ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
CENTER FOR EDUCATIONAL OUTREACH

DAY 2: HOW CAN WE STUDY BUTTERFLIES?

MINI-LESSON

Teacher introduces the Inquiry Chart for asking and recording research questions about the animals teams are investigating

SCIENCE INQUIRY CIRCLES

Teams begin to ask questions about their animals and record information on the team Inquiry Chart.

GUIDED SCIENCE INVESTIGATIONS

Teams prepare the premade growth habits for the butterfly larvae.

ABBREVIATED STANDARDS

- **Reading TEKS: 2(b)(13)(A)**
- **CCSS: W.2.8**
- **NGSS: 2-LS2-1**
- **Science TEKS: 2.1(A)(B)(C)(G), 2.5(F)**

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Day 2: How Can We Study Butterflies?

Literacy Strategy: Researching questions and recording with a visual format (Inquiry Chart).

Science Concept: All organisms need living and nonliving resources, including a place to live, for survival.

Science and Literacy Connection: An important first step in research is preparation, which may be formulating your research question or preparing for your investigation.

Mini-Lesson (15 minutes)

OVERVIEW

Scientists always identify a question to research and record their data in an organized manner. Today learners will be introduced to the Inquiry Charts they will use as they research animals. During this mini-lesson, the teacher will model how to use the Inquiry Chart while exploring the life cycle of painted lady butterflies. A sample of the Inquiry Chart is provided. The teacher can create a larger version on chart paper so that it can be easily seen by the whole class.

While a true inquiry project would allow learners to develop their own research questions, the Inquiry Chart contains questions that can be answered for each animal to be researched, with the opportunity for learners to develop questions of their own.

The teacher will need to create an Inquiry Chart on a large sheet of chart paper or butcher paper for each inquiry circle team. Be sure the size is manageable for storage but big enough for the children to easily record on.

MATERIALS

Teacher needs:

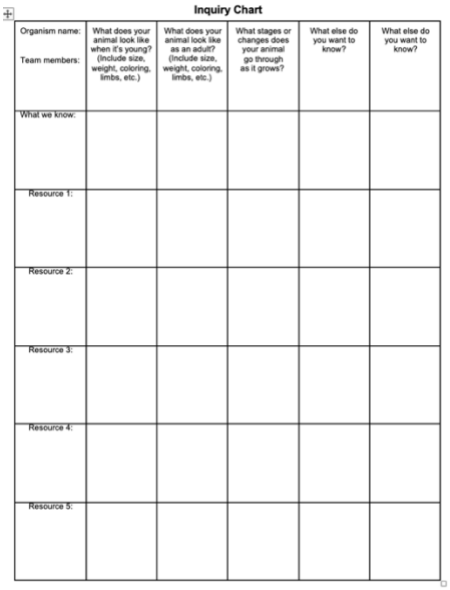
- chart paper
- marker(s)
- class Inquiry Chart
- informational text about butterflies to model the strategy (see “Animal Resources” spreadsheet for ideas)

PROCEDURE

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

Tell what the strategy is (declarative knowledge)

1. *Today we will learn how to generate our own questions. Scientists generate questions to help them focus on their research. In your inquiry circle teams, you will focus on your chosen animal, but as a class we will focus on butterflies.* (Post the class Inquiry Chart you've created where the class can see it.)



Inquiry Chart

Organism name: Team members:	What does your animal look like when it's young? (Include size, weight, coloring, limbs, etc.)	What does your animal look like as an adult? (Include size, weight, coloring, limbs, etc.)	What stages or changes does your animal go through as it grows?	What else do you want to know?	What else do you want to know?
What we know:					
Resource 1:					
Resource 2:					
Resource 3:					
Resource 4:					
Resource 5:					

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

1. *Before we begin answering questions, let's think about **what we already know**. What do you know about butterflies? I will give you a few moments to discuss with your team. The Lab Directors will lead the discussion.* (Allow a few minutes for teams to discuss, then ask for responses and write them on the class Inquiry Chart.)

Tell how to employ the strategy (procedural knowledge)

1. *Now that we have generated a list of what we know, let's make another list of **what we want to know** or questions we have about butterflies. The Lab Directors will lead the discussion. Be sure each team member has a chance to suggest questions.* (While teams are working, walk around the room to facilitate as needed. Allow a few minutes for teams to discuss, then ask for responses and write them on the class Inquiry Chart.)
2. *Notice that I have several questions already on my Inquiry Chart.* (Read the questions aloud.) *Now that we have generated some questions about butterflies, we will pick the other questions we would like to answer by voting. But first, let's see if any of your questions are already on the chart.* (Point out any questions that are the same.)

1. *Now that have seen which questions are already on the class Inquiry chart, let's vote on two more questions from your lists that we would like to answer.* (Have the class vote, then write the chosen questions in the appropriate boxes on the Inquiry Chart.)
2. *Looking at the Inquiry Chart, I see that I will also need to record my resources as I gather information to answer my questions. That means I will write the title and author of books I use and the URLs of any websites I use.* (Model an example.)
3. *Excellent work! You will repeat this process during inquiry circle time for the animal your team is researching.*

Science Inquiry Circles (30 minutes)

OVERVIEW

Scientists work in teams when conducting investigations or carrying out routine tasks. Each day of this unit, learners will work in inquiry circle teams while taking on the role of scientists engaged in research.

Specifically, they will speak like scientists (using new science language), read like scientists (using strategies to find information), and write like scientists (using journals to organize important information and observations).

MATERIALS

Each team needs:

- team Inquiry Chart
- pencils
- sticky notes
- preselected informational texts/media

Teacher needs:

- "Animal Resources" spreadsheet for ideas

PROCEDURE

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

Before Inquiry Circles

1. (Ask the Equipment Directors to gather the Inquiry Chart for their team). *To begin, the Data Scientists will write the name of the animal their team will be researching in the space under "Organism name." An organism is a living plant or animal that can carry out the actions needed to live, grow, and survive.*
2. *Next, the Data Scientists will add the names of the team members.* (Point to the space for names on the Inquiry Chart.)
3. *Now, look at the first row on your chart, where it says, "**What we know."** Take a few moments to discuss. The Lab Directors will lead the discussion, and the Data Scientists will write down **what you already know** about your animal under each question on the chart. Be sure everyone has a chance to share.* (While teams are working, walk around the room and assist as needed.)

During Inquiry Circles (20 minutes)

4. *Now, think about **what else you want to know**, or what questions that you have about the animal you are researching. The Lab Directors will lead the discussion. Be sure each team member has a chance to share their questions.* (While teams are working, walk around to observe and assist learners as needed.)
5. *When your team has generated your own questions, pick two questions the team would like to research. The Data Scientists will write these questions in the boxes directly under **"What else do you want to know?"***
6. *Tomorrow you will begin to research your animals to find the answers to the questions on your team's Inquiry Chart.*

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 created, as well as what they accomplished and learned. The Lab Directors will lead the*

team's discussion about today's results. For example, What did your team learn about its animal? Did your team encounter any problems? How did your team resolve those problems?

2. (After you have allowed the teams to gather their thoughts, have the Data Scientists share with the class. Try to encourage teams to share a variety of things—you do not want just facts about animals, just reading strategies, or just cooperative learning strategies.)
3. (When all teams have shared, thank them for their hard work, and point out any excellent behaviors that you observed. If you noticed any problems in the teams, take a moment to point them out and explain your expectations for all future inquiry circles. Collect all inquiry charts or have the Equipment Directors put them in their normal classroom place for ongoing work so students can easily access them.)

Guided Science Investigation (30–45 minutes)

OVERVIEW

In this activity, children will be introduced to the butterfly larvae, consider the larvae's needs, and equip growth habitats to meet these needs. The habitats will allow close observation of the changes that will occur as the larvae go through their life cycles and become butterflies**. The teacher should have the habits ready for each team.**

GUIDING QUESTIONS

How do scientists study organisms? What resources need to be provided for live animals to be safe and well cared for while they are being studied?

BACKGROUND INFORMATION FOR THE TEACHER

When we think of scientists, our minds are often drawn to clean white laboratories filled with all kinds of glassware and machines. We usually don't think of the other "laboratory" scientists work in: nature itself. Scientists observe nature's many phenomena and collect data and form questions for further research. Outdoor observation and data collecting go hand in hand with research in the classic laboratory. Our study of painted lady butterflies demonstrates just how this partnership works.

When painted lady butterflies lay their eggs, they do so on the underside of plant leaves that are good for larvae to eat after hatching. By careful observation, scientists can find where the eggs are laid and wait for a couple of days for hatching. However, after a few days, when they come back to see the larvae, they are gone. Were they eaten by predators? Did they just move someplace where the food is better? The scientist can't tell. Eventually, the scientist will find larvae again but where did they come from? Different parents? How old are they? The scientist can't tell.

This is why it's important to have an indoor laboratory or enclosed space. To study the life cycle of the butterfly, scientist collects some eggs and places them inside some sort of growth chamber, or habitat, that simulates the natural environment and provides food and moisture. In this way, the scientist can study the complete life cycle of the butterfly and compare their observations with those made in the natural world.

In this activity, **each team** will help complete its own growth habitat for the butterfly larvae. The butterfly larvae will come in small cylindrical containers that contain larva food; however, we suggest you use real plants for feeding the larvae. In this way, children can observe the incredible amount of food that caterpillars eat during this stage of their life cycle. **A list of acceptable food plants can be found in the "Before the Unit Begins" document.** Caterpillars are voracious eaters, so, if needed, you can supplement their diet with the pasty food that comes with the larvae.

The benefit of larvae growth habitats is that they permit the larvae to move about a large area to facilitate easier observation and data collection by teams. Instructions for how to build the growth habitats out of cardboard boxes are included in the "Before the Unit Begins" document. Alternatively, the teacher may choose to purchase a premade habitat. **Either way works, as long as each team has its own habitat to observe.**

MATERIALS

Each team member needs:

- Butterfly Investigation Journal
- pencil

Each team needs:

- 1 premade habitat
- 2–3 twigs or small branches to fit into the habitat
- handful of fresh plant leaves **(Fresh plant leaves provide a source of food and water the larvae; because of this, it will be important to add fresh leaves every day!)**
- 1 white paper towel

Teacher needs:

- "Habitat Construction" document **(be sure to create the habitats for each team prior to this day's lesson)**
- 1 class set of painted lady butterfly larvae
- gallon plastic bags
- Butterfly Investigation Journal

SETUP

- **Before class time**, the teacher will need to prepare shoeboxes as described in the "Habitat Construction" document.
- Make copies of the Butterfly Investigation Journal (1 per team member).
- **Beginning on Day 3, learners will need daily time to observe their butterflies (whether they are in the larvae, pupae, or adult stage), take measurements of the larvae (if applicable), and record their observations in their Butterfly Investigation Journals.**
- Prepare plastic bags containing 2–3 twigs or small branches, leaves, and a white paper towel (1 bag for each team) Remember, you can supplement the larvae diet with the pasty food that comes with the larvae.
- Designate an area for materials pickup.
- Have the butterfly larvae ready to add to the habitats.

SAFETY

- Remind teams daily to be gentle with the growth habitats during handling to prevent disturbing the larvae, especially once the chrysalis forms. **Ideally, the growth habitats should be placed where teams can do daily observations without moving them**.
- Please follow all district and school science laboratory safety procedures.
- It is good laboratory practice to have teams wash hands before and after any laboratory activity.

DAILY OBSERVATIONS

Learners will need daily time to make and observe their organisms (whether they are in the larvae, pupae, or adult stage) and record their observations in their Butterfly Investigation Journals. They will also need to take measurements of the larvae (caterpillars) if applicable.

Facilitate discussions with the teams by asking questions, such as, *What did you notice? What has changed since the last time you observed your organisms?*

PROCEDURE

Engage

1. Ask the children where they think butterflies come from. Accept all responses and discuss their ideas.
2. Remind them that they are now going to become scientists working in teams. Tell them that their science investigation will focus on the life cycle of butterflies. In other words, they will observe how the butterflies grow and change over time. Explain that, in their inquiry circles, they will be looking for information about the life cycles of the other animals they are investigating as well.
3. Discuss why it might be difficult for scientists to study butterflies over time in nature (outside). Ask the children to share their ideas about how it might be easier to study butterflies. If no one else brings it up, suggest setting up an indoor habitat where the class could study the life cycle of butterflies.
4. Tell the class that you have received butterfly larvae (very young forms of butterflies) to observe and study for their investigation. Pass around the container of larvae so the children can see what larvae look like.
5. Ask, *What do they look like to you?* Accept responses. (Possible answers may include that they look like worms or caterpillars. Let them know they will learn more about these larvae in the coming lessons.)
6. State that today learners will help complete the habitats, or homes, for the larvae to grow in. Ask them to think about what the larvae, which are animals, might need in the habitat.

Explore

1. Remind learners that all living things have basic needs. Ask them to think about what we (humans) need to stay alive. (Source of energy/food, air, water, and a place to live.) Ask, *Do all animals have the same needs? Think about the animals you are investigating in your inquiry circles—what are their needs?*
2. Ask for their ideas about how we can make sure the larvae have what they need.
3. Ask the Equipment Directors to pick up a bag of materials and a habitat from the designated materials area for their team.

4. Using a habitat to model with, explain that the windows are for viewing and the small flap is for feeding the larvae.
5. Next, describe the contents of the plastic bag (leaves, twigs, paper towel).
6. Explain that the leaves will feed the larvae and that the larvae will also get their water from the leaves, so **it will be important to add fresh leaves every day.**
7. Remind the children that the **larvae eat a lot** as they grow, and they will poop a lot! It is important to keep the habitats clean. The paper towel will be placed on the bottom of the box habitat; the teacher will change out the paper towel as needed.
8. Finally, the twigs will provide the larvae a place for resting.
9. At this point, the children will add the contents of their bags to the habitat as the teacher models how to add the paper towel to the bottom of the habitat and how to place the twigs and leaves.
10. The habitats are now complete and ready for the larvae. The teacher will model how to gently add the larvae to the habitat using a spoon. Each team will add larvae (2–4) to their habitats.

Explain

1. Ask the children to compare the larvae habitats to the natural world where painted lady butterflies live. How are they the same? Different?
2. Ask what they expect will happen to the larvae over the coming days.

Elaborate

1. Distribute the Butterfly Investigation Journals and explain that, just like real scientists, the children are going to write their daily observations in their journals.
2. Tell the children that, beginning in the next class, **they will observe the larvae every day for 10 days and record their observations in the Butterfly Investigation Journal.** Let them know that they will work as a team to collect information as they observe the larvae but that each team member will write in their own journal.
3. Instruct them to write their names on the front on the journal and then turn to the first page.
4. Tell the children, *Notice that the first thing on the page is the date. This is an important piece of information because it allows us to record exactly when the changes we see occur.*
5. Next, read through each box in the journal, explaining what the questions are asking and what the children need to record. Be sure to point out that they will include a drawing in the first box.
6. Add that any new questions they have can be written in the last box **("What does this make you wonder?**")
7. Ask if there are any questions. Remind the children that they are working as a team and will discuss what they should write in their journals together (children will write in their own Butterfly Investigation Journal).
8. Collect the journals and remind the children that they will begin recording information in the next class.

Evaluate

1. Did learners communicate a reasonable understanding of the basic needs of animals in general or butterfly larvae specifically?
2. Did learners use new science language in their responses?
3. Did learners work collaboratively within their teams?

Science Language

- **Organisms** are living things that are able to carry out the actions needed to live, grow, and survive.
- A **larva** is the wingless, often wormlike form in the life cycle of a newly hatched insect (larva is singular, larvae is plural).
- A **caterpillar** is the larval stage in the life cycle of a butterfly.
- When a caterpillar is transformed into a **butterfly,** it has reached the adult stage in its life cycle.
- A **habitat** is the place where an organism usually lives and grows.
- **Data** are facts and information (such as images, words, and measurements) collected during an investigation.

Expanded Standards

Reading TEKS

2(b)(13) Inquiry and research: listening, speaking, reading, writing, and thinking using multiple texts. The student engages in both short-term and sustained recursive inquiry processes for a variety of purposes. The student is expected to: **(A)** generate questions for formal and informal inquiry with adult assistance.

CCSS

W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

NGSS

2-LS2-1 Science & Engineering Practices: Planning & Carrying Out Investigations—Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Science TEKS

2.1 Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to: **(A)** ask questions and define problems based on observations or information from text, phenomena, models, or investigations; **(B)** use scientific practices to plan and conduct simple descriptive investigations and use engineering practices to design solutions to problems; **(C)** identify, describe, and demonstrate safe practices during classroom and field investigations as outlined in Texas Education Agency-approved safety standards; **(G**) develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem. **2.5** Recurring themes and concepts. The student uses recurring themes and concepts to make connections across disciplines. The student is expected to: **(F)** describe the relationship between structure and function of objects, organisms, and systems.