Day 4: What Makes a Good Science Question?

Mini-lesson — Children learn how to use a fix-up strategy to help them understand what they are reading.

Inquiry Circles — Learners will work in inquiry circle teams to investigate questions about ecosystems.

Guided Science Investigation — Learners work through the process of defining a testable question then formulate a testable question to investigate.

Literacy Strategy: practice using fix-up strategies	**Reading TEKS** ELA.3.6I	**CCSS** RF.3.4, RF.3.4A, RF.3.4C
Science Concept: good science questions are testable and can be answered in a measurable way through investigations or experiments.	**Science TEKS** **2018–19:** 3.2A **2024–25:** 3.1A	**NGSS** 3-5ETS1-3
Science and Literacy Connection: science consists of asking questions then conducting research and planning investigations to search for answers.		

Mini-Lesson (15 minutes)

OVERVIEW

Scientists are aware that they need to understand what they are reading while doing research. Sometimes they read an entire page and realize they have no idea what is being said, and sometimes they get confused while doing an investigation. When that happens, scientists will use a fix-up strategy to help them understand what they are reading and doing.

Note: You are encouraged to create a “Fix-Up Strategy” anchor chart with your learners as you move through the lesson, using the provided anchor chart as a model. Post it for easy reference when completed and remind learners to refer to it during inquiry circles.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- "Fix-Up Strategy" anchor chart as a model
- exploratory text about pond ecosystems to model the strategy

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may use for the lesson; additional teacher actions and considerations are in parentheses.

EXPLAIN THE STRATEGY

Tell them what the strategy is (declarative knowledge)

1. *Today we will practice using comprehension fix-up strategies when we read. A comprehension fix-up strategy is a tool we can use when we don't understand what we read.*

Tell when and why to use the strategy (conditional knowledge)

1. *I use a comprehension fix-up strategy when I am reading and encounter a problem that causes me to not understand what I read. Sometimes when I am reading, I forget what I just read. Sometimes I am interrupted or distracted while reading. And, sometimes, the text is just too hard! When this happens, I use comprehension fix-up strategies because I am a strategic reader.*

Tell how to use the strategy (procedural knowledge)

1. *Yesterday we learned how to monitor our comprehension. Remember, I use metacognition to listen to myself and talk to myself as I read to be sure everything makes sense!* (Refer to the "Monitoring Comprehension" anchor chart.)
2. *If I do not understand something that I read (because I was distracted or there was too much noise around me or something else went wrong), then I need to use a comprehension fix-up strategy.*
3. *There are several comprehension fix-up strategies I can use. But first I have to recognize that something has gone wrong in my reading. I know something has gone wrong when I read, and I think, "What in the world did I just read?" Once I recognize that I'm not understanding, then there are a few things I can do to fix it.* (Remind learners of the examples you provided yesterday when monitoring comprehension. Did you use a fix-up strategy then? If not, here are some options you might consider. Alternatively, you can read a new section of one of the texts about pond ecosystems. Model monitoring comprehension and then using a fix up strategy.)

   Some examples of fix-up strategies include the following:
   - *I can look at the graphs, charts, and pictures in the text.*
   - *I can read out loud.*
   - *I can visualize or create a picture in my head.*
   - *I can re-read the text.*
   - *I can stop and think about what I already know.*
   - *I can ask someone in my inquiry circle.*

Science Inquiry Circles (30 minutes)

OVERVIEW

Scientists work in teams when conducting research and scientific investigations. Today, learners will work in inquiry circle teams to investigate questions about ecosystems.

MATERIALS

Each team needs:

- team Inquiry Chart
- pencils
- exploratory texts/media (see the "Ecosystem Resources" spreadsheet for ideas)

Teacher needs:

- class Inquiry Chart (pond ecosystem)
- exploratory text, website, or eBook about pond ecosystems to model the strategy

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may use for the lesson; additional teacher actions and considerations are in parentheses.

Before Inquiry Circles

1. *You will be with the same team as yesterday, but we will rotate the science roles. Remember that each team member has a role or a job within the team.* (Assign roles at your discretion and have the Equipment Directors gather the Inquiry Chart for their team).
2. *Yesterday, we started looking for the answer to the first inquiry question with our first resource. Today we will answer more questions or add additional information to a question you've already answered.* (Use a new resource about ponds on the class Inquiry Chart to model how to record the resource in a new row. Depending on your example, you may add additional information to the first question's column or answer another question. Be sure to model this for your learners. To incorporate the mini-lesson from today, you can also model using a fix-up strategy at this time.)
3. *Now, inquiry teams will work together on their Inquiry Chart.* (Be sure to display the class Inquiry Chart as a model.)

During Inquiry Circles (20 minutes)

1. *Use a different book, website, or eBook to find answers to the question you're investigating about your ecosystem or add information to a question you've already answered.* (Remind learners that the class Inquiry Chart is visible as a guide. Also, you may choose to be more explicit for your class and only allow them to answer one question at a time daily. Use your judgement on the level of guidance, especially in the first few days.)
2. *Do not forget that it is important to record your resources on the Inquiry Chart as you complete it.* (Point out to learners where sources are located on the inquiry chart and how one source may answer multiple questions. Remind learners to record the title and author for texts and the URL for websites.)

3. *Remember, we have anchor charts to help guide your thinking. Do not forget to use them while in teams.* (Refer to the "Inquiry Toolbox," "Monitoring Comprehension," and "Fix-up Strategy" anchor charts. Remind learners to monitor their reading and use fix-up strategies as needed.)
4. *My role is to help guide the inquiry circles, but I expect you to work as a team to solve your problems together.* (While teams are working, walk around the room to facilitate as needed.)

After Inquiry Circles (10 minutes)

1. *As we conclude our inquiry circles for today, each team will have a chance to share the questions they answered, as well as what they accomplished and what literacy strategies they used. The Lab Director will lead the discussion about today's results. What did the team learn about its ecosystem? Did the team monitor comprehension and use a fix-up strategy? Which one did the team use? What other problems did the team encounter? How did the team resolve those problems?*
2. *The Data Scientist will now share with the entire class either something the team learned about their ecosystem, or how the team solved a problem.* (Try to encourage teams to share a variety of things. You do not want just facts about ecosystems, just literacy strategies, or just cooperative learning strategies. If you saw a great example in action, encourage that team to share with the entire class.)

Guided Science Investigation (30–45 minutes)

OVERVIEW

Learners work through the process of defining what a testable question is, then formulate a testable question to investigate.

GUIDING QUESTIONS

What makes a good science question? What do I want to know? Is my question testable?

BACKGROUND INFORMATION FOR THE TEACHER

After observing a phenomenon or conducting research, scientists formulate a question or questions to investigate. The question(s) are used to plan and conduct investigations either alone or collaboratively with other scientists. However, the question(s) should be answerable in a measurable way that provides evidence to support their explanation or the answer to their question. Sometimes investigations lead to more questions!

MATERIALS

Each team member needs:

- science notebook
- pencil

Each team needs:

- access to "Questions We Have about Ecosystems" chart
- access to "What Makes a Good Science Question?" anchor chart
- 1 pre-assembled question wheel ("Is My Question Testable?")

Teacher needs:

- marker(s)
- chart paper with "Questions We Have about Ecosystems" (created in class on Day 2)
- chart paper with "Ideas and Questions about the Green Substance" (created in class on Day 3)
- "What Makes a Good Science Question?" anchor chart
- templates for the question wheel ("Is My Question Testable?")
- card stock
- scissors
- brad
- tape

SETUP

- Before the class, make copies (**preferably on card stock**) of the templates for the question wheel (one set per team). Assembly: Cut out both circles along the outer border. Then, using the brad (or a pencil), punch a hole in the middle of both the top and bottom parts. Push the brad through both parts, open the brad, then tape along the back to secure the brad.
- Post the chart paper labeled **"Questions We Have about Ecosystems"** and the chart paper labeled **"Ideas and Questions about the Green Substance"** where they will be visible by all learners.
- Post the **"What Makes a Good Science Question?"** anchor chart.

SAFETY

There are no safety concerns.

DAILY OBSERVATIONS

None at this time.

PROCEDURE

Engage

1. As you point to the class lists on chart paper, announce, *Today each team will decide on a question to investigate about the green substance. Think about what it is you want to know about the green substance.*
2. Tell learners that scientists always have questions about the world around us. The things we know and can explain about the natural world came through discoveries that were made through scientific investigations that began with a good science question.
3. Ask, *So, what makes a good science question?* Accept their ideas and discuss. Explain, *A good science question should be testable*. *What do you think a "testable" science question is?* Accept all responses.
4. Point out the **"What Makes a Good Science Question?" anchor chart.** Explain, *This anchor chart lists the things that make a good science question testable.*
5. *Let's use a question I have about the green substance to see if it is testable. I want to know if light has an effect on its color. My question is, "Does light affect the color of the green substance?"* Add this to **"Ideas and Questions about the Green Substance."**
6. Explain that testable questions are questions that **can be answered either through observations or experiments**. Scientists also conduct research and may do field work to find answers. Ask, *Can I answer my question through observation or an experiment?* Accept learner responses before affirming YES.

7. *Next, it says that testable questions **should be connected to scientific concepts** and not feelings or opinions*. (Different people can have different ideas or opinions.) *Is my question connected to a science concept?* Accept responses before affirming YES—it is connected to the concept of light energy. *What other science concepts might be related to your questions about the green substance?* Accept responses. Offer suggestions such as weight, color, effect of temperature.
8. *Lastly, testable questions **should be specific** (centered on the green substance) and **able to be answered using the materials or tools available**, **within the time frame allotted**. In other words, we can complete the investigation during class time using materials we have here or that we bring in from home. My question is specific: I am looking at the effect of light on the green substance. And I can complete my investigation here in class with the materials I have.*

Explore

1. *Now it's your turn to determine if your team has a testable question to investigate.* Remind learners that they are now working as a team of scientists, with everyone contributing to the work. Their work includes helping each other check for testable questions and then deciding on the ONE question they will choose to investigate.
2. Ask the Equipment Directors to collect 1 **question wheel** for each team. Explain that this tool can be used as an easy way to determine if they have a testable question and that the text is the same as it is on the anchor chart. Give teams a minute to look at the wheel.
3. Ask teams to pick one of the questions the team put on its list.
4. Using the question wheel, read what it says on the front out loud. Demonstrate how to rotate the **bottom wheel** in the direction indicated by the arrow (to the **right**). It should bring #2 into view: **Can it (your question) be answered through observations or experiments?** *If the answer is "YES," continue to rotate the bottom wheel to the right.*
5. Instruct learners to continue turning the wheel to the right. *If **all** your answers are "YES," you have a testable question! However, if your answer is "NO" at any point, you need to rethink and write a new question.*
6. Tell the class they have 15 minutes to decide on ONE question that is testable. Ask them to write all the questions they work on in their science notebooks along with any notes or observations they make to discuss later.
7. As they work, move between the teams to offer help if needed. If learners are stuck on a "NO" on the question wheel, ask them to consider what it is they want to know and suggest that perhaps the question can be changed. Refer them back to the teacher example as well as the other questions they practiced with.

Explain

1. When time is up, ask the Data Scientist from each team to explain the team's choice of question to investigate. Why did the team choose that one? Did it meet the criteria for a testable question?
2. Provide feedback and allow discussion or comments about the process they used to decide on the question.
3. Notify the class that each team will receive enough of the green substance for 1 investigation to find an answer to their question.

Elaborate

1. Tell learners that, in the next class, they will determine what information they need to collect to find an answer to their question as they begin the process of planning their own investigations.

Evaluate

1. Did learners communicate a basic understanding of what makes a good science question?
2. Are they using new science language in their communications?
3. Are the teams ready to move forward in designing their own investigations?

Science Language

- A **testable question** is connected to a specific science concept and can be answered through an investigation or experiment.
- A **science investigation** is a plan for finding answers to questions and solving problems.
- **Evidence** is data collected from the investigation that supports (backs up) explanations and answers.

Expanded Standards
Reading TEKS **ELA.3.6I:** Listening, speaking, reading, writing, and thinking using multiple texts. The student uses metacognitive skills to both develop and deepen comprehension of increasingly complex texts. The student is expected to: (I) monitor comprehension and make adjustments such as re-reading, using background knowledge, asking questions, and annotating when understanding breaks down.
CCSS **RF.3.4:** Read with sufficient accuracy and fluency to support comprehension. **RF.3.4.A:** Read grade-level text with purpose and understanding. **RF.3.4.C:** Use context to confirm or self-correct word recognition and understanding, rereading as necessary.
NGSS **3-5ETS1-3:** Science and Engineering Practices: plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
Science TEKS **2018–19: 3.2A:** plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world. **2024–25: 3.1A:** ask scientific questions and define engineering problems based on observations or information from text, phenomena, models, or investigations.