVESTIGATION 1 — Exploring Air

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In Investigation 1, students investigate air’s role in several everyday phenomena. The guiding question is where is air and what can it do?

“What can Air do?”

Air is difficult to pin down in order to verify its existence. It is, first of all, invisible, so you can’t look around to see where it is. Air is not very dense so it is difficult to feel. Add to this, it does not make any noise by itself and has no taste or odor. Air can easily be overlooked. But you can observe air interacting with objects. Air can move from place to place (blow through a straw or tube), it can make light objects move (a piece of paper, a cotton ball, a feather, a leaf), and you can feel it when it hits your skin. Moving air is wind.

The best way to find out about air is to capture some in an air tight container and conduct some investigations. If the container is flexible, like a plastic bag or rubber balloon, you can use the air inside. If you try to press the sides of the bag together, the air inside will prevent you from doing so. If you press and apply enough force, the air inside will push out on the sides of the bag until the plastic ruptures, allowing the air inside to escape. Similarly, the rubber balloon, which is more flexible than the plastic bag, will force itself open if you try to do the same to it.

Teaching Children about Properties of Air

Conceptual Flow

The anchor phenomena for this module are air that surrounds us and the natural objects that we see in the sky. The driving question for the module is what is all around us and what do we observe in the sky above us?

In Investigation 1, students investigate air. The guiding question is where is air and what can it do?

In Investigation 2, students look at the atmosphere. The concept of air’s role in the atmosphere is introduced. Air’s role in the atmosphere is introduced. Air’s role in the atmosphere is introduced. Air’s role in the atmosphere is introduced. Air’s role in the atmosphere is introduced.

Air and Weather Module—FOSS Next Generation 87
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. In some instances, students are making observations to answer the focus question. These discussions can follow a similar format as described here. For first graders, plan about 6–8 minutes for the sense-making discussion.

To illustrate this process we will use an example from the *Air and Weather Module*, Investigation 1, Air Is There. 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 (DCIs).

NOTE
It is important that a sense-making discussion occurs after data acquisition but before students are asked to answer the focus question. The discussion will prepare the students to answer the focus question.
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, “How are all leaves the same?” or “What is the effect of using a bigger parachute?” Some of these questions might be found in the Background for the Teacher and the Teaching Children about section. 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 that part 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 did you observe with the objects and air?
- What could you use the balloon to do?
- What happened when you dropped the feather?

What to listen for

- Air can move objects like the feather when you blow through the straw or let the air go from the balloon.
- Air makes the balloon bigger.
- Air takes up space in the balloon and the bag.
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, “How could we make the air come out of the balloon slower?” or “Jenny said the vibrations traveled from the string to the cup. What do you think will happened to the sound if we used a bigger 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 students’ claims. 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 Concept chapters. The next-step strategies found in the Assessment and Science Notebooks chapters can also be incorporated into sense-making discussions when appropriate.
### SENSE-MAKING DISCUSSION PLANNING GUIDE

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**Guiding question:** What is air and what can it do?

**Focus question:** What can air do?

### NEXT GENERATION SCIENCE STANDARDS

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### Questions and What to Listen For

**Step 9:** Have a sense-making discussion

**What to ask**

- What did you observe with the objects and air? (Analyzing and interpreting data, constructing explanations; cause and effect)
- What could you use the balloon to do? (Analyzing and interpreting data, constructing explanations; cause and effect)
- What happened when you dropped the feather? (Analyzing and interpreting data, constructing explanations; cause and effect)
- How do you know if air is in the balloon or the bag? (Analyzing and interpreting data, constructing explanations; cause and effect)
- What can air do? (Analyzing and interpreting data, constructing explanations; cause and effect)

**What to listen for**

- Air can move objects like the feather when you blow through the straw or let the air go from the balloon.
- Air makes the balloon bigger.
- Air takes up space in the balloon and the bag.
- You can feel the air move.

**Scaffolding questions**

- What did you do with the balloon? The feather?
- How could you feel the air?

**Application questions**

- You moved the feather across your desk by blowing on it. Could you do the same thing with your pencil?
- How is the air coming out of the balloon different than the air coming out of the bag? How could you make the air come out of the balloon slower?
**TEACHING NOTE**

While not a specific talk move, consider how to appropriately interject when a student’s response begins to veer off the topic.

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**REFERENCE**

For more on talk moves, refer to *Talk Science Primer,* by Sarah Michaels and Cathy O’Connor (Cambridge, MA: TERC, 2012).

Available online at [https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf](https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf)

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**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. Plan to use partner talk often as many younger students like to share and it encourages everyone to do the talking.

- 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.

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 frame such as “What I hear you saying is ______,” when a student is responding to other students. For younger students at the beginning of the year, consider having all students work on one sentence frame for a few lessons before introducing a second frame. 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 K–2 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.

**Sentence frames.** These samples can be posted as a scaffold as students learn and practice their reasoning and participation skills.

- I observed ______.
- I think ______, because ______.
- I agree with ______ because ______.
- <Name> shared _____ with me.
- Why do you think ____?
- Would it matter if ____?
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 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, a rich sense-making discussion will go a long way to improve 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 distractions 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 for. 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,” or “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

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**Questions and What to Listen For**

**Step 9: Have a sense-making discussion**

**What to ask**
- What did you observe with the objects and air? (Analyzing and interpreting data, constructing explanations; cause and effect)
- What could you use the balloon to do? (Analyzing and interpreting data, constructing explanations; cause and effect)
- What happened when you dropped the feather? (Analyzing and interpreting data, constructing explanations; cause and effect)
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**What to listen for**
- Air can move objects like the feather when you blow through the straw or let the air go from the balloon.
- Air makes the balloon bigger.
- Air takes up space in the balloon and the bag.
- You can feel the air move.

**Scaffolding questions**
- What did you do with the balloon? The feather?
- How could you feel the air?

**Application questions**
- You moved the feather across your desk by blowing on it. Could you do the same thing with your pencil?
- How is the air coming out of the balloon different than the air coming out of the bag? How could you make the air come out of the balloon slower?
Decision Map—This is for an introductory sense-making discussion.

Sense-Making Discussions for Three-Dimensional Learning—Grade 1
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, 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

On the next eleven pages are samples of sense-making discussion planning guides from the three grade 1 FOSS Next Generation Modules—Air and Weather, Sound and Light, and Plants and Animals. 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 copyright 2018 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.
### Sense-Making Discussions for Three-Dimensional Learning

#### Module
Air and Weather

#### Investigation 1: Exploring Air, Part 1: Air is There

**Guiding question:** What is air and what can it do?

**Focus question:** What can air do?

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**Application questions**
- You moved the feather across your desk by blowing on it. Could you do the same thing with your pencil?
- How is the air coming out of the balloon different than the air coming out of the bag? How could you make the air come out of the balloon slower?
**SENSE-MAKING DISCUSSION PLANNING GUIDE**

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<td><strong>Guiding question:</strong> What is air and what can it do?</td>
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**NEXT GENERATION SCIENCE STANDARDS**

| Properties and structures of matter (PS1.A) | Analyzing and interpreting data by using observations to describe patterns. **Constructing explanations** by making observations to construct an evidence-based account for natural phenomena. | Cause and effect, structure and function |

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

### What to ask

- *What happened when you flew your parachute?* (Analyzing and interpreting data, constructing explanations; cause and effect)
- *What made the parachute float slowly?* (Analyzing and interpreting data, constructing explanations; cause and effect)
- *Where is the air?* (Analyzing and interpreting data, constructing explanations; cause and effect)

After introducing air resistance

- *What do you think would happen if we used a really big napkin?* (Analyzing and interpreting data, constructing explanations; cause and effect, structure and function)

### What to listen for

- The parachute fell or floated to the ground.
- Air made the parachute fall slowly.
- Air is all around.
- Air is trapped underneath the parachute.

### Scaffolding questions

- *What is getting in the way of the parachute falling straight down?*
- *How do we know air is under the parachute?*

### Application questions

- *What do you think would happen if we used a heavy piece of construction paper instead of a napkin?*
- *Did you notice a difference between flying one and two passengers? What was the difference?*
### Sense-Making Discussions for Three-Dimensional Learning

#### Module
**Air and Weather**

#### Investigation 2: Observing the Sky, Part 4: Observing the Moon

**Guiding question:** When you look up at the sky, what do you see, and how does it change?

**Focus question:** What time of day can we observe the Moon?

### Next Generation Science Standards

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### Questions and What to Listen For

**Step 14:** Have a sense-making discussion

**What to ask**

- Do objects in the sky, such as the Sun, Moon, and stars always stay in one place? (Analyzing and interpreting data)
- When can you see the Sun? The Moon? The stars? (Analyzing and interpreting data)
- What do you see on a clear night? What observations have you made about stars? (Analyzing and interpreting data)
- What have you observed about the shape of the Moon? (Analyzing and interpreting data; stability and change)
- Does the Moon appear to be getting bigger or smaller? (Analyzing and interpreting data; stability and change)
- Based on the pattern you observed, how do you think the Moon will look tomorrow? (Analyzing and interpreting data, constructing explanations; patterns)

**What to listen for**

- The objects in the sky move.
- You can see the Sun during the day, other stars only at night. You can see the Moon during the day sometimes and sometimes at night.
- On a clear night, you can see stars and sometimes the Moon. There are lots of stars and they look very small. Some are brighter than others.
- The Moon changes a little bit each day. The Moon looks bigger each day (so far).

**Scaffolding questions**

- How has the shape of the Moon changed in the last few days?
- Do you think that pattern will continue?

**Application questions**

- What do you think the Moon will look like in a week?
- Someone told me that you can only see the Moon at night, do you agree with that? Why or why not?
SENSE-MAKING DISCUSSION PLANNING GUIDE

Module: Air and Weather

Investigation 4: Looking for Change, Part 1: Change over a Month

Guiding question: How do daylight and weather change though the seasons?

Focus question: What does the Moon look like at different times during a month?

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<td>Patterns</td>
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Questions and What to Listen For

Step 10: Have a sense-making discussion

What to ask

➤ What have you observed about the shape of the Moon? (Analyzing and interpreting data)
➤ Does the Moon appear to be getting bigger or smaller? (Analyzing and interpreting data; patterns)
➤ Can you predict what the Moon will look like tomorrow? (Analyzing and interpreting data; patterns)
➤ How long did it take for the Moon to get back to the shape that we observed on the very first day? (Analyzing and interpreting data; patterns)
➤ How does the Moon change over a single day? (Analyzing and interpreting data, constructing explanations; patterns)
➤ What does the Moon look like at different times during a month? (Analyzing and interpreting data, constructing explanations; patterns)

What to listen for

• The Moon changes a little bit each day.
• The Moon is getting smaller.
• The Moon shape takes about a month to return to the starting shape.
• The Moon rises in the east and sets in the west.
• Depending on when you start observing the Moon, the Moon gets smaller until you can’t see it then it gets bigger until you can see all of it.

Scaffolding questions

➤ How has the shape of the Moon changed in the last few days?
➤ Do you think that pattern will continue?

Application questions

➤ What do you think the Moon will look like in a week?
➤ What do you think the pattern would be if we continued to watch it for another month?
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### Questions and What to Listen For

**Step 13: Have a sense-making discussion**

**What to ask**

- What have you observed about sound and vibration? (Analyzing and interpreting data)
- What has to happen for sound to be made? (Analyzing and interpreting data; cause and effect)
- How do you know if an object is vibrating? (Analyzing and interpreting data; cause and effect)
- How can you stop sound? (Analyzing and interpreting data; cause and effect)
- What causes sound? (Analyzing and interpreting data, constructing explanations; cause and effect)

**What to listen for**

- Vibration is a kind of back-and-forth motion.
- Objects that vibrate make sound. Sound is made when an object vibrates.
- If you stop the object from vibrating, you stop the sound.
- Sound is caused by vibration.

**Scaffolding questions**

- What did you see when you plucked the rubber band? What did you hear?
- What happened when you put your hand on the vibrating rubber band?

**Application questions**

- What is the same about the vibrating rubber band and the vibrating stick? What is different?
- What would happen if you plucked the rubber band very hard? Very gently?
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<td>Cause and effect, systems and system models</td>
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**Questions and What to Listen For**

**Step 10:** Have a sense-making discussion

**What to ask**

- Where do the vibrations start in our spoon-gong system? (Constructing explanations; cause and effect, system and system models)
- Do the vibrations travel through the string? How do you know? (Constructing explanations; cause and effect, system and system models)
- How can we show the string vibrating in our model? (Developing and using models; system and system models)
- We are showing the string is vibrating, but the string isn’t attached to our ear. How do the vibrations travel to our ear? (Constructing explanations, developing and using models; cause and effect, system and system models)
- How does sound travel from the source to the receiver? (Constructing explanations, developing and using models; cause and effect, system and system models)

**What to listen for**

- The vibration starts when we hit the spoon. The spoon starts to vibrate.
- The vibrations travel from the spoon to the string. When we put our fingers on the string the sound stopped. So the string must be vibrating even if we can’t see it.
- The vibration goes from the string to the cup and then to our ear.
- Sound travels from the source to the receiver by vibrations.

**Scaffolding questions**

- What is the sound source in our system? What causes that to vibrate?
- What is the sound receiver in our system?

**Application questions**

- What would happen to the sound if we hit the spoon harder?
- When group 2 hit their spoon, I could hear it but I didn’t have a string and a cup. Why do you think I could hear their spoon?
**Sense-Making Discussions for Three-Dimensional Learning**

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**Questions and What to Listen For**

**Step 17:** Have a sense-making discussion

**What to ask**

➤ On what types of objects can you see reflections? (Analyzing and interpreting data)
➤ What do the surfaces of these objects have in common? (Constructing explanations; patterns)
➤ Why do reflections from a spoon look different? (Constructing explanations; cause and effect)
➤ How is a shadow different from a reflection? (Constructing explanations; cause and effect)

**What to listen for**

• You can see reflections on mirrors, windows, and water.
• Reflective surfaces are shiny and smooth.
• Reflections on a spoon are different because the spoon is curved.
• Reflections and shadows are both an image of an object. A reflection is from a shiny surface and you can see the colors and details of the object. A shadow happens when light is blocked and the image is darker with no colors.

**Scaffolding questions**

➤ How do you know if you are seeing a reflection or a shadow?
➤ What does the reflection of a hand look like? What does the shadow of a hand look like?

**Application questions**

➤ What can you see with a mirror that you can’t see otherwise?
➤ How does light travel and change direction?
SENSE-MAKING DISCUSSION PLANNING GUIDE

Module | Plants and Animals

Investigation 1: Grass and Grain Seeds, Part 3: Wheat
Guiding question: What are the structures of a young plant growing from a seed?
Focus question: How does a wheat seed grow?

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Questions and What to Listen For

Step 17: Have a sense-making discussion

What to ask

After asking discussion questions in Step 16

➤ What does the root do? (Analyzing and interpreting data; structure and function)
➤ Why does the root need to grow first? (Constructing explanations; structure and function, cause and effect)
➤ What evidence supports the claim “A seed is alive”? (Constructing explanations; patterns)
➤ What evidence supports the claim “Plants have basic needs”? (Constructing explanations; structure and function)
➤ How does a wheat seed grow? (Constructing explanations; structure and function)

What to listen for

• The root brings in water and nutrients.
• The root needs to bring in water so the plant can grow.
• Seeds are alive because they grow into plants.
• Plants need water, air, light, and space.
• A labeled drawing of a growing wheat seed with a description of the roots and leaves growing.

Scaffolding questions

➤ How do you know something is alive?
➤ What did we have to give the wheat seed for it to grow?

Application questions

➤ What would happen to the plant if there were no roots?
➤ Do you think other plants have the same needs?
# Sense-Making Discussions for Three-Dimensional Learning

## SENSE-MAKING DISCUSSION PLANNING GUIDE

**Module**  
Plants and Animals

**Investigation 1:** Grass and Grain Seeds, **Part 4:** Variation in Plants and Animals

**Guiding question:** What are the structures of a young plant growing from a seed?

**Focus question:** How many different kinds of plants live in an area of the schoolyard?

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## Questions and What to Listen For

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

### What to ask

- **What observations do you have about the leaf and plant collection?** *(Analyzing and interpreting data)*
- **What are the similarities and differences in the leaf shapes?** *(Analyzing and interpreting data; patterns)*
- **Do you think the leaves are from a young plant or adult plant? How might they be different?** *(Constructing explanations; patterns)*
- **How many different kinds of plants live in an area of the schoolyard?** *(Analyzing and interpreting data, constructing explanations; patterns)*

### What to listen for

- Observations about the leaf and plant collection are shared.
- Similarity and differences about the leaves and plants are shared.
- Leaves from a young plant might be smaller, but the general shape would be the same.

### Scaffolding questions

- **How do you know if two leaves are from the same plant?**
- **What is the same and different about the size of the leaves? The color? The texture?**

### Application questions

- **Do you think you would find different leaves or the same kinds of leaves if you studied the plants around your home or in a nearby park?**
- **What might happen to the insects, birds, and other animals in an area if there was only one type of plant in that area?**
# SENSE-MAKING DISCUSSION PLANNING GUIDE

**Module** | Plants and Animals  
--- | ---  
**Investigation 2: Stems, Part 1:** Rooting Stem Cuttings  
**Guiding question:** Where can new plants come from besides seeds?  
**Focus question:** How can we make a new plant from an old one?  

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## Questions and What to Listen For

### Step 17: Have a sense-making discussion

**What to ask**

- Did all of the cuttings develop roots? Why do you think that happened? (Analyzing and interpreting data; structure and function, cause and effect)
- What do the roots look like? (Analyzing and interpreting data; structure and function)
- How do roots help the cutting grow? (Constructing explanations; structure and function)
- Are any new leaves forming? Where do they form? (Analyzing and interpreting data; structure and function)
- How can we make a new plant from an old one? (Constructing explanations; structure and function, cause and effect)

**What to listen for**

- Cuttings will grow roots if their nodes are underwater and when they have leaves.
- The roots look like hairs (or similar description).
- Roots take in water for the plant.
- Leaves form above the roots and out of the water on the stems.

**Scaffolding questions**

- How are the leaves helping the cuttings grow?
- What is different about the cuttings that started to grow and the ones that didn’t?

**Application questions**

- What are other ways new plants form?
- If we were to plant new cuttings from our new plants, what do you think will happen?
## Sense-Making Discussions for Three-Dimensional Learning

### Module: Plants and Animals

**Investigation 4:** Growth and Change, Part 3: Plant and Animal Growth  
**Guiding question:** What do offspring get from their parents that help young survive?  
**Focus question:** What do animal parents do to help their young survive?

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### Questions and What to Listen For

**Step 16:** Have a sense-making discussion

**What to ask**
- How do parents care for their offspring? (Obtaining, evaluating, and communicating information; patterns)
- How do parents keep their young warm? (Obtaining, evaluating, and communicating information; patterns)
- Tell how parents provide food for their offspring? (Obtaining, evaluating, and communicating information; patterns)
- What do young animals do if there is danger? (Obtaining, evaluating, and communicating information; patterns)
- What do animal parents do to help their young survive? (Obtaining, evaluating, and communicating information; patterns)

**What to listen for**
- Parents feed and clean offspring, protect them from predators, and keep them warm.
- Some parents hold their offspring next to their bodies; birds keep small birds under their feathers by sitting on them.
- Birds carry food to the offspring in the nest; camels and other animals provide mother’s milk.
- Young animals might hide or run away. They might run to be near their parents.

**Scaffolding questions**
- How do humans care for their offspring? How is that the same and different for other animals?

**Application questions**
- What other animals do you want to know more about how they care for their young?
- Why are there so many different ways that animals care for their young?