"Bee" an Entomologist!

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Literacy activities including hand and kinesthetic rhymes, a craft to construct an insect of body parts from recycled plastic lids, and six easily constructed sets of materials that allow preschoolers to emulate the skills of entomologists are described and related to a complete insect unit. The constructed sets of materials also provide practice in foundational mathematics skills (matching, one-to-one correspondence, counting, sorting, forming a series, and repeating a pattern) and fine motor skills using implements such as tongs.

Young children need opportunities to practice the skills that scientists use and to imagine themselves as scientists through structured activities and play. An insect investigation can provide many of these occasions. Children are naturally curious about insects because of their small size, interesting body shapes, and, in some cases, bright or iridescent colors. In this article, we discuss several authentic learning activities for an insect unit, including children's literature and poetry about insects, an insect body parts craft, and fine motor skill activities that practice the skills of entomologists, the scientists who study insects. We, five preservice teachers and an education professor, created these activities for preschoolers at our college campus daycare center. These activities comprised only part of the children's study of insects; science inquiry involving real insects such as observations of an ant colony (Echols et al., 1996; Marcoux, 1990;) raising butterflies to observe their life stages (Howley-Pfeifer, 2002), keeping and observing crickets, or finding, observing, and identifying insects in their natural environments were also part of our insect unit.

Insect Literacy Activities

To support children's reading of a wide range of print and non-print texts (National Council of Teachers of English and International Reading Association, 1996) we began a unit on insects by reading non-fiction picture books that feature colorful illustrations of insects and tell distinguishing features. There are many interesting books available. We read *Bugs are Insects* (Rockwell, 2001), which described common insects and their distinguishing characteristics: small size, three body segments (head, thorax, abdomen), six legs (on thorax), two large eyes, and usually two antennae and two pairs of wings. In another book, *On Beyond Bugs! All about Insects* (Rabe, 1999), the Cat in the Hat explained insect characteristics and adaptations for survival such as bright warning colors on a stinging wasp, camouflage of moths, foamy covering of spittlebugs, and the odor defense of ladybugs. Other popular children's books that focus on insects include Eric Carle's *The Very Hungry Caterpillar* (1987), which tells the life cycle of a butterfly and *The Very*

Quiet Cricket (1990), which features many noise-making insects.

Understanding insect body parts and insect adaptations supports the National Science Education Standards (National Research Council, 1996), which state that K-4 students should learn characteristics and life cycles of organisms. Also, the Benchmarks for Science Literacy (American Association for the Advancement of Science, 1991) indicate that by the end of second grade, children should know that plants and animals have features that help them live in different environments.

In warm weather, children may go outside and search for insects. Because some insects or other small creatures such as spiders and centipedes bite or sting, an adult should determine if each creature should be taken or not and accomplish the capture without harming the creature. Insects may be held in clear plastic containers for observation. Provide magnifying glasses so that children may observe interesting body features. Punch tiny holes for air circulation and release the creatures to their original habitat later the same day. Children may use the pictures in a field guide to insects for identification of their captured insects. Perhaps a bulletin board display of digital photos of identified insects or photocopies of field guide pictures and insect names might be made. Children's drawings of the insects should also be posted. This will allow children to refer to them as they ask questions, write, draw, or play.

Our children enjoyed poetry and hand rhymes related to insects. This supports English Language Arts Standard 2 (National Council of Teachers of English and International Reading Association, 1996), which states that students should experience many genres of literature. *Insectlopedia* (Florian, 1998) features illustrated short poems about insects, many of which are simple enough for preschoolers. Figure 1 shows a hand rhyme about a cricket that our children enjoyed and Figure 2 shows a kinesthetic rhyme in which our children acted out the spinning of a butterfly's cocoon. After reading about spittlebugs, children pretended that one finger was a spittlebug and said this rhyme as they washed their hands with liquid soap to produce lather, then rinsed their hands at the end.

Spittlebug

Spittlebug, spittlebug, spit bubbles of foam.
Rub them all over. Now they're your home!
Spittlebug, spittlebug, safe from all troubles,
Grow to adult size, then leave your bubbles.

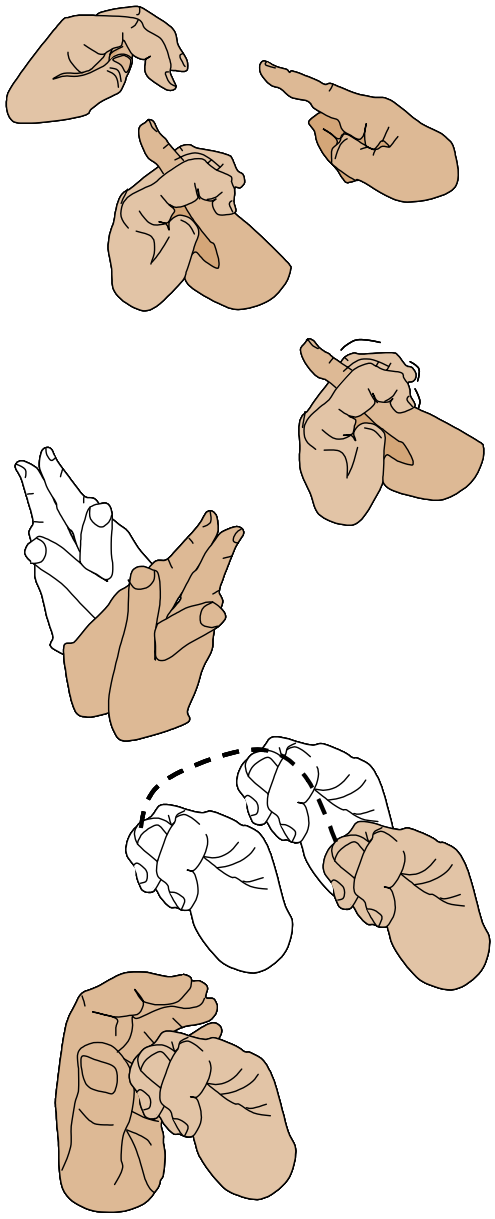
Insect Craft

Our preschoolers enjoyed inventing an insect zoo by stringing colorful recycled bottle caps and insect body parts cut from flexible plastic lids. This activity reinforced the science content children had learned about insect body parts. Figure 3 shows three of the insects we made, Figure 4 shows one insect with its body parts, and Figure 5 shows a preschooler completing the activity.

To prepare for the activity, collect lids from various containers such as shampoo or food bottles, plastic film canisters, round raisin boxes, nut cans, plastic icing cans or cream cheese lids. Use a strong craft glue to attach two faux jewel eyes to a film canister, tall bottle top or plastic capsule half from a gumball-toy dispenser, and then drill a large paper-punch-sized hole through the end. This forms the insect head. Using scissors, cut two antennae attached to a circle of plastic from one of the flexible lids. Use a hole punch to make a hole in the center of the circle for stringing. Then cut six legs attached to a circle of plastic from another larger lid. The turned edge of the lid gives the legs three-dimensional feet. Use a hole-punch to make a hole in the middle of the circle. Make wings by cutting a large

flexible lid into two semi-circles, overlapping them and trimming the two pieces. Staple them together and punch a hole for stringing. Make the thorax with two lids joined with glue to form a hollow barrel. Drill a hole in each end. Finally, choose another interesting lid for the insect's abdomen. We used some mustard bottle lids (among other types of lids), taking them apart and snipping off the interior "plug" so that we didn't need to drill.

Figure 1. Cricket hand rhyme



Cricket Hand Play

Long bent legs,

(Bend first two fingers on left hand.)

Shiny black head,

(Point finger on right hand and slide between bent fingers of left hand to make cricket.)

"Chirp, chirp chirp,"

Was what he said.

(Rub bent fingers against pointing finger to simulate cricket's legs rubbing wing to make sound.)

Here comes a snake,

Looking for the cricket;

(Slither hands from side to side.)

Cricket hops away,

(Slide thumb between two bent fingers of right hand to make cricket and make hopping motion with hand.)

And hides in a thicket.

(Place right hand against slightly cupped left hand and close left hand around it.

We prepared many of each body part in different shapes and colors so that kids could each create a unique insect by mixing and matching.

Use a long piece of plastic boondoggle or lanyard cord for the stringing. String a pony bead on the cord, fold the cord in half with the bead caught in the loop, and tie a knot next to the bead with the two ends of the cord held together. This bead will stop the first piece of the insect, the abdomen, from sliding off the doubled cord. If you unbend a large plastic-coated paperclip and carefully attach the two loose ends of the plastic cord to it by winding tape around them, the paperclip can serve as a long, blunt, stiff needle for stringing. After the abdomen, string on the thorax, wings, feet, antennae, and head. Use another pony bead at the end, and then tie two knots using the two ends of the cord held together. Snip the cord ends a couple of centimeters from the bead to complete the insect's mouth. Our preschoolers had no trouble stringing the pieces in order and naming the body parts as we went. Of course, we tied the final knots to tighten the strung pieces and complete the insects. Our children were delighted with their insect models and quickly had them buzzing and crawling around the room! Figure 6 shows a child playing with her insect model.

Fine Motor Skill Activities

The Benchmarks for Science Literacy (American Association for the Advancement of Science, 1993), in describing mathematical inquiry, state, "Concrete objects should be employed routinely to help children discover and explain symbolic relationships. Students should come to see that numbers and shapes can be used to describe many things in the world around them." The structured fine motor skill activities described here integrate skills and knowledge from three important areas: 1) science content knowledge about insects appropriate for preschoolers (identifying and discriminating between common insects); 2) foundational mathematics skills of matching, one-to-one correspondence, counting, sorting, forming a series, and following a pattern; and 3) fine motor skills using tongs, clothespin clips, or fingers (Rule & Stewart, 2002).

Figure 2. Kinesthetic Rhyme about Butterfly Life Cycle

Butterfly Stages Kinesthetic Activity

A caterpillar squirms

It moves just like a worm.

(Stand with arms against body, legs together, writhe and squirm.)

I'm spinning my cocoon,

To change my body soon.

(Swing hand in circular motion above head to spin the cocoon around body.)

But soon I'll flutter by:

A moth or butterfly!

(Extend arms out at shoulders, make back and forth flutter motion.)

Our preschoolers were from three and a half to five years old and had learned not to put non-food items into their mouths. However, each activity was closely supervised for safety and to provide important dialog about insects and the skills being practiced.

Figure 3. Three insects made by stringing parts.

Figure 4. Insect and insect parts.

Figure 5.Girl stringing insect

Figure 6. Child playing with insect.

Insect Match

There are four to six million different kinds of insects (Kirby, 2002). Because there are far too many insects to identify by memory or description, entomologists often rely on matching an insect to a photograph

to determine its species. Preschoolers practiced these discrimination skills by matching insects to images in this activity. To make the set of materials, we purchased colorful erasers featuring insects, glued digital images of the erasers (photograph or scan the erasers) on leaf and flower paper cutouts, and laminated them. Our preschoolers used their fingers or tongs to place the erasers exactly on their matching images. Interestingly, most children adjusted the orientation of each eraser to exactly cover its image. As preschoolers worked with this activity, we asked, "Can you name these insects?" "Which insects can fly?" "How do you know?"

Figure 7. Girl matching insect erasers to images.

One-to-One Correspondence and Counting

One-to-one correspondence, pairing a member of one set with each member of another set, is a necessary prerequisite to counting. To count accurately, a child must say one number for each item in a collection. We made a simple set of flowers and butterflies for this activity. The flowers were wooden cutouts purchased at a craft store and painted with acrylic paints. The butterflies were attractive plastic buttons, as shown in Figure 8. The children practiced fine motor skills by using a clothespin clip to transfer each butterfly from the cup to a flower so that each flower had exactly one butterfly.

Figure 8. Putting on butterfly on each flower to show one-to-one correspondence.

Entomologists often count insects to estimate the number in a colony or farm field. The number of spots an insect bears differentiates some species of beetles. We created an attractive counting activity by making ladybugs from Styrofoam ball halves painted red with black ball heads, chenille stick legs, and antennae. The number of spots on the ladybugs' backs varied from one to ten. Only five (one to five spots) were used for younger students (three-year-olds). Each ladybug had a corresponding numeral card (1-10) that could be placed beside it after its spots were counted.

We asked children to arrange the ladybugs in order from least to most spots. Then, children counted the spots on each ladybug and placed the corresponding numeral card next to it. Photographs of real ladybugs were used to enrich the activity. Children were asked, "Have you seen ladybugs before?" "Where?" "There are many different types of ladybugs. Some are helpful to people because they eat other insects that destroy plants." "What do you

notice about the ladybugs in these pictures?" Figure 9 shows a child completing the activity.

Figure 9. Girl counting spots on ladybugs.

Sorting Insects

Children were fascinated with an activity (shown in Figure 10) that involved sorting colorful realistic plastic insects by type. Different types such as dragonflies, houseflies, grasshoppers, bees, and crickets were identified by using a picture to mark each type. Children used small tongs to pick up and sort each insect into its correct group. Some of the insects were identical to the pictures, but others were not: they varied in size, position, or markings. We noticed that younger children had more difficulty placing insects that did not exactly match the pictures. We helped students sort the insects by asking questions like these: "Are there any insect pictures here that are similar? Which insects look *almost* like the one you have?"

Scientists often classify insects of different but related species into groups called genera. When children sort insect models by similarity, they are emulating the work of entomologists.

Figure 10. Insect sorting activity.

Forming a Series

Differentiating between insect models that vary in size and placing these items in order is the basis of the important skill of forming a series. Students first sort the insects into groups according to type. Then they make a series as they arrange the insects according to size from largest to smallest. Figures 11 and 12 show a series of bees and a series of grasshoppers.

Figure 11. Bee series.

Figure 12. Grasshopper series

Duplicating and Extending a Pattern

Science involves a search for patterns in nature. When children practice producing and extending patterns with stamps, they are preparing themselves to identify patterns in other settings. The most challenging set of insect materials we made was a set of insect stamps used to produce different patterns. We made several different pattern templates with the stamps with ABAB, ABBABB, and ABCABC repeats and laminated them. Children enjoyed stamping the patterns on strips of paper. Many of the four-year-olds copied the existing pattern correctly and several were able to extend the patterns beyond the templates.

Problem-Based Learning

There are many exciting projects connected to insects that would engage preschoolers in meaningful learning and provide opportunity for student-directed work. One or more problem-based projects should be combined with the activities we have described above. In this section, we suggest three different suitable projects.

Figure 13. Boy stamping a pattern.

Figure 14. Another boy stamping a pattern.

Problem Idea 1: Documenting Children's Exploration of Insects

The bulletin board activities mentioned earlier can be a starting point for documentation of the process of learning about insects. Begin by asking children what they know about insects and what questions they would like to investigate. Post photographs of students observing insects or making images of them, along with

illustrated stories. This may evolve into a class book of insects with records of their observations of insects (ants in the ant farm, butterflies at different stages, crickets in an aquarium, or insects outdoors) through original artwork and text.

The teacher may record and publish student insights from class or small group discussions. Children's understandings after a visit from a guest speaker (farmer or county agricultural agent, pest control professional, biology/entomology professor, insect collector) should be included. Another extension is a garden project in which children plant flowers or vegetables and make observations of the insects that are attracted to them.

Problem Idea 2: Making a Model of an Insect

Students can discover more about insect bodies by creating a large model of an insect. There are countless ways this might be accomplished, but it is best to take children's lead. Begin by asking *what* and *how* questions (Wurn, 2005): *what* insect interests them and *how* might it be made? Some possible items to make are models out of cardboard or papier-mâché, insect costumes from fabric or paper so children can pretend to become insects themselves, or stick puppets. This activity might be extended into a dramatization of insect life (flying from flower to flower, becoming caught in a spider web, building a hive, undergoing metamorphosis) and performed for other children or parents.

Problem Idea 3: An Insect Product

What product (perhaps for a holiday gift or charity bazaar item) might children make that is insect-inspired? Be sure to involve children in choosing and planning the project through class discussions spaced to allow children sufficient wait time to generate ideas and consider suggested possibilities.

Children might mix no-bake honey-peanut butter granola balls or decorate insect-shaped sugar cookies with icing and different sprinkles. They could create insect stamps from pieces of a rubber inner tube glued to a cardboard base to produce original cards, wrapping paper, bookmarks, or stationery. Insect ornaments for rear-view mirrors or windows might be made with twisted coated wire and tissue paper. Consider introducing a new art technique for this project. Children might make an insect plaque by pressing toy insects into damp sand, pouring plaster, and then painting the resulting plaque. So much can be learned about positive and negative space this way.

Conclusion

Our preschoolers found the activities described here engaging. Children liked naming insects in the picture books and acting out the poetry. The activity in which children assembled insects part by part on a string was very popular. Additionally, many children asked to complete the fine motor skill activities again and again. Preschoolers at our daycare exhibited a broad range of abilities; there was an appropriate fine motor/ early math skill activity here for each child. Some more proficient children enjoyed completing them all, obviously feeling a sense of accomplishment and competence in easily matching or sorting items and being challenged by counting to ten or extending patterns.

One child expressed that, as a result of these activities, he would like to "get to know insects better." Perhaps this will be the beginning of an exciting science career. A childhood writing project inspired Ken Edgett to pursue science as a career; (1998) the story he composed about Joe the Martian led him to a career at NASA, culminating in

his work on the Mars Rover project. Part of the excitement of being a teacher is sparking children's imaginations.

References Cited

American Association for the Advancement of Science. (1993). *Benchmarks for science literacy*. Washington, DC: Author.

Carle, E. (1987). *The very hungry caterpillar*. New York: Scholastic.

Carle, E. (1997). *The very quiet cricket.* New York : Philomel Books.

Echols, J. C., Hosoume , K., & Kopp, L. (1996). *Ant homes under the ground. Teacher's guide*. Berkeley: GEMS, Lawrence Hall of Science. (ERIC Document Reproduction Service No. ED399173)

Edgett, K. (1998). The legend of Joe the Martian, *Science and Children, 35*, 14-17.

Florian, D. (1998). *Insectlopedia*. New York: Scholastic.

Howley-Pfeifer, P. (2002) Raising butterflies from your own garden. *Young Children, 57*(6), 60-65.

Kirby, A. (2002, April 25). Insect species "fewer than thought." *BBC News Online Sci/Tech*. Retrieved September 29, 2005, from http://news.bbc.co.uk/2/low/science/nature/1949109.stm

Marcoux, M. F. (1990). Farm living. *Science and Children, 28* (3), 18-21.

National Council of Teachers of English and International Reading Association. (1996). *Standards for the English language arts*. Newark, DE: International Reading Association; Urbana, IL: National Council of Teachers of English.

National Research Council. (1996). *National Science Education Standards*. Washington, DC: National Academy Press.

Rabe, T. (1999). *On beyond bugs! All about insects.* New York: Random House.

Rockwell, A. (2001). *Bugs are insects*. New York : HarperCollins.

Rule, A. C. & Stewart, R. A. (2002). Effects of practical life materials on kindergartners' fine motor skills. *Early Childhood Education Journal, 30*(1), 9-13.

Wurm, J. P. (2005). *Working in the Reggio way: beginner's guide for American teachers*. St. Paul, MN: Redleaf Press.

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