Insect Keepers

A unit for first- and second-grade students integrates life science and technological design.

By Virginia J. Moore, Debby A. Chessin, and Becky Theobald

Insects are fascinating creatures—especially when you and your students get up close and personal with them! During a combined first- and second-grade class author study of Eric Carle, the children were captivated by the amazing organisms characterized in his quintet of books, which include *The Very Hungry Caterpillar, The Very Lonely Firefly, The Quiet Cricket, The Very Busy Spider,* and *The Very Clumsy Click Beetle.* "These are all books about insects, right?" commented one child. *What is an insect? Insects, spiders—are they the same?* Questions such as these, coupled with children's natural curiosity, initiated a classroom experience based on a process scientists use when conducting investigations and based on the stages of technological design addressed in the *National Science Education Standards* (NSES; NRC 1996).

Drawing on the NSES, we facilitated an inquiry-based investigation with an emphasis on identification of the different types of insects found in the school yard, their characteristics, their habitat, and what they eat, while engaging the children in problem-solving skills and technological design. Eric Carle was the springboard that launched us into this world of adventure and student discovery.

Brainstorm and Investigate

To determine the students' prior knowledge of insects, we brainstormed together: "Insects are like . . . ladybugs!" "I saw a grasshopper and it had large legs and big eyes!" "We have fire ants in our backyard…my mom told me not to touch them!" and "Insects are little creatures that crawl around on lots of little legs, right?" We listed the names of each response (ladybug, caterpillar, spider, and so on). From the brainstorming session, students concluded that insects should have the same basic characteristics. Students were ready to draw conclusions about the characteristics of insects.

The investigation began with some plastic insects and spiders and several magnifying glasses. The teachers talked about how scientists use magnifying glasses or hand lenses to observe things more closely. The children immediately noticed that the insects looked bigger when they used the magnifying glasses and observed the differences in appearance. "This one has six legs, but this one has eight." This was a teachable moment to focus on mathematical terms, concepts, and skills. We asked the children, "Which insect has more/less legs?" and "How many more legs does a spider have than an insect?" to reinforce the mathematical terms and concepts of *more, less,* and *more than*. In comparing numbers of legs, we invited children to simply count using one-to-one correspondence and "counting on." To extend this minilesson, children were encouraged to consider how many legs would be found on two or three insects? How about one insect and one spider? The children enjoyed the challenge—some drew pictures and some used counters to represent and solve the problems.

Other children chimed in with various differences, until finally, somewhat frustrated, Jackson said, "These are not all insects!" He based his conclusion on the differences he and his classmates observed—Jackson stated that insects must have six legs and the spider had eight legs. His classmates agreed with his conclusion so we asked the children how to find out if this was a true statement. Books and the computer were named as good sources of information and were used to determine the distinguishing characteristics of all insects (see NSTA Connection). Students learned that some other organisms we think are insects aren't really insects at all! They learned about the larger group of organisms called *arthropods*.

The excitement of our study prompted one of our students to bring in a cricket basket that she called an "insect keeper." This "insect keeper" gave the children the idea for an "insect hunt." One student quickly responded, "We all need one of those things!" This set the stage for a truly meaningful experience that was guided by the children! Their enthusiasm prompted the making of an "insect keeper" for our "insect hunt." Next, we began to tackle the stages of technological design.

Identify a Problem/Need

First, the class discussed the problem. How do we design an insect keeper? Children were invited to brainstorm ideas for creation. A discussion led to questions and ideas concerning how to observe the insects and not harm them. Students discussed how to keep the insects safe and alive and how to easily observe them. The children suggested that we use Mimi's insect keeper as just one example best suited to meet her insects' needs. Students wanted to talk about, draw sketches, manipulate objects, and think outside the box to design their own insect keeper. They realized that there are many types of models that could be designed.

Propose Solutions

"What materials would be needed to design and create a suitable insect keeper?" Sarah suggested using a shoe box that opens and closes with a top. Germaine remembered how his grandfather used a jar and punched holes in the lid for fireflies. The children prepared a list of recycled items needed to create their own insect keepers—milk cartons, detergent boxes, shoe boxes, tissue boxes, clear plastic peanut butter jars, and glass jars. The children collected different types of containers that were tested for suitability.

CAUTION

The first issue was safety. Glass and metal recycled materials were eliminated because they were potentially dangerous—glass could break and the metal could have sharp cutting edges. Items that stored household or garden chemicals (e.g., insecticides) were ruled out. Children considered suitability of different properties of the recycled items; for example, they discussed and decided that the item must "open and close easily," "let's cut into it with our classroom scissors," not be "too large or heavy to carry around," and "not be too floppy so it could stand up on its own. "

Implement Proposed Solutions

Children worked collaboratively in groups of four to discuss how to make an insect keeper with the objects they brought from home. Students had opportunities to discuss, sketch ideas, and manipulate materials. Looking at Mimi's cricket basket and the various sketches and models, the children all agreed that they needed some of that stuff—referring to the screen covering the cricket basket. Lightweight, plastic insect screen, recycled panty hose, open-weave cloth, and nylon netting are flexible, safe, and easy to cut. The children realized that all these materials provided ventilation, but some were better for viewing the insect. A few children thought about placing screen over the top of the slit in a tissue box. Others thought about placing the panty hose over the opening, but then quickly realized they could not place an insect inside if the top was completely covered. Braden said, "The opening of the milk jug might be too small." Jeremy said, "What if the insect doesn't want to go in that little bitty hole!" Then one group of children realized that the shoe box, detergent box, or oatmeal container would open and close easily, but needed what they called "some sort of window."

It became evident that the children were visualizing how they wanted the keepers to look and they were addressing problems of functionality. Children considered and evaluated what made a good container for their insect keepers. The jars were breakable, some of the containers seemed hard to open and close, and others had openings that were too small, but the children all agreed that the flexible screen or netting would provide air for the insect, a viewing component, and "maximum security!" Additional

PHOTOGRAPHS COURTESY OF THE AUTHORS

A collection of student-designed insect keepers.

viewing "windows" could be fashioned from scraps of lamination trimmings, overhead transparencies, or clear plastic food wrap.

Safety was discussed before children began cutting their materials. They were given goggles to protect their eyes; reminded to cut away from themselves; and if they had trouble, ask a teacher. Tyler quickly got his scissors and started to cut a "window" in the lid of his shoe box. Then he said, "I can cut the screen to fit my window and glue it on top." At this point several children used permanent markers to draw where they wanted a window on their containers. Children used paper clips or rulers to estimate or measure the length and width of the opening. They wanted to make sure they cut a piece of screen that was large enough to cover the opening. This allowed another teachable mathematics moment. Children were eager to measure and write down the numbers on their sketches. They had a quick refresher lesson on measuring. Some students used rulers to measure to the nearest inch and some needed paper clips to estimate length and width by placing small clips end to end and counting. The teachers stepped in with box cutters to cut the heavy cardboard on the detergent boxes and oatmeal boxes. Some children wanted their windows on the top of the container and others wanted the whole side to be a screen. Another group used masking tape around the screen and said, "This really looks more like a window!" Through this group effort, children made critical decisions about design and functionality based on individual preferences and peer suggestions.

Test Keepers

The children wanted to test the functionality of their design by going on an insect hunt. As a precautionary measure before the hunt, children's health records were checked for allergic reactions to insect bites and stings. A County Agricultural Extension Agent helped check the school yard and the perimeter for fire ants and other dangerous insects. The agent provided the class with photos of insects that could be found in this area and included the dangerous ones on a separate poster with a safety icon. The agent provided a minilesson on helpful and harmful insects and reminded the students that the insects must be released after viewing and sketching! The stress was on insects and ecology. With supervision, students discussed how they would handle insects safely. One group thought about detergent scoops so they would not have to actually touch the insects. Jeremy suggested tweezers and Kayla thought about meat tongs. It was agreed that the insects should be handled with care as not to harm the insect, themselves, or others. No one should capture insects with bare hands and everyone participating should wear gloves. One student suggested holding a paper cup upside down over the insect and sliding a sheet of paper over the opening. This way the insect could be caught safely and transported to its temporary viewing container. Children were reminded of the safety precautions on the day of the hunt and that some insects can bite and sting or have irritants on their wings.

In planning this unit, weather conditions and time of year must be a consideration. In our southern region of the country, insects become active during the spring, which has mild temperatures; so we conducted our "field test" on a warm March morning. Trusting we were now properly prepared and with keepers in hand, everyone proceeded to the playground. Our school playground has an open

Students peer into an insect keeper with magnifying glasses.

Students learn about arthropods and review the butterfly life cycle.

sandy area, a grassy knoll, and shaded areas. We also included the wooded area that surrounded our playground. For safety, manageability, and consideration of individual student's needs, children were placed in groups of three. They assumed roles such as the reporter, scientist, and project engineer. Heterogeneous groups were formed to create a balance—we wanted to be sure that reluctant or shy students were grouped together with more outspoken, outgoing students.

The children looked for insects under logs, in old tree trunks, on the ground, and under leaves. Because the playground had been checked for possible poisonous insects, children were instructed to cover an insect of interest with a clear paper cup. The "scientist" remained at the site and "the reporter" gained the attention of the teacher or other supervising adult. In addition, the poster of harmful insects was copied and distributed to each team "scientist." Photos of the helpful insects and other insects were available to help with insect identification. They found many different kinds of creatures to place in their insect keeper and even reluctant students delighted in searching and noting the many different environments in which they were found. Children decided in their field test that their keepers were functional but could use some modifications.

Evaluate Keepers

When everyone gathered back in the classroom, the children observed their insects carefully. Using a field guide as a reference, the children researched information about the insects they found to ensure that the environment created in the insect keepers met their needs. The ventilation allowed air in the keepers and insects were provided with the natural materials on which they were discovered—dead bark, grass clippings, and other items collected on the ground such as twigs, flowers, and leaves. Examples found were bark beetles crawling on a decaying log, grasshoppers and crickets in the grass, and plenty of ants in the sandy area. Discussions included information about how insects are adapted to their environment and how different climates and regions around the world have insects with different characteristics (see Internet Resources).

As a class, we agreed on the criteria to evaluate the effectiveness of the designs, but we realized the needs of the insects could only be met for a short period of time. After identifying our insects, we returned to the playground to release the insects back to their homes in their natural environment. After returning to the classroom, the children reevaluated their designs and made modifications, if needed, such as adding handles with pipe cleaners and making larger windows to view insects for another time. Groups presented their design to the class and provided explanations and then other small groups were invited to make comments and peer-evaluate. Checklists were used for self-, peer-, and instructor evaluation (Figures 1 and 2, p. 32).

Figure 1.

Self- and peer-evaluation checklist.

3 = included and correct
2 = included and partially correct
1 = not included

______ Identified the problem or need of project.

______ Identified insect, its environment, and what it needs to live.

______ Observed careful safety precautions when handling insects.

______ Worked cooperatively with group members.

______ Was the insect treated with care?

______ Was the project neat and carefully constructed?

______ Demonstrated good communication skills in writing and group presentation.

______ Helped others in group who had special needs.

Insect keeper:

______ Did it meet the needs of the individual insect?

______ Was it sturdy and unbreakable?

______ Was it easy to observe the insect?

Figure 2.

Checklist to evaluate student learning.

3 = included and correct
2 = included and partially correct
1 = not included

Rating	Criteria
	Identified general problem and needs in designing insect keepers.
	Identified insect and specific environmental needs.
	Connected the design with meeting the needs of the individual insect.
	Proposed and explained a reasonable solution to problem or needs.
	Implemented solution cooperatively; worked well with team.
	Explained—in presentation—how solution met the problem or need.
	Evaluated effectiveness of design orally or in writing.
	Revised design as necessary and reevaluated.
	Evaluated neatness and attention to detail.
	Used good communication skills in class presentation.

Reflection

Engaging students in problem solving, reasoning, and communicating in creating insect keepers helped them to connect life science topics to research and technological design strategies that scientists and engineers use in their jobs. Learning about insects in a meaningful way helped them develop a more unified understanding. Upon reflection, we learned as much as our students did—their thinking processes were revealed and we were constantly amazed at their capacity to learn and create. This unit is a "keeper" for years to come! ■

Virginia J. Moore (vjmoore@olemiss.edu) *is an assistant professor at the University of Mississippi. Debby A. Chessin is an associate professor in the teacher education program at the University of Mississippi–Tupelo. Becky Theobald is a retired first-grade teacher at Lafayette Elementary School in Oxford, Mississippi.*

Connecting to the Standards

This activity relates to the following *National Science Education Standards* (NRC 1996):

Content Standards:

Grades K–4

Standard C: Life Science

- Characteristics of organisms
- Organisms and environments

Standard E: Science and Technology

- Abilities of technological design

National Research Council (NCR). 1996. *National science education standards*. Washington, DC: National Academies Press.

References

Carle, E. 1969. *The very hungry caterpillar*. New York: Simon and Schuster.
Carle, E. 1984. *The very busy spider.* New York: Simon and Schuster.
Carle, E. 1991. *The very quiet cricket*. New York: Simon and Schuster.
Carle, E. 1995. *The very lonely firefly*. New York: Simon and Schuster.
Carle, E. 1999. *The very clumsy click beetle.* New York: Simon and Schuster.

Internet Resources

Insects of the World
www.earthlife.net/insects/six01.html
Invention at Play
http://invention.smithsonian.org/centerpieces/iap/inventors_main.html
Invertebrates
http://nationalzoo.si.edu/Animals/Invertebrates/Facts/insects/default.cfm
The Bug Game
www.ampersandpress.com

NSTA Connection
For more resources, visit *www.nsta.org/SC1003.*