

NTTI Media-Rich Lesson

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NAME

Are You Buggin'?

LESSON TITLE

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

GRADE LEVELS

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 second lesson (2nd of 3), 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 the first lesson, students created habitats for and observe the life cycle of mealworms, which exhibit complete metamorphosis.

In the first lesson, students learned the characteristics of insects. In this second lesson, students will learn 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. 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 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



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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

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



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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

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)

Waxworm Materials:

Each group of four will need:

- 2 Clear plastic cups
- 1 Lid for cup
- 4 Pushpins
- 1 Label
- 4 Hand Lenses
- 1 inch of waxworm medium

For the class:

- Waxworm culture
- 2-liter plastic jar
- Lid for jar with holes
- Waxworm Medium (see prep)
- Waxworm calendar
- Dark place for storing culture

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'.



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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.

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.)

Make the waxworm medium as described below. (Waxworm larvae live in and feed on the medium.) This recipe makes enough medium for students to put into their group cups and for the class culture. You will need: 3/8-cup glycerin, __ cup sugar, __ hot water and 1 box (8 oz.) of baby oat cereal. Dissolve the glycerin and sugar in hot water. Cool the solution. Pour the whole box of cereal into a large



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bowl. Pour the solution into to the cereal in a thin stream, while stirring briskly. (This should take 2 minutes.) The medium will be kind of sticky, lumpy and crumbly. Store it in a plastic zip-lock bag to retain moisture until you're ready to use it.

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 through waxworm observations: prolegs, claspers, spiracles, spinnerets, silk cocoon, pupae, moth, bristle and stage.

Step 1

Introduce the lesson. Say, "In this unit we are studying the characteristics of a few insects and their life cycles. In the previous lesson we learned the defining characteristics of insects, and today we will begin studying insect life cycles." Guide students in reviewing what they already know about insects (from previous lesson # 1). Ask students, "Why are insects 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.) "What are the characteristics of insects?" (Winged-adults, six legs and three body parts) "Can anyone name the three-body parts of an insect and their structures?" (Body parts: head, thorax, abdomen; structures: antennae on head, wings and legs on thorax)

LEARNING ACTIVITIES

Step 1

Introduce waxworms. Say, "Today we will observe the waxworm." Remind students of insect rules:

- How should the insects be handled? (gently)
- How can we keep them safe/from falling? (be careful)



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- 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 put them on anyone else, never put them near your mouth, etc.)

Challenge students to find out everything they can about the waxworms, including how they are the same as mealworms and how they are different. Say, “After we create the waxworms habitat, we will try and figure out why we call mealworms and waxworms are insects.”

Step 2

Reassign 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 waxworm 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 waxworms 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 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? How is it similar to the mealworm? How is it different? 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 waxworm larva.

Step 3

Students will create group habitats for their waxworms. Guide students through the following steps while reinforcing the needs of all living things: (1) label plastic cup on the bottom (group names), (2) add $\frac{1}{2}$ inch of medium (waxworm food & water), (3) punch 25 - 30 holes in the lid with push pins (air supply). Place the groups (4) waxworms in the group’s cup and place the cups in a secure place for future observations.



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Step 4

Ask students to share their observations and drawings of waxworm structures/body. (Allow only 2 minutes for each group) Have students compare the characteristics of waxworms with the mealworm body structures using a Venn diagram. (If students are unfamiliar with it as a graphic organizer, lead them through the activity demonstrating on the board.) Ask, “How are mealworms and waxworms the same?” (Record answers on the Venn diagram) Ask, “How are mealworms and waxworms different?” (Record answers on the Venn Diagram)

Ask students if they know how a butterfly becomes a butterfly? How does a butterfly begin?” Hopefully students will be able to talk about caterpillars and how they go through metamorphosis. Tell students, “The process insects go through is called metamorphosis. Provide your students with a **Focus for Media Interaction** by saying, “The next video clip demonstrates the stages of complete metamorphosis. Watch for the stages of metamorphosis. Record the information about the stages of metamorphosis and any other important or interesting information that you hear on your journal sheet.” (Direct students to their *Insects Metamorphosis Stages* sheet in their journals.) Show the video clip Junior Zoologist: Insects; Insect Life Cycles on <http://peachstar.unitedstreaming.com/index.cfm>.

Review answers to questions on the *Insects Metamorphosis Stages* journal sheet with students. As the students give answers, record them on the *What We Think We Know About Insects* chart. (Each time you record information on the *What We Think We Know About Insects* chart, review the information previously recorded with students. Ask students if there is any information that they need to revise. **Note:** Misconceptions should gradually be revised to accurate information about insects. Near the end of the unit, all of the information about insects recorded should be accurate, so scratch through the word We in the title so that it reads *What We Know About Insects*.)

CULMINATING ACTIVITY

Tell students that mealworms and waxworms go through a similar process. Ask students to predict what the mealworm and waxworms will look like when they become adults. Give each student a bag of candy (Gum drops, toothpicks, licorice, moth balls, marshmallows, raisins). Have students create a model of their prediction, labeling all body parts and incorporating what they have learned about insects. (Insects should have three body parts six legs, antennae coming from the head, legs and wings coming from the thorax.) Walk around monitoring the models, using questioning strategies to guide students’ corrections as needed.



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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 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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