

NTTI Media-Rich Lesson

Kayren Bell Hughley

NAME

What's Buggin' You?

LESSON TITLE

Targeted grade level(s) 2-3, but remember that all lessons may be adapted to any level.

Grade

2 class periods; each 50 minutes (followed by on going observations for 4 –6 weeks),

Or

4 class periods; each 30 minutes (followed by on going observations for 4 –6 weeks)

TIME ALLOTMENT

OVERVIEW

In this introductory lesson (1st of 3), students will create habitats for and observe the life cycle of an insect (mealworms) that exhibits complete metamorphosis. In the second lesson, students will create habitats for and observe the life cycle of waxworms (complete metamorphosis); and in the third lesson, students will create habitats for and observe two additional insects (milkweed bugs and crickets), which exhibit simple metamorphosis.

In this lesson, students will learn the characteristics of insects, in the second lesson - the stages of complete metamorphosis; and in the third lesson, students will compare and contrast the stages of simple and complete metamorphosis as exhibited in each of the insects that they are studying.



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Students should continue to observe insects and record data in their journals for 6 – 8 weeks to see/experience the full life cycle of each of the insects. A variety of instructional techniques are utilized including hands-on/minds-on activities, cooperative grouping, media interaction, and collective inquiry.

Background Information

They inhabited the earth 1 million years before the dinosaur. There are 200 million of them for each human being on the planet. They have adapted to every environment on earth. Some live above ground, but most live below it. Some even live underwater. They are ***Insects!*** Insects are the most successful animals in the history of the world. There are more kinds of insects than all other kinds of animals put together. Insects completely dominate the planet in total living mass, total numbers of individuals, and they occupy the largest percentage of the planet's ecosystems.

Insects are of the kingdom Animalia and in the phylum Anthropoda, (meaning jointed foot), the order Uniranians and the class Insecta. Insects have three major things in common: (1) Segmented Bodies - three parts, the head thorax and abdomen; (2) Exoskeleton – they are Invertebrates – no inner skeleton to protect their soft fleshy insides/nervous systems; and (3) 6 Legs – and most have wings. Insects have an open circulatory system that carries digested food to cells and removes wastes. Insects do not have lungs to transport oxygen, instead they have small openings along their abdomen and thorax called spiracles through which air enters and waste gases leave the insect's body. While insects are commonly called bugs, entomologists (scientists who study insects) point out that bugs are a special type of insect. The term bug is reserved for insects of the order Hemiptera. Bugs suck their food, while most other insects eat with claspers.

Insects change in form as they grow and mature. The change process is called metamorphosis. There are two types of metamorphosis – *simple* and *complete*. Insects that grow through simple metamorphosis exhibit three stages – *egg*, *nymph*, and *adult*. Insects that grow through complete metamorphosis exhibit four stages – *egg*, *larva*, *pupa* and *adult*. Insects typically don't grow to be more than 6 inches because their exoskeletons would be too heavy and cumbersome for them to move. Larger bodies would make transporting oxygen to and from cells more difficult. Also, because insects have exoskeleton, they must go through a process of molting (shedding the outer shell-like cuticle) periodically to accommodate the growth. Larger bodies would require more molting, leaving the newly shedded soft-shelled insect vulnerable to predators more often.

Entomologists discover thousands of new insects in the rain forests each year, so no one is sure exactly how many insects live on earth. The number has been estimated to be more than 15 billion. We do know, however, that some insects are helpful to both culture and commerce, whereas most of us think of them as



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pests. The silk produced by silkworms and the honey produced by bees are examples of insects' commercial and cultural benefits to our lives, while flies, mosquitoes and ants are examples of common pests. The economic impact of insects as pests on humans is massive! Moths eat our clothes, termites eat our buildings, and a multitude of other insects ravage our agricultural products. In addition, there are a number of insects that carry and spread diseases. We spend an extraordinary amount of time, money and energy battling insects.

SUBJECT MATTER

Life Science, Insects

LEARNING OBJECTIVES

- Develop a curiosity and interest in insects and a respect for them as living things.
- Experience some of the great diversity of forms in the animal kingdom.
- Explore the life sequences that different types of insects exhibit (simple and complete metamorphosis).
- Observe the behaviors of insects at different stages of the life cycle.
- Provide for the needs of insects (and all living things), air, water, food and space.
- Gain early experiences that will contribute to their understanding of several pervasive themes that relate one scientific idea to another: structure, pattern, change and interaction.

STANDARDS

National Science Education Standards

Life Science Content Standard C:

As a result of activities in grades K-4, all students should develop understanding of:

- The characteristics of organisms
- Life cycles of organisms
- Organisms and environments

Georgia Quality Core Curriculum Standards

Topic: The Living World: Animals

Standard: Recognizes and describes a variety of animal and plant life cycles. Illustrates the life cycles of a chicken, butterfly, frog, turtle, grasshopper, dog and fish.

Topic: The Living World: Living Things

Standard: Recognizes and describes basic life processes. Identifies evidence of basic life processes in the immediate environment such as gathering and digesting food, excreting waste products, reproducing, breathing and responding to the environment



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Topic: Science Inquiry, Process Skills and Problem Solving

Standard: Asks questions, classifies objects and events, communicates with others, makes inferences and predictions, uses estimation and measurement, uses evidence to construct explanations, makes sketches and diagrams to explain ideas, and organizes data into tables and charts to interpret and formulate simple hypotheses.

Topic: Activities/Tools

Standard: Actively engages in the learning process via hands-on/minds-on science activities and experiences. Uses appropriate tools to collect and analyze data and solve problems.

MEDIA COMPONENTS

Video

The Biology of Small Life, Episode 114, “The Biology of Arthropods”

This video has information about all arthropods, so only the small portion on insects is appropriate for this lesson.

Internet

Junior Zoologist: Insects; The Characteristics of Insects

<http://peachstar.unitedstreaming.com>

On this website Students will learn a great deal about these fascinating creatures including the harm insects do as well as the good they provide for nature and man. This 11-minute video, divided into specific insect topics, gives an overview of insects.

MATERIALS

For each Student:

My Insects Journal (several sheets of story paper stapled together)

Mealworm Materials:

Each group of four will need:

- 1 Sheet of Chart paper
- 2 Markers,
- 4 Vials with lids (clear)
- 4 Mealworms
- Paper plate
- 4 Hand lenses
- Food (apple & oatmeal)

For the class:

- Screen
- Mealworm culture
- Paring knife



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Apple, sweet potato, or carrot
Mealworm stages duplication master
Mealworm calendar

PREP FOR TEACHERS

As a minimum experience, students should work with mealworms or waxworms, milkweed bugs and at least one other safe, local insect. (Waxworms, mealworms and crickets can be purchased at Pet Smart.) This way, students will experience simple and complete metamorphosis, as well as the characteristics that make an insect a 'true bug'.

Consider the schedule. You will need to order insects. You decide which insects to order and when. It is not necessary to use all of the insects as suggested if you do not have the time or the resources.

Consider safety. Young children must be taught how to act responsibly with organisms. Develop the rules for working with the organisms with the students. Also reiterate proper group behavior. You may also want to send a letter home to parents informing them of the pending insect study.

Consider management. Plan how to get students attention. Develop a signal so students will know when to give you their attention quickly. Explain to students what is the expected behavior when the signal is given.

Plan for weekend and holiday care of the insects. Most of these insects can thrive on their own over the weekend, but long holiday breaks (weeks) may be problematic without maintenance care.

Plan for disposing of the insects. **Do not release insects into your local environment!** Releasing cultured insects into the natural environment may upset the ecological balance of the environment. Therefore, you should place insects in a freezer to kill them, and then place them in a trashcan, not down the toilet or drain.

Consider making a large class calendar and/or student journal to model recording insect data for students. Laminating allows mistakes to be erased, if a dry erase marker is used.

Make a student journal for each student by stapling together story paper or a combination of lined and lineless paper. For younger students, include a prompt sheet to remind students of the Focus for Media Interaction. Cover the book with card stock or construction paper. Students can make the journal covers as an art activity.



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Set up a **Materials Distribution Center** with all of the materials for each insect's habitat clearly labeled. Materials are all in the FOSS Insects kit, but can be purchased at your local grocery store and/or pet store. (Pet Smart has waxworms and mealworms 50-count containers for \$3 - \$4. They also sell crickets. The other insects, milkweed bugs and painted lady butterflies can be purchased from a biological supply house, like Carolina Biological.)

Cue the videotape. Fast-forward the videotape past the introductory scenes and credits. Stop when you see the title screen (white background with black writing) of an eye and the word Insects.

Download the video clip Junior Zoologists: Insects; The Characteristics of Insects (entire 11-minutes) from <http://peachstar.unitedstreaming.com>. Save it to your desktop for quick and easy access. (Downloading will also ensure that you can access the video clips in case the Internet is down on the day that you do the lesson.) Type in <http://peachstar.unitedstreaming.com> as the website address. The United Streaming welcome page will appear. If you do not already have an account, follow the directions for creating a demo account. On the United Streaming Homepage, type in the keyword: *Insects*. You will see a listing of videos (with a brief description of each) on the screen. Scroll down the list and click on Junior Zoologist: Insects. Click on: *Download*. A message box asking where you want to save the video will appear. Save it to your desktop for quick and easy access.

INTRODUCTORY ACTIVITY: SETTING THE STAGE (Engage)

Note: This lesson is based on inquiry pedagogy. Therefore, vocabulary should be introduced as students encounter the phenomenon, not at the beginning of the lesson! Vocabulary introduced throughout the mealworm lesson: habitat, larva, molting, pupa, darkling beetle, 13 segments, head, abdomen, thorax, and complete metamorphosis.

Step 1

Ask students to answer the following riddle: "We inhabited the earth 1 million years before the dinosaur. There are more of us than all other kinds of animals put together. We are the most successful animals in the history of the world. Who are we?"

Allow students to brainstorm answers in groups of 3 – 4 for 5 minutes. Teacher monitors each group's discussion. Guide discussions when necessary, using the original riddle prompts. Have students to record their guesses/answers on chart paper, and then share with the larger group.

Step 2

Provide your students with a **Focus for Media Interaction:** Say, "The answer to the riddle is on the video clip we are going to watch. As you watch, listen for the



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answer to the riddle. Also listen for the reasons that these animals claim to be the most successful animal in the history of the world. There are three reasons given in the video clip. See if you can identify the animal and all three reasons.”

Step 3

Play *The Biology of Small Life*, Episode 114, “The Biology of Arthropods”. Start at the beginning of the video. **Stop** the video after you hear, “...and the single largest group of animals... the insect.” You will see a beetle on a leaf. Ask the riddle again and allow students to answer (“Insects”). Check for comprehension by asking, “What are the reasons insects are considered the most successful animals in the history of the world?” (Possible answers: greatest in total living mass, largest total numbers of individuals, they have survived longer than any other animal, and they occupy the largest percentage of the planet’s ecosystems.) Ask, “Was there is anything else in the riddle’s description or in the video clip of insects that you find surprising and/or interesting.” Allow 5 minutes or less for a brief discussion.

LEARNING ACTIVITIES

Step 1

Say, “In this unit we will be studying the characteristics of a few insects and their life cycles. We will study the mealworm, waxworm, milkweed bugs, crickets and painted lady butterflies.” Activate prior knowledge by having students to recall the things that all living things need (*answer: food, water, air and shelter/space*). Knowing this, ask students to identify the things we will need to provide for our insects so that they will survive. Ask questions like:

- How should the insects be handled? (gently)
- How can we keep them safe/from falling? (be careful)
- What are some things that we should never do? (squish, puncture)
- What are the most important things to remember when working with insects? (wash hands before and after; never out them on anyone else, never put them near your mouth, etc.)

Step 2

Assign roles to each student in the group: (1) a materials manager, (2) a recorder, (3) a reporter and (4) a timekeeper. The *Materials Manager* from each group will get materials for the mealworm activity (see materials list) from the Materials Distribution Center (a table within in the room with materials clearly labeled, and categorized by insect). Ask students to use their hand lenses to observe the mealworms on the paper plates. Participants will observe (5 minutes), draw and record information (5 minutes) in their individual insect journals to describe the larva.

(Recommend that the group drawing be a compilation of the individual details noticed by group members on their individual drawings. The group recorder should make a group drawing with input from the rest of the group. Remind



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Timekeepers to make sure that group members are aware of the time and are moving to the next activity promptly. Make sure students date their initial drawings.) You should walk around and monitor each group's interactions with the larva. Ask questions to prompt student observations like how does it move? How many legs does it have? How many body parts? Does it look like any of the insects you've ever seen? At this stage of the lesson, the answers to questions to prompt observations are not important. Future observations and the video clips will reveal the answers. There will be discrepancies, but be careful not to give any answers to questions, simply prompt students to make closer observations and to begin thinking about the characteristics of the mealworm larva. In

Step 3

Participants will create individual habitats for their mealworms. Guide students through the following steps: (1) label vial on cap (student's name), (2) add 1 cm of oatmeal, (3) Add water source – apple (carrot or sweet potato), and (4) punch 25 holes in the lid with push pins (air supply). Place one mealworm in each vial and place vials in a secure place for observations.

Step 4

Ask, "Is a mealworm a worm?" If students say that a mealworm is a worm, ask them, "How do you know?" If they say that it is not a worm, ask, "What is it, and how do you know?" Allow students to discuss their answers briefly, (make sure students defend answers giving reasons why or why don't they believe the mealworm is a worm. Guide students thinking so that they begin to think about mealworms as insects. Ask questions like, "What makes a worm a worm? What do worms look like?" (You are leading students to say that worms do not have legs.) "What do insects look like? What makes an insect an insect?" (Usually young students will give names of insects rather than characteristics and descriptions of body parts. Accept all answers and record them on chart paper entitled "*What We Think We know About Insects*".) These questions assess students' prior knowledge of insects. You will know whether or not students already know the characteristic body parts of insects. This information will determine how you introduce the next video clip.

Step 5

Provide your students with a **Focus for Media Interaction**: Say, "All insects have certain characteristics that make them different from all other animals. In this next video clip, listen for the characteristics that make an insect an insect. Record what you learn on the *What I Know About Insects* page in your Insect Journals. (See the appendix for *What I Know About Insects* page to be included in student journals).)

Review the items students are to listen for listed on the Journal page. **Play** Junior Zoologist: Insects; The Characteristics of Insects on <http://peachstar.unitedstreaming.com/index.cfm> from the beginning. **Pause** the



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clip after you hear, *“The third part is the abdomen or tail section.”* You will see a bee and the word *abdomen* on the screen. Check for comprehension by asking students, “What are the defining characteristics of insects?” (Winged-adults, six legs and three body parts) Most elementary students will not be able to identify all of the characteristics upon the initial viewing. Therefore, more focused prompting may be necessary. Say, “Name the three body parts of an insect.” (Head, thorax, abdomen) Ask, “What distinguishes insects from all other crawling creatures?” (The adults have wings.) If students are unable to answer any of these questions, **Rewind** the clip to the beginning. **Play** again; this time pausing the video as each question is answered. (For example, the video will say, “Of all the creatures that crawl, only insects have wings.” **Pause** the video and ask, “What is it that makes insects different from all other creatures that crawl?” Allow students to answer (wings). **Resume play.** After each body part is given, pause the video to ask questions. **Pause** the video after you hear, *“The head has antennae or feelers.”* and ask, “What is on the head?” (Antennae/feelers) **Resume Play.** When you hear, *“The thorax is the middle section that has the wings and legs,”* **Pause** the video. Ask, “What is the middle section?” (Thorax) Ask, “What is on the middle section?” (Wings and legs) **Resume Play.** When you hear, *“Another thing about insects is that they have an outside skeleton,”* **Pause** the video. Ask students, “What creepy crawler is commonly mistaken for an insect?” (Spider) Ask, “How do we know a spider is not an insect?” (8-legs, 2-body parts) Media Interaction prior to viewing was purposefully omitted. Therefore, you will need to **Rewind** the video to the picture of the spider in its web (tracking number: 58) and allow students to view it again. After you hear, “Did you notice that spiders have eight legs and two body parts, so they aren’t insects?” **Pause** the video. (You will see a picture of a beetle on the screen. Ask students again, “How do we know a spider is not an insect?” (8-legs, 2-body parts))

Note: If you are using two class periods to do this lesson, stop here and review the information collected so far on their journal sheets. Then allow groups to share their mealworm drawings with the class as a semi-culminating activity; otherwise, go on to Part 2.

Part 2

Step 1

Provide your students with a **Focus for Media** Interaction by saying, “Insects are very interesting animals with a lot of characteristics. As you watch this next video clip, listen for additional characteristics of insects and record them on your journal sheet under *Other interesting information about insects.*” **Resume Play.** When you hear, *“The hard outer covering acts as protection just like a suit of armor worn by a knight.”* **Pause** the video. Ask, “What protects insects?” (outer skeleton) Tell students, “We call this outer-skeleton the exoskeleton.” **Resume Play** When you hear, *“The antennae help the insect tell a lot about where it is and what is around it.”* You will see a picture of a black, green and yellow



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butterfly. **Pause** the video and ask, “What do the hairs on an insect help them to do?” (Smell, hear, taste and know where it is) “Where are the hairs located on an insect?” (Coming out of the outer skeleton/exoskeleton and on the antennae) **Resume Play** When you see a housefly and hear “No wonder we hear a buzz.” **Pause** the video and check for comprehension by asking, “How do insects breathe?” (Spiracles – holes along the body) “How do they make sounds?” (Rubbing their legs together or flapping their wings) **Resume Play** When you see the compound eye of the fly and hear, “*That’s why it’s so difficult to sneak up on a pesky fly.*” **Stop the video** “How do insects hear? (They feel vibrations through their feet) “How do they see?” (Compound eyes)

Review with students the information collected so far on their journal sheets. Have students compare the characteristics of insects with the mealworm body structures in their journals using a Venn diagram. (If students are unfamiliar with the Venn diagram as a graphic organizer, demonstrate how to use a Venn diagram by completing a large Venn diagram together, while students complete their individual diagrams. If students are very familiar with Venn diagrams monitor the groups as they complete the diagrams together.) Ask students to share their group drawings and observations of mealworm structures/body. (Allow only 2 minutes for each group.)

CULMINATING ACTIVITY

Have students write a paragraph or poem about insects and/or mealworms to display on the bulletin board with their group’s drawing of the mealworm.

You may want to send students who finish early to the computer station to complete an interactive butterfly puzzle. As students answer content questions about insects correctly, a new piece of the butterfly puzzle is revealed. Set computers on: Interactive Butterfly Puzzle

<http://www.enchantedlearning.com/Home.html>

CROSS-CURRICULAR EXTENSIONS

Read a story about insects, like Disney’s *A Bug’s Life*. (Language Arts) Have students to write their own stories about insects, incorporating both fact and fiction. (After stories are written, allow students to exchange stories and identify the facts and the fiction in classmates’ stories.

Research the Internet for the ways insect benefit and pester mankind. (Social Studies)

For Mathematics Connections, see the NTTI lesson plan entitled, *You Must Be Buggin’!*

Art Connection- Have students go to the website: *The Life Cycle of the Honeybee & Other 3-D Insects* at <http://gpn.unl.edu>. Students can create their



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own 3-D insects and manipulate (rotate on both the vertical and horizontal axis) them.

COMMUNITY CONNECTIONS

Invite a pest control specialist to visit your classroom to discuss the importance of pesticides being targeted to only pests, not the helpful insects.



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