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National 4-H Curriculum

NATIONAL 4-H CURRICULUM
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Teaming with Insects

Entomology 1-3 • Facilitator's Guide

Teaming with Insects Facilitator's Guide

Note to Parents and Project Leaders

Welcome to the fascinating world of insects. Insects impact our lives on an almost daily basis. Insects are found in our homes, our clothes, and the scraps of food we leave behind. Insects known as ectoparasites feed on our bodies and in our hair. Insects carry many types of disease-causing organisms such as malaria and dengue fever. Insects attack our pets, livestock, and wild animals. Insects such as bees and other pollinators help produce the food we eat.

Most people consider insects pests, and some insects do damage crops or bite humans and other animals. But most insects are an important part of their ecosystem and a few, such as honey bees and silkworms, provide direct economic benefits. The 4-H Entomology project offers many educational experiences, from collecting and identifying insects to learning about integrated pest management and forensic entomology. The *Teaming with Insects* curriculum is written for youth who enjoy learning about science and nature. Level 1 introduces the world of insects. Activities focus on how they look and move and provide some background for studying important entomology topics. Level 2 introduces the tools and basic concepts of biodiversity, invasive species, integrated pest management, and forensic entomology. Level 3 expands on these topics and encourages youth to take control of their learning by doing research using the scientific method and reference materials.

Parents can be a big help if they are involved with their child's learning, especially for younger 4-H members. As they mature, youth should take on more responsibility for their own learning, but parent involvement is still important in grades 6-8. Show interest in what your child is learning and doing. Your interest reinforces what they learn at meetings and workshops. High school-aged youth are able to direct their own learning experiences and may even teach their parents and others!

Acknowledgments

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Facilitator Tools

Welcome to the 4-H Entomology project! As a project facilitator you will work with 4-H members interested in learning about insects. This Facilitator's Guide provides helpful information on exploring insect study, the contribution of insects to biodiversity, how to manage pests, invasive species, and forensic entomology.

Your main role is provide a safe, supportive environment for youth to practice important life skills as they explore the world of entomology through many exciting, insect-related activities. You can help youth get the most out of this project by being enthusiastic about their efforts and asking thoughtful questions. Team up with youth to help them select goals, identify resources, gain confidence, and evaluate their own progress. The activities are designed so youth have an opportunity to "learn by doing" with your help and guidance.

Key Concepts

Safety First! Keep safety in mind at all times. Some of the activities will be done outdoors where wasps, bees, and other potentially harmful organisms might be in the area. Keep a watchful eye on the surroundings, including weather changes.

Gather Materials. Youth should collect the materials listed in the Tool Box before doing the activity. All the supplies used in these activities can be found around the home or purchased at minimal cost.

Read and Understand the Activity. Each activity is self-contained and often leads seamlessly into another activity. For example, in Level 2, youth will make simple insect collection tools to use in many other activities.

Support Youth. Most youth who take 4-H Entomology are interested in working with insects. Some may have reservations about picking up insects. Work with the 4-H members and explain that the insect they are working with is harmless. The youth must be willing to do the activity, so if you sense any continued reluctance, move on to the next activity.

Show Relevance of Each Activity. Explore the relevance and interconnectedness of each activity to the real world.

Relying on Others. Expand the learning activity and get additional supporting information from your state Extension Service. The Internet can provide a wealth of information to enrich learning. Take care to use sites that are supported by educational organizations (*.edu), professional societies, national organizations, and not-for-profit groups associated with entomology. The best way to confirm the reliability of the site is to check with entomologists at your state Entomology Extension office.

Learning Goals

4-H Entomology • Level 1

- Begin to learn about insect form and function.
- Begin to learn about integrated pest management and forensic entomology.
- Develop an understanding of and an appreciation for entomology (the study of insects).

4-H Entomology • Level 2

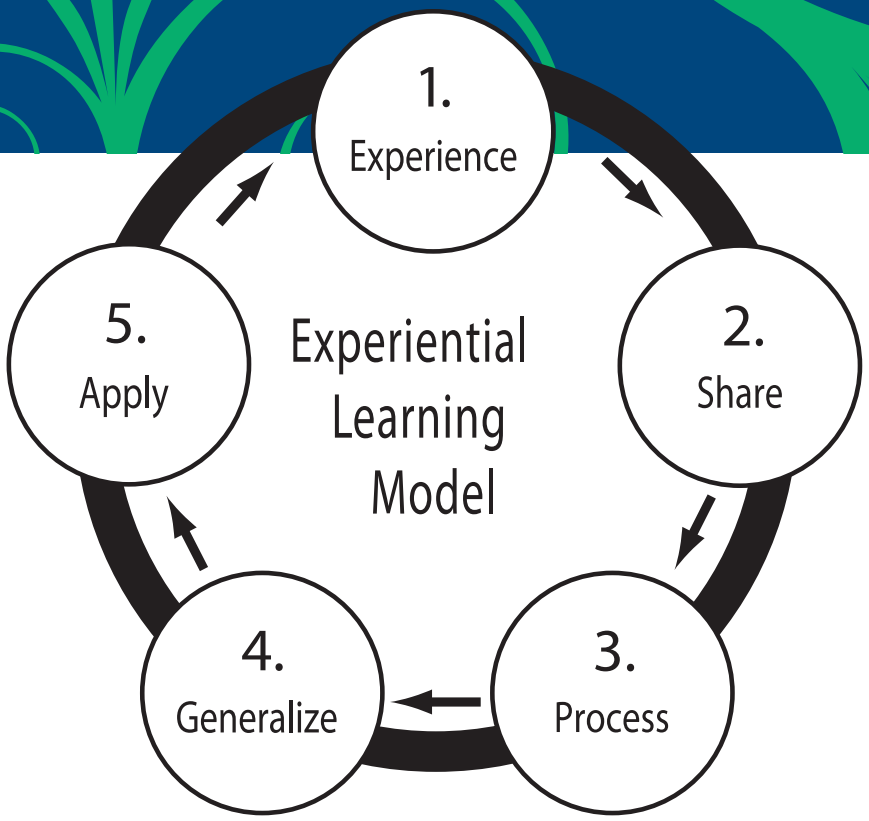
- Learn how to make insect collection tools.
- Learn more about insects and insect diversity.
- Develop a deeper understanding of and an appreciation for entomology.

4-H Entomology • Level 3

- Conduct research and use resources beyond the manual for in-depth study of entomology.
- Use the scientific method and keep accurate records.
- Expand understanding of and appreciation for entomology.
- Educate others about entomology.

Insect identification is not covered in the 4-H Entomology manuals. The following references are recommended for youth who want to learn more about collecting and identifying insects:

- *Arthropod Collection and Identification, Laboratory and Field Techniques,* Timothy J. Gibb and Christian Y. Oseto, Academic Press, books.elsevier.com, ISBN 12:978-0-12-369545-1 and 10:0-12-369545-7.
- *How to Make an Awesome Insect Collection, A Beginners Guide to Finding, Collecting, Mounting, Identifying and Displaying Insects,* Timothy J. Gibb and Christian Y. Oseto, Purdue University, available in print (from www.extension.purdue.edu/new) and online at www.4-H.org/curriculum/entomology.



The Experiential Learning Model

The ***Teaming with Insects*** activities are designed based on the Experiential Learning Model. This approach to learning helps youth gain the most from their activities by encouraging them to:

- Do an activity before being told or shown how (experience).
- Describe their experience and reaction (share).
- Discuss what was most important about what they did (process).
- Relate the life skill practiced to their own everyday experiences (generalize).
- Share how they will use the life skill and project skill in other parts of their life (apply).

The advantages of using the experiential learning process include:

- The adult can quickly assess the student's knowledge of the subject.
- The student builds on past experience or knowledge.
- The adult functions as a coach rather than a teacher.
- The youth relate the experience to their own lives and experiences.
- Mentors may use a variety of methods to involve the youth in the experience.
- Youth with many different learning styles can be successful.
- Discussions can move from the concrete to the abstract and analytical, which is particularly beneficial for middle and high school students.
- Youth are stimulated to learn through discovery and to draw meaning from the experience.
- Youth can work together, share information, provide explanations, and evaluate themselves and others.
- Youth take responsibility for their own learning.

Evaluate youth learning and interest in the activity. Are there changes you can make to enhance the learning experience? Are there ways the youth can enhance their own learning? Youth have different levels of interest and motivation for different activities at different stages of their lives. Learning how much coaching is needed for a particular youth on a particular day can be a challenging and rewarding experience.

Source: Excerpted and adapted from *Experiential Learning in 4-H Project Experiences*, 4-H Volunteer Leaders' Series, University of Arkansas Cooperative Extension Service, Dr. Darlene Z. Baker. You may view the entire document at www.4-H.org/curriculum/entomology.

Facilitator Tools

Youth Development Stages

Understanding the physical, mental, social, and emotional development of youth helps you work with the 4-H members in your club. No two youth develop at the same rate and transitions are often gradual. Your teaching and involvement helps 4-H club members grow and mature and makes 4-H a rewarding and fulfilling experience.

Activities at 4-H club meetings do not always work as you had planned. Sometimes youth talk among themselves rather than listening to you; sometimes no one comes to a planned field trip; and sometimes no one speaks up when you are trying to initate a discussion.

Youth of the same age can vary greatly in physical, mental, social, and emotional growth and interests. These differences are even more marked between age groups. If you are working with a broad age range, the activity may be too simple for the older youth and too difficult for the younger ones. Giving the older 4-H members leadership opportunities can be very effective.

Research has shown that there are some generalities that can help you understand how to plan activities for different age groups.

Early Elementary (Mini 4-H)

This is a very active age, so it is important to keep these children busy. They are concrete thinkers and need to understand what you want them to do and how to do it. They are generally more interested in making something than in completing a project (process is more interesting than product). Youth in this age group tend to seek adult

approval and depend upon adults, although the opinions of their peers are beginning to be important. They do best in small groups with set rules and rituals. Competition is inappropriate for this age group.

Upper Elementary

This is also a very physically active age, so hands-on activities work best. Youth in the upper elementary grades are still fairly concrete thinkers (things are black/white or right/wrong), but are beginning to think logically and symbolically. Because this age group has a strong need to feel accepted, it is best for an adult to evaluate each product rather than hold competition among peers with only one winner. This age child likes to know how much they have improved over past efforts and how to improve in the future.

These youth are beginning to identify with peers, but continue to value adult guidance. They are also beginning to discover the benefits of making other people happy, but more for the benefits to themselves rather than the benefits to others. They begin to take responsibility for their actions at this age and begin to develop an increased independence of thought, which may allow them to try new things. Letting this age group help in the decisions of the club helps them start to learn about leadership.

Middle School

Middle school youth are beginning to move to more abstract thinking. Justice and equality are important to this age. (Therefore, project judging may now be viewed in terms of what is fair, as well as being regarded as a reflection of self-worth.) They prefer to find their own solutions, rather than to be given solutions by adults. Try to provide supervision without interference. Independence of thoughts and actions begins to emerge. Avoid comparing middle school youth with each other. Performance should be compared with past accomplishments.

Junior volunteer organizations often are popular with teens toward the end of this age group, particularly if there are opportunities for developing leadership.

High School

Most high school-aged teens know their abilities, interests, and talents. They tend to be very concerned with themselves and their peer group. While they can understand the feelings of others, they tend to be self-absorbed, particularly in the earlier years of high school. Relationship skills are usually fairly well developed.

Getting a driver's license increases both independence and dating. Acceptance by the opposite sex is very important.

High school-aged youth begin to think about the future and make realistic plans. They enjoy career exploration and preparation. Their vocational goals influence the activities they select.

Projects requiring research and creativity give teens an opportunity to demonstrate how much they have learned and what they can accomplish. Teens set goals based on their personal needs and priorities. Goals set by others are generally rejected.

As teens master abstract thinking, they may try new ideas in ways that confuse adults. Teens can generally initiate and complete tasks without supervision. A leader can help by arranging new experiences in areas of interest to teens, but must be sure to allow them plenty of input. Assume the role of advisor/coach for independent workers rather than teacher/lecturer. Club meetings, rituals, and uniforms do not generally appeal to this group. Many teens enjoy looking back on their achievements in 4-H and appreciate special recognition for leadership activities. By the time they graduate from high school and begin college or a career, youth feel they have reached the stage of full maturity and expect to be treated as such.

Some Final Thoughts

These guidelines give only a brief overview of child and youth development. They are intended as a resource to help you plan your activities as a volunteer leader. The publication, *Ages and Stages of Child and Youth Development*,* has more in-depth information and is available from your county Extension Office.

You are a valuable asset to your community and to the members of your club. The guidelines for the stages of child and youth development, in combination with your special skills and interests in youth, will help you plan and carry out a successful 4-H program and make a positive impact on the lives of young people.

**Ages and Stages of Child and Youth Development*, A Guide for 4-H Leaders, NCR 292

Please note that some youth may have an emotional reaction to activities that involve collecting and/or killing insects. This is not unusual and should be supported. Do not allow other youth to ridicule or bully a person who does not wish to take part in an activity.

Science Standards Summary

ACTIVITY	NATIONAL SCIENCE STANDARD*
Level 1	
Activity 1: What Is an Insect?	Biological evolution
Activity 2: Copy Cat	Biological evolution
Activity 3: Define It	Biological evolution
Activity 4: Big Mouth Bugs	Form and function, Biological evolution
Activity 5: FACETnating	Behavior of organisms
Activity 6: Insect Olympics	Behavior of organisms
Activity 7: Pit Stop	Understanding about scientific inquiry
Activity 8: Buzz-z-z-zing Around	Behavior of organisms
Activity 9: Alien Insects	Behavior of organisms
Activity 10: Establishing a Toe-Hold	Behavior of organisms
Activity 11: Where Are They?	Understanding about scientific inquiry
Activity 12: Ants and Uncles	Understanding about scientific inquiry
Activity 13: Insect Investigation	Behavior of organisms
Activity 14: Chirp, Chirp	Behavior of organisms
Activity 15: Sherlock Bug	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 16: I Eat Insects	Behavior of organisms
Level 2	
Activity 1: Tools of the Trade	Understanding about scientific inquiry
Activity 2: Measuring Diversity	Behavior of organisms
Activity 3: You Are My Light	Behavior of organisms
Activity 4: I'm Sweet on You	Understanding about scientific inquiry
Activity 5: Come to the Light	Behavior of organisms
Activity 6: Plants That Attract Butterflies	Understanding about scientific inquiry
Activity 7: Spread Your Wings and Fly	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 8: Color My World	Understanding about scientific inquiry
Activity 9: Sowbug Investigations	Understanding about scientific inquiry
Activity 10: Life's Stages	Understanding about scientific inquiry
Activity 11: Invasive Species Investigation	Behavior of organisms/Environmental quality/Science in local, national, and global challenges
Activity 12: What's Hiding in My Closet?	Behavior of organisms
Activity 13: A Sticky Situation	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry

*National Science Education Standards (NSES), National Research Council, National Academy of Sciences, 1995.

ACTIVITY	NATIONAL SCIENCE STANDARD*
Activity 14: Footprint Clues	Understanding about scientific inquiry/Behavior of organisms
Activity 15: Write, Right	Abilities necessary to do scientific inquiry
Activity 16: Exoskeletons	Biological evolution
Level 3	
Activity 1: Career Connections	Science as a human endeavor
Activity 2: State Your Insect	Science as a human endeavor
Activity 3: The Scientific Method	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 4: Observing Arthropods	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 5: Transecting for Insects	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 6: This One or That One	Abilities necessary to do scientific inquiry
Activity 7: Please Drop In	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 8: Measuring Insect Diversity	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 9: Aliens Among Us	Abilities necessary to do scientific inquiry/Science in local, national, and global challenges
Activity 10: Biological Control of Purple Loosestrife	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 11: What Will the Neighbors Think?	Personal and community health
Activity 12: IPM – Learning and Teaching	Personal and community health
Activity 13: Grillin' with Insects	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 14: A Meal from a Worm	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry
Activity 15: What's That Doing in My Food?	Abilities necessary to do scientific inquiry/Understanding about scientific inquiry

The entomology activities listed above are organized by National Science Standard in Appendix A.

*National Science Education Standards (NSES), National Research Council, National Academy of Sciences, 1995.

Level 1 Facilitator Suggestions

Chapter 1: Be an Entomologist

Youth who are interested in insects will have fun watching and studying them. A good place to start is to learn insect body parts and how insects see and move. While all insects have the same basic parts, there are a lot of differences in how the parts look and work. This is called diversity.

Activity 1: What Is an Insect?

Big Picture

Youth begin learning about insect body parts in this activity. All insects have a body that is divided into three parts (head, thorax, and abdomen), a pair of antennae, and three pairs of legs. Some adult insects have one or two pairs of wings. Using pictures of insects, youth will draw and then cut out the antennae, head, legs, thoraxes (middle part of the body, between the head and abdomen), abdomen (the last, or third, part of an insect's body), and wings . Then they will combine the insect parts in a different way to create a new insect.

Facilitating the Activity

This is difficult if the pictures are small, so help them find larger pictures or make enlarged copies. Encourage youth to use their imaginations when naming and describing their new insect. Help them think about how the body parts affect the insect's habitat and what it eats.

Connections

Many people think of any small "bug" as an insect, but a "bug is not an insect unless it has the body parts used in this activity. For example, many people incorrectly think that spiders are insects. Spiders have four pairs of legs and no antennae, so they can't be defined as insects.

Essential Questions

What insect body parts can you name? What differences did you notice?

Activity 2: Copy Cat

Big Picture

The basic body plan of insects is the same even though insect body parts come in many different shapes, sizes, and colors. These differences result in a variety of body forms adapted to different environments. Insects may be small or large, drab or brightly colored, fast or slow, and these characteristics affect the role they play in nature.

Facilitating the Activity

Youth use their imagination in this activity. Encourage them to include the insect body parts, but note that it is more important to let them explore and enjoy this activity, than to worry about the accuracy of the model.

Connections

Insect art is found in many places. You can see insect drawings in movies, commercials, pictures, advertisements, and sculptures. Encourage youth to keep an eye out for them.

Essential Questions

What type of materials did you find most useful in making your insect model? What insect parts were most important to model?

Activity 3: Define It

Big Picture

Knowing the basic parts of an insect allows youth to identify insects and their relatives. The differences in shape, size, and color allow insects to live in different habitats throughout the world. In this activity, youth begin to learn more about insect parts by matching the name of each part to its definition.

Facilitating the Activity

Encourage them to match what they can, and then turn to the Glossary for help.

Abdomen

(ab•doe•men) The abdomen of insects is often the largest region. The abdomen usually has nine or 10 segments or rings.

Antenna
(an•ten•na) Insects have two antennae either in front of or between the eyes. Insect antennae shapes vary. This difference helps us identify different insects.

Compound Eye
Most insects have two compound eyes. They are called compound because each eye is made up of many individual lenses.

Head
The head of insects is like an upside-down bowl. The compound eyes and antennae sit on top of or on the sides of the bowl. The mouth parts are found on the underside of the bowl

Leg
An insect's leg has several parts. The parts have unusual names, and you can see where each is found on the drawing. Try to learn at least two of these names. The coxa attaches the leg to the body. The tiny trochanter joins the coxa to the femur. Following the femur is the tibia, which is often long and slender. The tarsus, on the end of the tibia, has small segments and ends in the pretarsus. The pretarsus has claws and a pad between the claws.

Ovipositor
(O•vi•poz•it•err) The ovipositor is on the last segment of the abdomen of female grasshoppers. The female uses the ovipositor to lay eggs.

Spiracle
(spir•a•cle) Insects breathe through small holes on the side of the thorax and abdomen. These holes are spiracles. There are two pairs on the thorax and eight pairs on the abdomen in most insects.

Thorax
(thor•ax) The thorax is the middle body region between the head and the abdomen. The thorax is divided into three segments. Each segment has a pair of legs. If there are two pairs of wings, they are on the last two segments of the thorax. If there is only one pair of wings, it is located on the middle segment of the thorax.

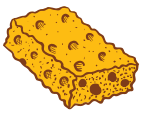
Tympanum
(tim•pa•num) The tympanum helps insects hear. You'll find it on each side of the first segment of the abdomen in grasshoppers. In crickets, the tympanum is on the inside of the front legs. Not all insects have a tympanum.

Essential Questions
Why is it important to learn the scientific terms for insect parts? (Answer: To be able to accurately discuss insect similarities and differences.)

Activity 4: Big Mouth Bugs

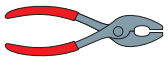
Big Picture
Insects are the most successful group of animals in the world. One reason insects are successful is that different species have adapted to many different habitats. Differences in mouth types allow insects to eat many different kinds of foods. In this activity youth match the mouth types with a common object that works much the same way.

Facilitating the Activity



Soft tissues used to mop up liquid • Sponging • House fly

Long thin mouth parts used to poke into food source • Piercing-Sucking • Mosquito



Used to tear chunks of leaves or other types of food • Chewing • Grasshopper

Long coiled tube used to suck up liquid • Siphoning • Butterfly

Connections
Insect mouth parts allow insects to eat a variety of foods. Some insects feed only on liquids such as nectar, plant sap, and blood. Others feed on solid foods such as leaves, wood, and clothes. Some feed only on plant materials, some only on animals, and still others on both plant and animal matter. Insects that have a chewing mouth type feed on plants; those with a piercing-sucking mouth type feed on blood; those with a siphoning mouth type feed on nectar from flowers; and those with a sponging mouth type feed on liquids. On the next page are some examples of different mouth types.