CHAPTER 8

Setting the Stage for Inquiry
by Doris Ash

Doing inquiry in the elementary classroom takes practice and preparation—for the teacher as well as for the student. Where does a teacher begin? This essay follows the experiences of one second-grade teacher who has devised her own set of techniques for preparing her students and their environment for doing inquiry investigations.

For the past 4 years, Wendy, a second-grade teacher with many students of limited English-speaking ability, has been grappling with teaching inquiry in her classroom. Each year, she develops new strategies based on the events of the past year.

When I entered her classroom recently, I was struck by the fact that there were a number of established structures in place that allowed her students to do investigations in small groups. The children were also well versed in the variety of skills and strategies that allow them to begin to plan and carry out their own investigations. I asked Wendy how she'd come to design this arrangement, what the components were, and how she prepared her students. The strategies and skills that she had learned, I realized, could help any teacher interested in inquiry set the stage for inquiry investigations in his or her own classroom.

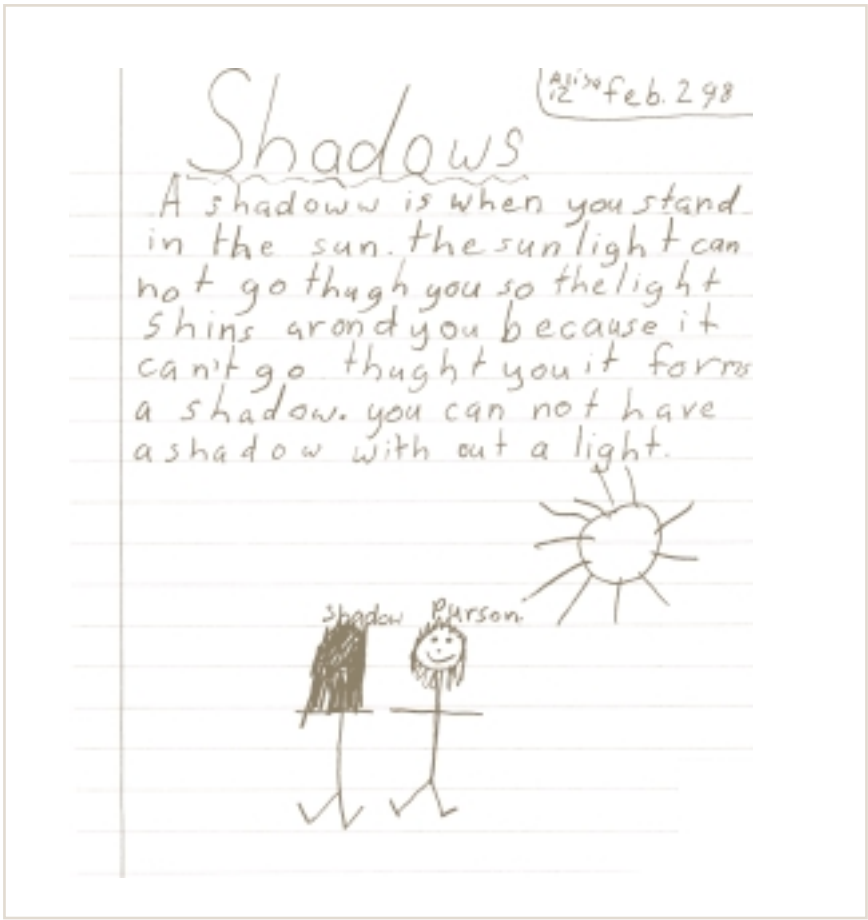
Wendy's plan to support inquiry in the classroom began with three essential elements. She had put in place:

- a definite progression of preparatory events,
- different student expectations at the different phases of inquiry, and
- the ability to pull together all the pieces near the end of the year.

Getting Ready for Inquiry

At the beginning of the school year, Wendy begins by preparing her students for doing inquiry investigations. For the students, the result is an increased ability to ask questions, observe, listen to each other, get along socially, and collaborate.

Building Socialization and Communication Skills. Throughout the school year (but most especially during the first few months), the students practice their social skills, through activities designed to help them learn how to work well with one another. At first, Wendy is more worried about student communication—talking among themselves, listening to each other, respecting ideas and opinions—than she is about content.



"Shadows," courtesy Betty Mott's third-grade classroom, Tamalpais Valley School, Mill Valley, California.

Activities that support these skills build up the classroom climate and culture, and Wendy keeps careful note of how these activities work. As the children begin to work collaboratively, she organizes them first in pairs, and then in larger groups.

Modeling and Practicing. All the while, Wendy talks constantly with the children. She finds out what they understand and where they're getting stuck, and helps them through any problems they may be having. She also helps them understand the particular usefulness of any skill they may be using. For example, she may model the meaning of the terms "most" and "least" for the children. After some time practicing the use of these terms, she will help the children use their new terminology in other areas of content.

Process Skills. In order to prepare her students for doing investigations, Wendy spends a considerable amount of time helping them develop their process skills—illuminating the processes they will be using to do inquiry. For example, she purposefully plans activities that include observation and questioning, and she models how they work. The students get to try out their own observing and questioning skills, and reflect on what they're doing. In this way, Wendy helps her students practice both social skills and process skills, but always in a particular content area. Early in the school year, she also has her students work in journals. They practice describing, observing, and keeping records in science, as well as in other curriculum areas.

Questioning. Wendy allows extra development time for her students to practice the skill of questioning. At the end of every activity, she allots time for asking questions. At the beginning of the year, she models appropriate question forms, focusing on the "five Ws" of who, what, when, where, and why. At first the children practice asking open-ended questions; later they ask more specific science questions. This process builds gradually, until the students are comfortable asking such questions as: "What will happen if I do this?" and "How long will it take if I do that?" Over time, the students also learn how to categorize their questions into groups. A question may be investigable or it may already be answered, or a student may be unsure about the category it fits into. Again, Wendy models how this is done, and investigable questions are selected for future investigation.

Language Use. Wendy always models the use of appropriate scientific language with her second graders. At the beginning of the

year, this may involve the use of words for specialized materials, such as hand lenses or petri dishes. Over time, she infuses additional terms into the conversation as they naturally appear in investigations. As a result, words such as vibration and pitch become part of the students' day-to-day vocabulary.

The "Do, Talk, Reflect, Write" Cycle. When the students begin to explore science topics, there is a regular pattern of events that they can expect. First they are asked to do the activity. Then they gather together to share their ideas and questions. They reflect on their work, and then write their ideas and questions into their science notebooks. Using this process, each activity takes about 90 minutes. During the group share time, Wendy assesses the students' ideas and offers suggestions and challenges for further work. Essentially, she redirects their work based on this formative assessment of events.

Trying It Out for the First Time

Once the foundation pieces for inquiry have been put in place, Wendy integrates them in a particular way. She usually begins by selecting an instructional unit, a prepackaged set of sequenced activities designed to develop a progression of content ideas and skills in the classroom.

During my visit, a variety of musical instruments (from a "Sound" module) were set out on tables placed around the room. Wendy asked her students, who were in small groups of twos and threes, to try out the instruments. While they were experimenting, Wendy asked a number of open-ended questions. She asked the students to think about what they had to do to get each instrument to make a sound, and then what they had to do to change that sound. She asked them to notice the materials the instruments were made of, and if the instruments had any special features. These questions were designed to stimulate the children's thinking. They also served as formative assessment, providing information about what the children could do and what they still needed to learn. Working together, the children had a variety of experiences, shared ideas, suggestions, and points of view.

When Wendy examines an instructional unit for an activity like this, she selects some basic scientific concepts she wants to highlight—such as the idea that sound is a vibration, which is one focus of the module. She is explicit about the process skills that she wishes to reinforce with her class.

She reflects back to them what she sees them doing, with comments such as, "I noticed that you decided to compare the sound the big tuning fork makes with the sound that the little tuning fork makes…." Over time, the children begin using the words she has modeled and internalizing the requisite concepts and skills.

During the first lessons, the children all generally do the same activities. With each activity they follow the basic "do, talk, reflect, write" cycle. During these beginning phases, children focus on the same process skills and move toward selected big ideas. After each round, the children come together to discuss what they have discovered, and then they write down their results. By doing this, Wendy helps students develop their abilities to observe closely and ask questions within a defined content area.

With each new cycle, Wendy allows students more and more latitude to expand their experimentation—for example, in asking questions or making predictions. At the beginning of the year, Wendy directs activities, modeling each of them explicitly. In the middle of the year, she begins to allow students to take more responsibility, as appropriate. As they work, she carefully monitors small- and large-group discussions in order to discover where the children's abilities and interests lie. This structure gives her a manageable way to allow students to work more independently.

Doing the Investigation

Later in the year, students are ready to undertake independent investigations. By this point, they have had the opportunity to work on developing their social and process skills, they know how to use individual discoveries and observations to build up their conceptual understandings, and they know that their observations and questions have value. Now they are ready to embark on independent small-group investigations.

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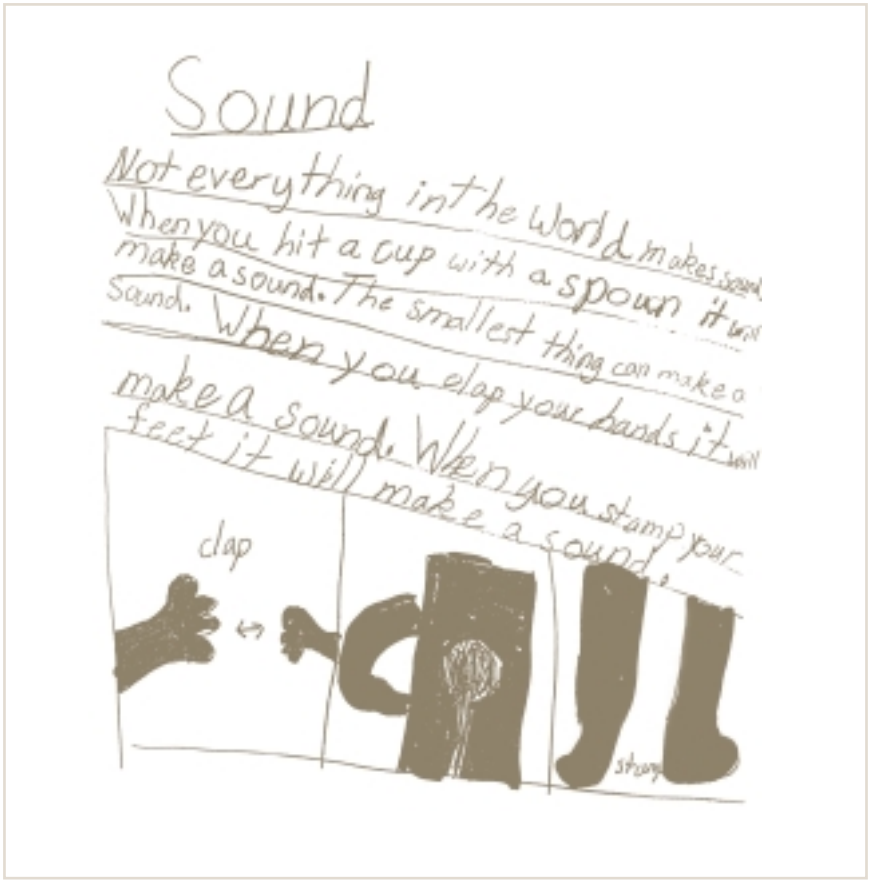
After the initial activities that set the stage for any inquiry, the students are encouraged to ask questions. Wendy groups together similar questions to emphasize relationships between ideas. The children with the same interests form small groups and begin working together. They begin their planning collaboratively by listing the materials they will need and fine-tuning the designs of their investigations. This takes time.

Later in the year, Wendy's students may be working on a unit about mixtures and solutions. In one activity, students explore the characteristics of acids and bases. They have done some preliminary exploring with vinegar and baking soda, and they introduce new materials, such as salt or



"Sound," courtesy Wendy Cheong's second-grade classroom, Jefferson School, San Francisco Unified School District, San Francisco, California.

baking soda, as they go along. Wendy uses this as an opportunity to explore the idea of variables.

Along the way, as the group looks at their own questions, Wendy helps them refine their investigation and reflect on the nature of the activities involved. If they get stuck or need help, she models ways to ask new questions. As the children work, Wendy moves through the room. She spends time talking over the investigation with each group, clarifying materials and procedures and asking questions such as "Why did you choose to wrap that rock in paper?" or "Can you think of another way you could mix those two liquids together?" She paraphrases students' statements back to them and helps get them talking about what they are doing, and why. "Tell me about your exploration," she says, or "Is there something in particular you're thinking about?" This gives Wendy the opportunity to assess the children's understanding and reasoning.

To create a minimum of disorder, materials are strategically set around the room, and the children use them based upon their investigation plans. The lessons are structured so that a variety of materials are available, and Wendy guides the children's access to them.

In the first full inquiry of the year, Wendy maintains an emphasis on the use of process skills (questioning, predicting, hypothesizing, investigating, observing, interpreting, and communicating) while planning and conducting experiments, and knowing how to make sense of an activity. At this point, concepts such as acids and bases are important, but the major emphasis is on knowing how to perform a "fair test"—that is, knowing and thinking about variables. During the second inquiry investigation in the year, the emphasis shifts towards the larger scientific concepts, as well as testing the notion of variables.

Wendy's process is a good example of how one teacher has adapted inquiry teaching in a simple and effective way, even with young students. When the children leave Wendy's class at the end of the year, not only have they learned information about science, but they've also been introduced to skills that will help them become active, independent learners for the rest of their lives.

EXTENDING KITS TO DO INQUIRY

by Fred Stein

Many teachers use instructional materials that come prepackaged in the form of activity kits. Most kits provide students with valuable materials and a carefully chosen sequence of related activities that support the learning of science concepts and certain process skills. Kits can provide excellent starting points for teachers interested in moving toward more student-driven investigations. But kits don't often give students the opportunity to propose, plan, and carry out their own investigations. If a kit is taught as written, the questions and procedures are often predefined. The strategies here are just a few examples of ways in which teachers can extend kits to provide more opportunities for their students to do inquiry investigations.

Teachers can "open up" kits by giving students the chance to work from their areas of interest, and at the same time validating their questions and enriching their learning. By determining what questions interest students, teachers can give emphasis to those interests, referencing students' questions as they are addressed by the kit's activities. Teachers can also extend or even modify activities to address these interests and questions.

Another strategy focuses on directions a class can take at the conclusion of a unit. After using their kit, teachers can have students do short investigations based on questions that came up from their kit-based work. This method is a valuable way to reinforce and extend some of a kit's concepts. For instance, teachers can give students the opportunity to revisit one of a kit's core activities and think about next steps they would take: what they would want to investigate, what materials they would need to do their investigations, and how they would use those materials. After carrying out short investigations, teachers could have students share their discoveries with one another.

A third method is for teachers to have students base inquiry investigations on the scientific concepts presented by the kit. Teachers can begin by choosing one activity from the kit that is intriguing and that involves some of the kit's major concepts, and then help encourage students' questions about it. Students who are already proficient in using appropriate process skills can then be asked to carry out extended investigations based on these questions. Teachers can then group students according to their interests and ask them to propose plans for investigations, which they carry out after consulting with the teacher. After they complete their investigations, students can share their results, distributing the knowledge they have gained to the rest of the class. The teacher can use the remaining kit activities as needed to reinforce or complement what the students have learned so far.

Each of these approaches uses a kit as the basis for developing, identifying, and pursuing students' interests about the kit's materials and concepts. The process also helps teachers assess student progress. Working this way allows teachers to offer students ways to explore a complex subject in greater depth than they would normally be able to do.

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