A Web of Learning

Beyond "Itsy Bitsy Spider," preschool students learn science content naturally

By Marie Faust Evitt

In our preschool play yard, four-year-old Justin was yelling, "Teacher Tim, Teacher Marie, there's a spider under the slide! We need to get it!"

"What do you think we need?" Teacher Tim, my assistant, asked.

"A cup or something, so we can look at it. It's huge!" Justin shouted.

"This might work," Teacher Tim said, reaching for a magnifying container. "Show me the spider."

Justin, Teacher Tim, and a line of children rushed to the slide. Teacher Tim positioned the bottom of the container under the spider and carefully lowered the clear plastic top. Six kids crowded in. "I want to see!" "He's not sharing!!" "Eeeew." "Smash it!" "I want a turn." "I can't see."

So began our exploration into spiders and their webs. One of my biggest challenges as a preschool teacher is helping children in a group see and touch and do. Hands-on explorations are important for everyone, but essential for young children (Copple and Bredekamp 2006). How can you do hands-on explorations of spiders and their webs? Teachers certainly don't want children handling all sorts of spiders. We worry about child safety and children unwittingly hurting the spiders.

Also, the spiders are so small that it's hard for children to see them, even in a magnifying container. That day I solved the problem by suggesting that everyone go spider searching—emphasis on the searching, not touching. I told the children not to put their hands into an area they cannot see. Teacher Tim and I kept a close eye on children as they searched the school yard and classroom. Although most spiders are absolutely harmless to people, there are a few that might bite a person if threatened. Each morning before school starts, Teacher Tim does a safety check of the yard for possible hazards, so I knew the yard was safe for children to explore. They were thrilled to add their findings of spiders, webs, and insects to a giant graph that I created so that we could record and discuss our results.

Extending the Interest

"What can we do next?" I asked Teacher Tim after school.

"How about making a really big spider web?" he said. "Not like those Halloween decorations. A giant web that's more accurate, using tape so stuff will stick to it."

"And how are we going to do that?" I asked as I looked around our tiny classroom.

"Oh, we can make it outside," Tim said. "It won't be hard."

I read about spider webs (see Print Resources) and the next day at circle time I asked the children whether they'd ever seen a spider web. "There was a huge one in my garage," Elena said, "My mom knocked it down with a broom." I asked what they knew about spiders and webs and what they wanted to find out and recorded their comments to assess their prior knowledge. "How come spiders don't get caught in webs?" Blake asked. We talked about spiders and webs, including how spiders spin different kinds of silk—strong silk that isn't sticky, which they use to build the frame, and sticky silk to catch their prey.

Making a Model Web

During activity time, Teacher Tim brainstormed web-building (Figure 1) *with the kids. "What could we use to make the threads that aren't sticky?" he asked.*

"String!" "Rope!" the children said.

"And what about the sticky threads?"

"Glue?" "Gum?" "Tape!"

"Let's study these pictures to see how we can make our own web," Teacher Tim said. "I have some string."

Children compared webs in several photos, practicing their observation skills. Teacher Tim talked through a condensed version of a spider's web-building sequence (see Science 101, p. 68)—the first horizontal line, the next framing lines, then diagonal lines radiating out from the center, and finally a sticky spiral (see Internet Resources).

Teacher Tim suggested building the web at the end of our patio, out of the main traffic area so that people wouldn't walk into it. He helped the children tie top and bottom horizontal lines between two posts, then a center line with a shower curtain ring in the middle. Once the center ring was in place, he asked children to estimate how long the diagonal lines needed to be—as long as their legs? As long as the table? Children cut lengths of string, providing opportunities to assess their ability to use scissors and estimate length. Children often underestimated how long a strand needed to be so there were lots of loose ends. "That's okay," Teacher Tim said, "It looks like an insect broke some of the strands and got free. What tool could you use to measure the length of string you want?"

Then came the really fun part: adding the sticky silk.

Figure 1.

Materials for making a giant spider web.

- Illustrations of webs (see Print/Internet Resources)
- Yarn or string about 10 m to 15 m
- Clear tape
- One binder or key ring, shower curtain ring, or any hollow circle
- Construction paper
- Child-safe scissors

Figure 2.

Materials for building a giant spider.

- Photos or drawings of spiders (see Print/Internet Resources)
- Large, black plastic garbage bag
- Large paper grocery bag turned inside out to hide the writing
- Newspaper
- Clear packing tape
- 16 black, gray, or brown pipe cleaners
- 14 plastic milk jug caps or a sheet of construction paper
- Sturdy string
- Large safety pin
- Child-safe scissors

Children loved cutting tape and attaching it. We didn't worry about how many pieces of tape the children added or how far apart they spaced them. They just enjoyed filling in the web. We assessed their ability to count and observe relative amounts by asking how many pieces of tape were in one section and which sections needed more tape to catch insects. To focus their observation on their sense of touch, we asked children to close their eyes, touch different web strands, and say whether they were sticky.

They began their own impromptu investigation of web stickiness by testing whether bits of grass and leaves would stick to the tape or the string. Some drew and cut out paper insects to stick on.

"This web is going to catch really big stuff," Lucia said.

"Yeah, it can even catch bad guys," Vijay said.

"How does our web compare to the illustrations?" Teacher Tim asked. "What is the same and what is different?" The children answered immediately, "Ours is much bigger!" "Ours has a circle in the middle," demonstrating that they could compare relative sizes and notice details. Conversation

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A student looks at spiders in the magnifying container.

also revealed that the children were learning that spiders spin different kinds of silk.

It was obvious how engaged they were with their giant web when Anthony asked, "Where's the spider that made the web?"

"Yeah, we need a big spider. A really gigantic spider," said Justin, standing on his tiptoes, stretching out his arms as far as he could.

Well, of course. I should have thought of that myself! "What do you think we need to make a giant spider?" I asked.

A Giant Itsy Bitsy

I wrote down the children's ideas, gathered materials (Figure 2), and found illustrations of spider body parts so we could build a model of a spider another day.

Children gathered eagerly to build a giant spider. Pointing to the illustrations, Teacher Tim asked, "Where are the spider legs?" It's surprising to see that the legs are located on the first body part, called the *cephalothorax* (a fused head and thorax). After mentioning the technical term, we called it the *spider head* and *thorax*. They counted the legs (four on each side) and noticed how long and thin they are. Working with Teacher Tim, the children then:

1. Twisted pairs of pipe cleaners together, poked them through the paper bag head/thorax, and taped them securely on the inside.
2. Stuffed the paper bag about half full with newspaper and twisted it shut.
3. Taped on eight milk jug lids for eyes. (Children could cut construction paper circles for eyes.)
4. Crumpled up newspaper and stuffed the big garbage bag to create the abdomen.
5. Reinforced the bottom of the garbage bag with packing tape then taped on six milk jug lids to represent spinnerets.
6. Attached the two body parts by placing the twisted end of the paper bag into the open end of the garbage bag, using lots of tape to make it sturdy.

After inserting a large safety pin through the packing tape on the bottom of the spider, Teacher Tim attached a long piece of string to represent the spider silk and threaded it through a pulley attached to a patio beam so the children could take turns gently raising and lowering the spider on the web. (It's possible to play with the giant spider without a pulley by hanging the spider string over a door, a tree branch, or the playground monkey bars.) "What do you want to name our spider?" Teacher Tim asked. "Itsy Bitsy" was the unanimous decision.

The Power of Play

Playing with Itsy Bitsy and the giant web helped ease children's fear of spiders. Play is a crucial element of learning for young children (Copple and Bredekamp 2006). They raised and lowered him over and over while we sang the familiar song.

The children also used Itsy Bitsy to act out the story of *Little Miss Muffet* multiple times. Taking turns being Miss or Mister Muffet and controlling the spider helped children feel less anxious. They were so much braver than Little Miss Muffet! They also used the web and spider in their own stories, becoming invincible Spider-Man and Spider-Woman catching bad guys.

The Value of Models

Making models of the web and spider were "aha" moments for me as a teacher. I saw the power of taking something small, fragile, and frightening and making it big, robust, and playful. Spiders are scary to many people because they are silent and tiny—we don't hear them or see them coming, and they startle us. When children make a giant spider out of a garbage bag and paper bag, they see the creature taking shape so they aren't afraid. It looks silly, not scary. Then they can play with their creation and imagine they are as powerful as a superhero.

We've studied spiders many times over the years because spiders are common in our school yard. I've found that virtually all children are eager to make models of webs

and spiders. Creating the models boosts learning and understanding on many levels.

We discuss content standards about organisms and their environment as we make the models. We talk about how only a few types of spiders might bite people. People are so much bigger and more powerful than spiders. We read books and online information to learn about the important role spiders play in the ecosystem, catching insects that bother people, such as mosquitoes and flies. And we read stories such as *Be Nice to Spiders* (Graham 1967), *Itsy Bitsy, the Smart Spider* (Harper 2003), and *Anansi the Spider: A Tale from the Ashanti* (McDermott 1987) to help children consider spiders positively and in cultural context.

Models provide a fun way to learn science content naturally. Children experience how much work it takes for a spider to build a web, an important ecological lesson. They learn to appreciate the richness of language and the variety of organisms in the natural world as they build models with specific body parts and learn that spiders are not a "bug" but are a special type of animal with eight legs and two body parts called *arachnids,* which are different from insects such as butterflies, mosquitoes, and bees, which have six legs and three body parts.

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Reflecting on the modeling process by drawing provides an opportunity for assessment.

Additional Outcomes

As we study illustrations while building models, we introduce vocabulary words such as *abdomen*. Children love knowing that big word for the middle of their own bodies, too. They are excited to learn the word *spinneret*, the part of a spider's body that produces silk for webs and traveling. We label the model parts, strengthening the literacy connection.

Important spatial learning is taking place as well. While making the giant web and spider we use spatial words: attaching tape to the *center* of the web, taping the lids to the *outside* of the bag, poking the pipe cleaner legs *through* the bag, stuffing newspaper *inside* the bag. Research suggests that early attention to children's spatial thinking increases their achievement in math and science (Newcombe 2010).

Building models provides many opportunities for assessment in realistic situations that provide the most accurate picture of children's abilities (Copple and Bredekamp 2006). Assessment of tool use, sequencing, estimating, and problem solving is embedded in the activities. After building the web and spider models, children draw pictures of their creations, describe how they built the models, and dictate observations. This promotes reflection on the experience and what they have learned while building communication skills and providing an assessment of their thinking.

During group time I review children's initial comments and questions, then ask them to talk quietly with someone sitting nearby about what they know now and more questions they have. Then I call on them one at a time and write their responses. Young children are often so eager to share ideas they get frustrated while waiting their turn. Talking with a neighbor satisfies the urge to talk and helps focus thoughts. I can assess growth by comparing comments at the start of our explorations with these later observations. To further assess communication skills, I encourage children to show their families the models we construct and describe the building process.

In our experience, model-making enriches many topics. When exploring earthworms, for example, children make a giant worm by stuffing brown paper lunch bags with newspaper, taping the bags together, and covering them in plastic wrap to simulate the skin. This helps children comprehend the concept of segments and helps them understand how earthworms move.

Models also help when we are exploring something as huge as the Moon. We sculpt our sandbox into the

A larger-than-life model web needed a spider to match.

surface of the Moon, complete with craters and canyons. We make models of Mission Control and spaceships from cardboard boxes.

Whether big or small, creating models helps make topics approachable and child-size so children can be fully engaged, boosting their interest—and their learning. ■

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Print Resources

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McDermott, G. 1987. *Anansi the spider: A tale from the Ashanti*. New York: Henry Holt.

Internet Resources

How Spiders Work
http://animals.howstuffworks.com/arachnids/spider.htm

San Diego Zoo's Animal Bytes: Spider
www.sandiegozoo.org/animalbytes/t-spider.html

References

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Connecting to the Standards

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

Content Standards

Grades K–12

Unifying Concepts and Processes

- Evidence, models, and explanation

Grades K–4

Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry

Standard C: Life Science

- Characteristics of organisms
- Organisms and environments

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