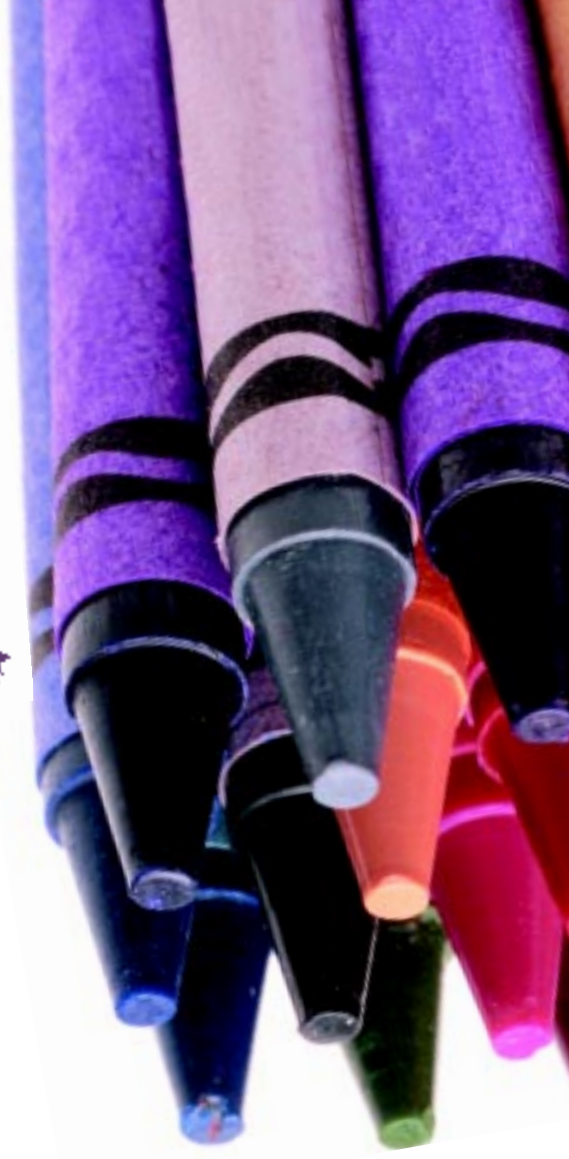
DRAWING ON STUDENT UNDERSTANDING



Using illustrations to invoke deeper thinking about animals.

By Mary Stein, Shannan McNair, and Jan Butcher

VISITORS ARE DELIGHTED and amazed when they come upon beautifully detailed drawings of a wide variety of insects in the halls of Upland Hills School. More intriguing is that these beautiful drawings were created by students ages 7–12. At the Lowry Center for Early Childhood Education, drawings of turtles with patterned shells adorn the kindergarten classroom walls. In the preschool classroom, drawings of ducks hatching from eggs are displayed along one wall and bees of various sizes line the hallway.

Drawing has always helped artists closely observe and reflect on their ideas; however, using drawing as a tool to help students develop and document more complex understandings is not often used in science instruction. Here we discuss reasons for using art as a tool for deepening scientific concept knowledge and some essential components for creating a successful learning experience.

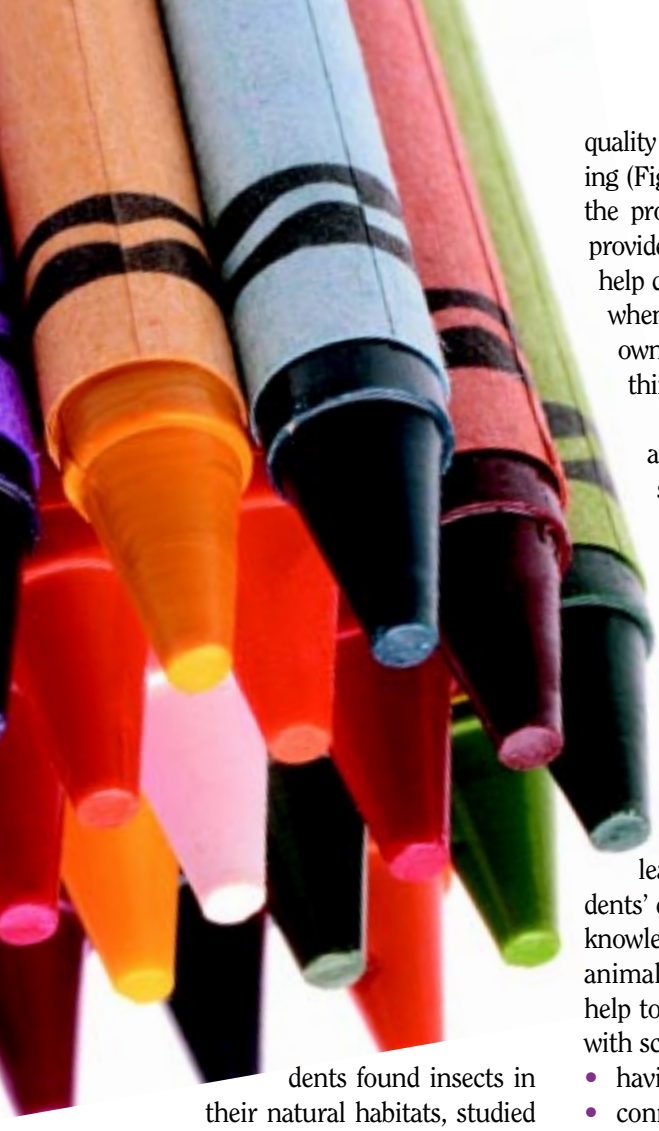
The Art and Science Connection

Art and science have often been viewed as very different—even opposing—disciplines; art being viewed as creative expression, and science being portrayed as a fact-based discipline with a lockstep approach to solving problems. This view of science does not accurately portray the creativity inherent in science, nor does it serve to help students think about science as a human endeavor (Stein and Power, 1996).

The *National Science Education Standards* (National Research Council [NRC], 1996) have emphasized science as inquiry. The standards also highlight science as a human endeavor and suggest ways that emphases in science teaching change as the standards are implemented. Using artistic expression as a tool for learning supports the standards by enhancing students' abilities to communicate science explanations, engage in science as a means for explanation, and communicate their ideas to the public and to their classmates (NRC, 1996).

Integrating Drawing with Learning About Animals

As part of a semester-long science class, coauthor Jan Butcher's students were engaged in an in-depth study of animals. The students ranged in age from 7–12 years, so she was careful to create learning experiences in which students had opportunities to further their understandings independent of developmental levels. One component of the class included the study of insects. Stu-



dents found insects in their natural habitats, studied insects from an assortment of books and field guides, observed live catches (which were later returned to their environment) in glass jars, and examined parts of insects with magnifying lenses and microscopes. The instructional activities also included readings and discussions about insect classification, life cycles, and identification.

As one part of the study, students chose an insect about which they wanted to learn. They used resources, such as books (see Student Resources at the end of this article); living insects that had been collected; specimens from a mounted insect collection; and posters and photographs to create detailed drawings of the insects. The students became completely engaged in the assignment, and the detail and quality of their drawings were astounding (Figure 1). When questioned about the process, one student's comments provided insight into how drawing can help deepen understanding: "It is like when you draw it, it becomes your own. You pay attention and draw the things you are interested in."

At the Lowry Center, preschool and kindergarten children pursue project work to learn about animals. Through a variety of experiences, they gain a greater awareness of animal names, appearances, movements, sounds, and diet. Each of the children's drawings are different, as they are representations of their individual experience and understandings of the animals. As they learn more about animals, students' drawings reflect their increased knowledge and interest in particular animals. The following suggestions help to successfully integrate drawing with science learning:

- having student ownership,
- connecting drawing to specific science learning experiences,
- providing resources,
- and providing teacher modeling.

Student Ownership

Individual students have special interests and are more likely to be engaged when they make choices to direct the learning activity. The Upland Hills students were given the opportunity to learn about and observe various insects through experiences such as field observations and exposure to literature and media before they selected which insect they would like to draw in detail.

Unlike some classroom activities in which students are all creating the same artifact, this activity was based on student interest, and the drawings and the ways students chose to represent their insects varied. Therefore, competition among students was reduced because they were all creating a unique drawing—students were not worried that a fellow student could draw a particular insect better than they could. With this variety, characteristics could be compared and contrasted.

Another component of student ownership involved

FIGURE 1. Children of all ages were able to participate in the project. These drawings represent samples from students ranging in age from 7 to 12.

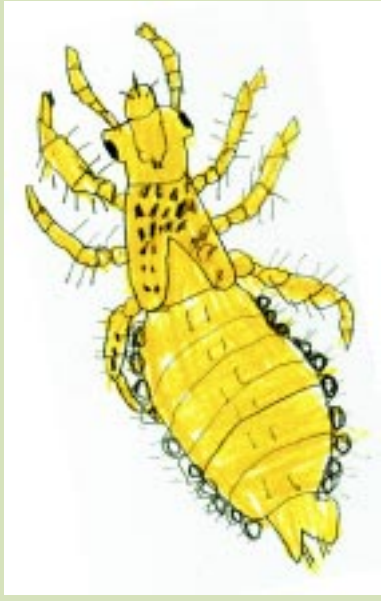
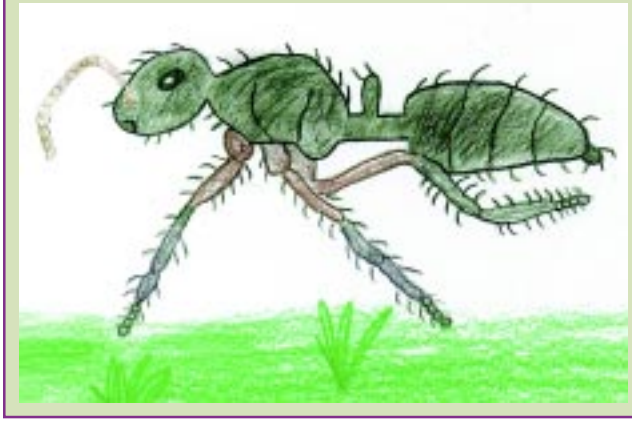


FIGURE 2. It was clear from the students' drawings that they paid attention to the details of the insect they chose to draw.



students' natural interest in drawing as a means to communicate—most students love to draw. When the students were told that their drawings would be displayed in the hall outside the classroom, their enthusiasm was clear. They worked hard, paid attention to detail, and had fun in the process (Figure 2, previous page).

Children at the Lowry Center are also encouraged to draw many things throughout the day, and a variety of materials (markers, colored pencils, paints, and crayons, and an assortment of paper) are always available for children to use. For example, they might be asked to draw their plan for the day, what they observed on a walk, an illustration of a mathematics solution, or a pictorial version of a recipe or rules to a game.

FIGURE 3. These drawings show how students included one of the lesson objectives—to learn insect body parts—within their drawings.

When children become excited about something they are exploring, there's a natural desire to represent that experience. For example, when a teacher brought baby ducklings into the kindergarten classroom, one boy immediately got a piece of paper and pencil and began drawing the ducklings. Students also use journals to record these experiences. Their drawings are an important part of class-created newsletters that give parents information about the children's experiences during the week. Children recall what they learned and what they liked and then illustrate this within the newsletter.

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Connecting Drawing to Science

These students had spent a significant amount of time learning about insects through teacher-guided experiences. They found various insects in their natural habitats, recording their observations in the field and then sharing their findings with other students in class discussions.

Through reading, observation, and class discussion students learned about insect types and characteristics, habitats, and interesting facts. They also learned about the important role insects play in our world. When students were asked to select an insect to draw, their learning experiences had not only prepared them for the activity, but had also made them eager to begin. Drawing an insect was a creative way in which students could communicate their detailed understandings. Before beginning to draw, students were asked to identify the body parts they learned about. They were also asked to think about their drawing as a way to show all the details modeled by Nancy Winslow Parker and Joan Richards Wright in the book *Bugs* (1987).

The objective of the activity was to reinforce students' learning and aid younger students who knew the body

Safety with Insects and Animals

When handling insects and animals it is very important that the teacher use safe, humane procedures. This usually requires that the teacher have access to specific information about the animals or insects that the children will be observing. The teacher should include rules and procedures for students to follow when studying animals. For example, students should wear gloves when handling specimens and should be careful not to harm the insect or animal. Specific information about the use and care of animals in the classroom can be found at the NSTA websites: *199.0.3.5/handbook/animals.asp* and *199.0.3.5/handbook/organisms.asp.*

Children learn to look for insects outdoors during the cool mornings, when the cold-blooded creatures are moving more slowly. Stinging insects are either observed from some distance, or dead specimens are gathered and placed in magnifying boxes for closer examination. Children are told not to handle spiders until an adult has identified them as harmless. Gathering insects is done with a plastic cup and a large index card—the children scoop up the insect carefully with a cup and slide the index card underneath. Insects are observed for the day and then released outdoors.

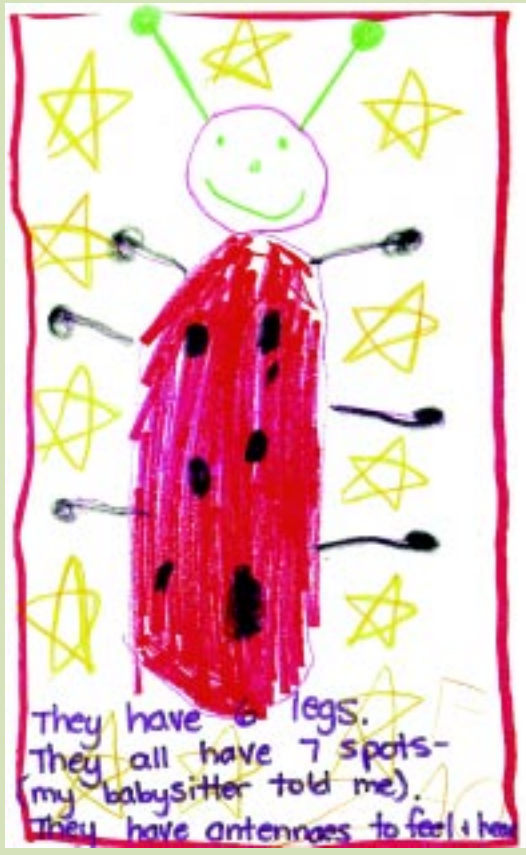
parts, but could not name them: head, thorax, abdomen, six legs (Figure 3). The experience also provided a direct learning experience: Students used their fingers, hands, and eyes to link their reading and listen to their own observations. For example, often a student had ideas about how to draw a particular insect based on field observations, but then had a desire to use additional references to check the details of their ideas.

Following special classroom presentations that exposed students to something new, children at the Lowry Center often used drawing to capture those experiences. After a presentation on rain forest animals—in which zoological professionals brought rain forest animals (macaw, clouded leopard, boa constrictor, gecko, frogs, and a sloth) into the classroom, allowing the children a close look of some of the animals—children in the classroom drew detailed pictures of sloths. The amount of interest in that particular animal was probably due to the fact that sloths look very different from more familiar animals and because none of the children had ever seen a sloth.

Following a special presentation by an entomologist, a student drew a praying mantis. Other children drew shiny beetles with impressive pincers, while some drew dragonflies and butterflies with colorful wings. Similarly, after outdoor hikes, children used drawing to represent and revisit their experiences. After a hike to a pond, one student drew the goose she had seen. Other children drew minnows and water spiders, representing what they could see around and on the surface of the water. Drawing what is underneath the surface was achieved when an aquarium was filled with water and life from a pond for classroom observation. A piece of butcher paper taped to the table holding the aquarium made a nice "tablet" for ongoing drawings of the children's observations.

Young children can often express their understanding and concept development more effectively through drawings than verbally or in written assignments. They are often more engaged in details of their understanding when they draw. Examining drawings, their emerging understandings become evident. For example, many young children will place a humanlike face on their animals (Figure 4) that is eventually replaced by a more accurate representation. When students draw both before and after an experience, the drawings can serve as an assessment tool for the teacher. For example, in a second drawing of the same insect, one student adds more detail, along with the features of wings, head, and antennae. He also shows much greater detail of the bee's stinger after he has learned about bees in the class. Other characteristics, such as the relative length of frog and turtle legs and the details of caterpillar legs, are reflected in children's representations of their animals.

FIGURE 4. Young children often draw human characteristics (face with smile) on their animals. As their understanding develops, so do their drawings.



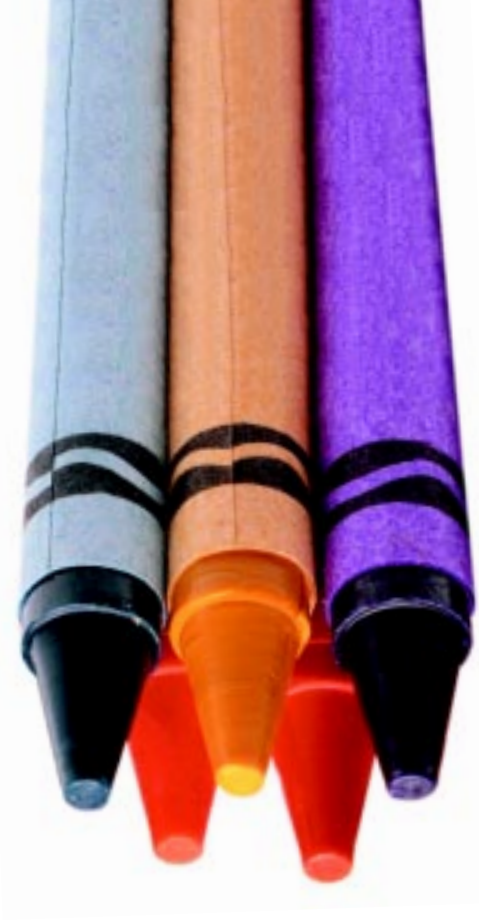
Providing Resources

It is one thing to make close observations in the field and something quite different to record your observations on paper. The drawing and writing process, in itself, encourages students to think more deeply about what they believe. It can be a way for them to continue to explore an idea or concept. Many questions begin to emerge: How many legs did it have? How many body sections? Were the legs hairy? Did the insect have antennae? What did the insect's eyes look like?

Students need various resources to help them answer the questions that emerge. In addition to live animals and insects, students had other resources that helped them find their own answers to their inquiries. Representing something that has been observed involves recalling significant details, thinking about the relative size of body parts and background in the picture, and choosing colors or making patterns that match the model. They also used scientific tools such as hand lenses and books with photographs to help them with their work (see Resources).

Teacher Modeling

At the Lowry Center teachers modeled careful observation of detail when hiking or conducting classroom exploration. They also modeled sketching things they wanted to remember, such as a nature log recorded on hikes or a child's block construction to share with a parent.



When students were drawing their insects in the classroom, the teacher also modeled the process. She was as busy as the students in learning about her insect of choice, drawing her insect using the same information, processes, and resources that students used. The teacher's role became one of modeling through example. When students observe their teacher engaged in the same activity that they are doing, it helps provide assurance that the activity is important and worthwhile and, at the same time, is a learning experience for the teacher.

Deeper Learning

These experiences show how art and drawing can be used as a tool to deepen student understanding. Just as an emphasis on "writing to learn" has emerged as a means to deepen understanding, drawing is another tool through which students can be encouraged to think deeply about what they know and **have observed.** Student questioning that arises during this process also suggests that drawing can be used to encourage inquiry. It is important to view the drawing activity as a student-centered inquiry through which students can express their creativity and find answers to their own questions; otherwise, integrating drawing may be no more useful than having students copy sentences out of a book.

People often compartmentalize their knowledge and strengths by saying things like "I'm a math and science person" or "My strength is in language and the arts." As educators we recognize these labels and narrow definitions can serve to limit what our students believe they are "good at" and eventually what they will choose to do. Broadening students' perspectives by integrating art as a tool for scientific inquiry enables students to become more reflective and aware of their understanding.

As questions emerge, students learn how to find answers to these questions and how their artistic creations can be used to communicate what they have learned. Through artistic experiences, students experience science as a human endeavor that uses the full range of human creativity and does not promote science and art as opposite ends of the continuum. As students begin to view themselves as artists, scientists, and humans unhampered by labels, all of society will reap the benefits of artistic expressions.

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The authors would like to thank the students at Upland Hills School and the Lowry Early Childhood Center for sharing their work with us.

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