1 The Essence of Continuous Assessment

WHAT IS CONTINUOUS ASSESSMENT?

> *"Continuous Assessment is listening closely to students, observing students as they are engaged in learning, as they are engaged with materials, and trying to understand what they understand."*
>
> —Program Associate

Every day, you, as teachers everywhere do, observe your students, listen to their conversations, and talk with them about their ideas, writings, and drawings. Always striving to understand and expand students' thinking and skills, you use the daily input you gather to decide what next steps you'll take to support their growth. When these things are done in a purposeful way, they become a kind of formative assessment we refer to as "continuous" assessment or "everyday" assessment.

> *"The best way I can describe continuous assessment is the process of learning to be with children in such a way as to understand their thinking so that you can continually expand, challenge, and scaffold each child's experiences."*
>
> —Kindergarten Teacher

We choose the phrase "continuous assessment" to describe a type of assessment that happens in real time rather than at the end of a week or unit. It is continuous/ongoing because it involves daily observations and documentation of students' work while they are engaged in inquiry investigations and discussions. This is not to say you are conducting assessments all of the time, but rather, you weave assessment strategies in with your facilitation techniques. At times, your assessment is indistinguishable from your teaching.

> *"Teachers see that they don't have to wait until the unit is done and the test is given and graded to find out how their students are doing. They can gather the information right then and there while the students are exploring their ideas."*
>
> —Project Co-Director

In the Educational Testing Service (1995) document, *Capturing the Power Classroom Assessment,* this type of assessment is referred to as Naturalistic assessment: "Naturalistic assessment refers to evaluation that is rooted in the natural setting of the classroom and involves observation of student performance in an informal context." The description goes on to say that documentation is the method for this type of assessment. "Documentation, a naturalistic method, is a process of classroom observation and record keeping over time, across learning modalities, and in coordination with colleagues."

In the inquiry-based classroom, continuous assessment is crucial to student learning. Because students' understanding and skills unfold naturally as they work with materials and explore their ideas through investigations and discussions, it is important that you be present. Being there to interact with your students both as a facilitator and an assessor, you can gather important information while the students are engaged in inquiry. Keeping track of this information and analyzing the data can help you to understand your students' thinking, and to monitor their growth in the concepts, processes, and dispositions of science. When students become "stuck" and need guidance, your intervention can help them delve deeper and move forward in their understanding. You can be as inquiry-oriented as your students by observing, recording, analyzing, and using the data you collect as they do their work.

> Continuous assessment has a lot to do with how well inquiry-based science actually functions, not only in the classroom but also in the real scientific world. It's about how scientists actually go about doing good science—in a process-oriented and inquiry-oriented way.
>
> As a teacher, you guide students along a path to the content that you want them to master down the line. It is not something where you can just intervene here or there, and think they are going to end up at the right point, in terms of national standards or whatever. You've got to be there, listening to them, interacting with them when they are manipulating the equipment, and have a question about it or are starting to see

a pattern. That is the time for you to reinforce those ideas, especially if they are ideas that are important down the line for conceptual understanding. (Bob Prigo, in *The Essence of Continuous Assessment,* Center for Education and Professional Development, 2001)

CONTINUOUS ASSESSMENT IN THE "BIG PICTURE" OF ASSESSMENT

> *"One component of my teaching that I have developed through my work with continuous assessment is that I have started documenting what we are doing in my science classroom. The biggest 'aha' for me was that assessment isn't an end; it's a beginning, prompting further investigation by the kids. Assessment didn't turn out to be a culminating thing like I thought it was, but a starting point for more learning."*
>
> —Third-Grade Teacher

The more this teacher practiced using continuous assessment in her classroom, the more she realized that assessment isn't always an end activity. Many of us, because of our own education experience, have the conception of assessment as an end-of-the-week, or end-of-a-unit event. Many of us make assumptions when we hear the word *assessmen*t. We assume that assessment means there is an item or task to complete; that assessment(s) happen after the students have completed a strand or unit, or outside of the time devoted for instruction; that assessments are given to see if the student "got it"; that an assessment is often in the form of a product, artifact, or investigation that the teacher evaluates outside of classroom time; and that good assessment(s) often comes from an external source. Many of us think of assessment as traditional tests and quizzes. Students often think of assessment as

What do you think of when you hear the word *assessment?* At a recent conference, we began our presentation by asking the participants—teachers, administrators, professional development providers—if they would write a few words or phrases that come to mind when they hear the word assessment. Here are some samples: Assessment = Traditional Tests, . . . the culmination of the unit, . . . standardized, . . . formal, . . . unpopular, . . . students' perspective: good–bad, pass–fail, . . . pressure for kids to do well; and if you don't do well, there is no going back, . . . value judgment, . . . paper and pencil, . . . high stakes, . . . state proficiency, . . . standardized statewide tests, . . . confusion over the use of classroom assessment, . . . SAT, . . . report card, . . . grades. Once these ideas were out in the open and recognized as commonly held conceptions, we continued our session and offered our participants a chance to learn about and experience continuous assessment as an important strategy to practice while students are engaged in normal everyday work.

a practice conducted for the sole purpose of grading, yet the feedback they get from these assessments often identifies for them what they don't know, rather than what they do know. Often times the words *assessment* and *testing* are used synonymously, while the reality is that assessment has many different meanings depending on the context.

Continuous assessment is *formative* by nature. The key here is that the collection of data about students' understanding of concepts, and their practice of the processes and habits of mind of science happens while the students are engaged in learning. When these data are used by teachers to make decisions about next steps for a student or group of students, to plan instruction, and to improve their own practice, they help *inform* as well as *form* practice; this is *formative assessment.* When data are collected at certain planned intervals, and are used to show what students have achieved to date, they provide a *summary* of progress over time, and are *summative* assessment. Both types of assessment are important and useful for the purposes they serve. The greatest benefit to students is when there is alignment of what is valued in science learning across the continuum of formative to summative assessments. In the section in Chapter 5 titled, "Challenge: How Do I Integrate Continuous Assessment With Traditional Testing?" you will see a more detailed discussion of differences between and value of both formative and summative assessments.

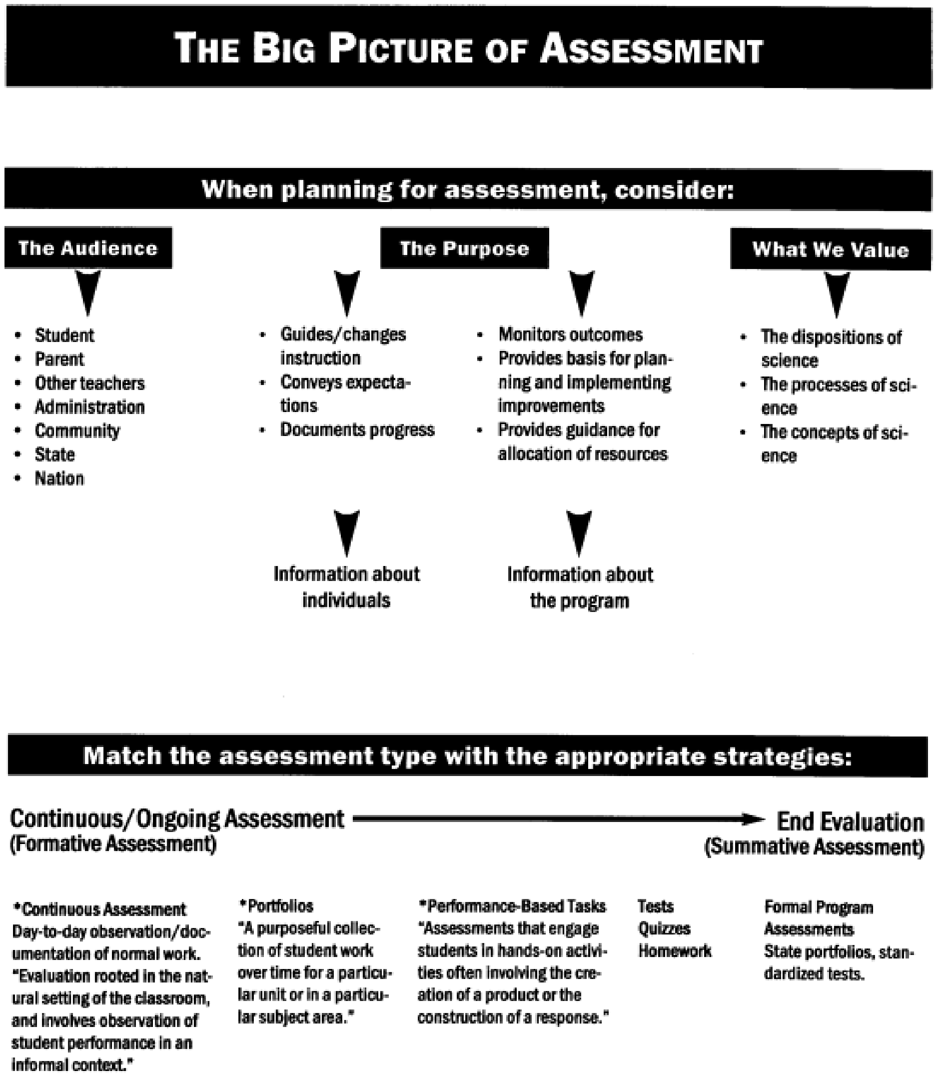
To see what continuous assessment is and is not, and to recognize that different assessments have different purposes and result in different types of data, see the graphic in Figure 1.1. It describes the niche this type of assessment has in the continuum of assessment types.

In the top section of the graphic are three important things to consider when planning for assessment: the purpose of the assessment; who is using the information (the audience); and what is being assessed, or, as we like to say, what is valued in science learning. Being clear about whether you are seeking information about individuals or information about the program will help you to match the assessment type to the appropriate strategies.

The Purpose and Use of Your Assessment

The use of the information you gather about student learning is what is important here. Are you gathering information in order to provide documentation of individual students' progress over time? Is it a way to convey your expectations to students? Will the information be used to guide or change your instruction? If it is any one or all of these, then the focus of your assessment is formative and is on individual students. If, instead, the data are collected for the purpose of monitoring the outcomes of a body of students and are to be used to provide a basis for planning and implementing improvements to a program, or to provide guidance for the allocation of resources to the program, materials, or

Figure 1.1 The Big Picture of Assessment



* Adapted from Focus 28, Capturing the Power of Classroom Assessment, Educational Testing Service, Princeton, NJ, 08541-0001. 1995.

the school building, then the assessment is most likely to be summative and to focus on the program.

What You Value (What You Want Students to Know and Be Able to Do)

Much research and attention to best practice has led to development of the *National Science Education Standards (*National Research Council, 1996; see more in Chapter 4). You will recognize these standards as the targets for student learning in science and therefore what ought to be taught and assessed:

- *The dispositions of science* (such as being able to use evidence to propose explanations, being willing to revise explanations as a result of new evidence or discussion, being open-minded, being able to persevere, etc.)
- *The processes of science* (such as identifying questions, observing systematically, measuring accurately, controlling variables, etc.)
- *The concepts of science* (such as, properties of matter, diversity and adaptations of organisms, the Earth in the solar system, etc.)

The Audience

If the audience is at the national or state level, the evaluation strategy will be summative and more formal than classroom assessment. Standardized tests and state portfolios are examples. If the audience is the students themselves, parents, or other teachers, then you will find it most helpful to use formative assessment strategies such as continuous assessment.

At the bottom of Figure 1.1 you will see a continuum of assessment strategies. Continuous assessment has its own unique position in the overarching concept of assessment. It does not take the place of, but rather provides completion to a continuum of assessment that starts in the classroom and culminates in formal program assessments. Continuous assessment is placed at the far left end of the continuum as formative assessment. What this kind of assessment looks like and how its data can be used is the subject of the remainder of this book. Placed on the far right of the continuum are examples of summative assessment, including formal program assessments like standardized tests. In between these endpoints we see some strategies such as portfolios and performance tasks—types of assessment that have both formative and summative characteristics.

Challenges may arise when one or another of the elements in the big picture is not considered; or when an assessment is used in a way for which it wasn't intended, such as choosing an assessment that can't provide the information needed or using the information in a way that doesn't match the purpose, the audience, or what is valued. For example:

- *Purpose:* A school district may send students' standardized test information to parents as a courtesy. Even if district administrators state that the results are used only to inform programmatic decisions, parents often interpret these results as the definitive say on their individual child's progress in the subject areas tested. Having received these results from the school district, parents may also assume that other assessments, such as classroom assessments, are less important than the standardized test.

- *What is valued:* A teacher may do an assessment but may not be clear about what she is looking for, that is, what she values as "good" science learning. In this case, she may pay attention to only the most easily observed information, such as how well students work together, whether they know facts, and whether or not their science notebooks are neat. In contrast, if she were clear about the processes and dispositions of science she wanted students to practice and the concept(s) she wanted them to develop, she could focus on these in her assessment and gather information about student progress that would be much more useful to both her and her students.

- *Use:* When a district places a heavy emphasis on test scores to evaluate teachers, they send a message that the standardized test score is what really counts. Standardized test scores are not meant to evaluate individual teachers, but to inform program decisions. Teacher evaluation should take place within the school setting and between the school or district administrator and the teacher. Another result of the use of these test scores to evaluate teachers is that teachers may start to put less emphasis on their own classroom data and begin to teach to the test.

Quite a bit has been written about formal or summative assessment. The focus of this book will be on continuous assessment—the day-to-day observation/documentation of normal work for the purpose of moving students forward in their understanding and practice of science.

TECHNIQUES AND TOOLS FOR CONTINUOUS ASSESSMENT

The techniques of continuous assessment listed below will not necessarily be new to you. In fact, you will recognize these techniques not only as good assessment strategies, but as excellent teaching strategies as well. These, when combined with some familiar tools, help you to gain and document information about students' understanding of science concepts, the practice of scientific dispositions, and the development of the processes of science (see Resource A for user-friendly charts that summarize the techniques and tools of continuous assessment).

Techniques for Continuous Assessment

- *Sitting and Listening Closely*. Teachers watch the behavior of the students at work and listen closely to their conversations. At times, they may ask questions during conversations to clarify details about what students are doing and what they are finding out, but otherwise do not interfere.
- *Purposeful Questioning*. Teachers ask open-ended questions that enable students to reflect on, clarify, and explain their thinking and actions and give their point of view during investigations.
- *Sharing New Material/Information*. Teachers give students new materials or information to help them move deeper in their inquiry.
- *Sparking Science Conversations.* Teachers structure opportunities for whole-class, group, and individual conversations to explore the learning occurring through the inquiry.
- *Student Self-Assessment.* Students conduct routine reflection.

Tools for Continuous Assessment

- Teacher's observation notes
- Videotape
- Audiotape
- Photographs
- Student science writing
- Artifacts and products of student science

You will see a more thorough description of the benefits of each technique and tool, and an explanation of how each can be used to enhance student learning, in Chapter 3, "Techniques and Tools for Facilitating Inquiry and Collecting Student Data."

WHY USE CONTINUOUS ASSESSMENT?

Black and Wiliam (1998) use the metaphor of the classroom as a "black box" to describe what the public, school administrators, and the media often focus on regarding assessment. In this model, inputs (e.g., curriculum requirements) go into the black box and outputs (e.g., test results) come out. There is often little attention paid to whether the students actually understand the concepts, but rather whether they can pass the tests. In contrast, continuous assessment uses the black box of the classroom as the site for an ongoing inquiry into what and how the students are learning. This collection of data, in conjunction with performance tasks and standardized tests, provides a more complete picture of what students have learned.

There are a number of benefits for you and your students when you start using continuous assessment in your classroom. The following is a sample of the benefits and reasons this type of assessment is so useful (a summary of these benefits is found in Resource A under "The Purposes and Uses of Continuous Assessment").

Serves Instruction While Monitoring Growth

By using continuous assessment strategies and tools, you are able to capture what your students are doing with and without your intervention. Whether you are a removed observer or sitting and listening closely as you watch your students and document what you see, the information you glean helps you to determine next steps to support their growth. At times this support is immediate and happens in the moment you suggest a new material for a group of students to use in their investigation, or help a student further understand a concept by offering an explanation.

> Students in a fourth-grade class were given several liquids to explore. They tried various "tests" on these liquids. One group of three girls was working on an investigation to see what size and shape a drop of liquid would become when dropped on a piece of waxed paper. When the teacher stopped by to see what they were doing, she noticed that the girls were making a data table of the liquids, including the diameter of each drop. They were using such words as "small," "medium," and "large" when it came to recording the diameter or size of the "spread" of each of the drops. The teacher left the group for a minute and came back with rulers in her hand. She made the suggestion to the group to, "See what you can tell me about each of the drops by using this measuring instrument." In this case, the teacher seized the moment to teach these students about the importance of accuracy and the use of tools in scientific measurement.

Other times the information helps you decide what to do the next day. For instance, hearing a misconception like "all fruits float" helps you to think what you might do the next day. You may decide to bring in some different fruits to initiate an investigation to help the students see that while many fruits float, some sink, and to consider the factors of floating and sinking. This discussion may lead to other questions such as, "Do fruits that float, still float without their skins?" "What about vegetables? Do they sink or float?"

Consideration of how you might support your students' development over the long term is another benefit/use of the data you collect. You may also find yourself thinking about what you will do in next week's class or during next month's unit.

Enhances Student Learning

You will find you are able to catalyze "deeper" thinking and understanding as students reflect on their own investigative processes and experiences. Reviewing a portion of a videotape of class discussion is one example. After watching a video clip of an initial scientist meeting at the beginning of a unit on motion, one student was able to describe a change in his conceptual understanding. He described what he originally thought would happen when his group rolled balls of various sizes and weights on linoleum and carpeted floors. Because the more massive balls rolled farther on the linoleum floor, he thought that the more massive balls would also roll farther on the rug. What he actually found out is that in some cases the less massive balls rolled farther than the more massive balls. After talking with the students in his group, other students, and the teacher, and continuing to experiment further, he determined that the rug provided a certain amount of interference for objects of different masses. He compared what he thought at the beginning of the unit to what he now understood about mass and friction, and the data he collected showing how the resistance of the rug affected the results of the trials on both surfaces. During the process, he was beginning to think that the angle of the "ramp" might also have something to do with his results.

Using continuous assessment data to provide timely feedback throughout an investigation encourages students to expand their thinking, modify their investigation, and revise their ideas while the investigation is still going on.

Continuous assessment also enhances student learning in an inquiry-based classroom when the students and teacher work together to articulate a vision of "good science." Just as the national committees did when developing the National Science Education Standards, when you work with your students in their science investigations, you can help them see that what they're doing is considered "good science." They begin to realize that when they make a careful observation, when they make a table to organize their data, when they communicate their findings to the group, they are doing the same things that scientists do. Pointing these things out helps students recognize what is valued so they can work toward concrete learning goals and identify their own growth. If you keep a list of these indicators posted, you'll find that in addition to it being a guide for you, the students can use the list to self-assess how they are doing in science. In Chapter 2, you will see a similar list that teachers in a professional development institute created for themselves to refer to "on the run."

Enables Teachers' Professional Growth

By striving to better understand and guide students' thinking and learning, you can become more reflective about your own practices and refine your teaching strategies. As a result of looking closely and sharing experiences with colleagues, you can develop new perspectives about how teaching, assessment, and learning interact and consider adjustments you might make in your teaching. One teacher reported,

> *"I was getting to each group and taking notes about each individual. But it didn't feel right. I felt rushed and not very effective. So I reflected and talked it over with my fellow teachers in my science study group and began to see what was happening. . . . I needed to stop being a walking report card data collector and get back to facilitating good science practices."*
>
> —Fourth-Grade Teacher

As soon as this teacher became more of a researcher into what her students were thinking and doing and less of a collector of information for end evaluations such as report cards, she was able to reflect on her practice. She decided to focus on becoming a better listener.

Provides Information to Report Students' Progress

While the main purpose of using continuous assessment techniques is to inform decision making and professional practice, there is a strong summative component to this formative process. Over time the documentation of the evolution of students' understandings, skills, and science dispositions can be accumulated and can provide a wealth of data for reporting student progress and development for occasions such as report cards, science nights, and parent conferences.

As you read on in this book, you will see that we use the context of science inquiry to describe this type of formative assessment. Continuous assessment is not a specialized method designed for science alone. Rather, its methodology is useful for all areas of learning.

The *National Science Education Standards* (NRC, l996), *Classroom Assessment*, and the *National Science Education Standards* (NRC, 2001), call for changes in the ways we assess. These NSES (National Science Education Standards) reports call for less emphasis on (but not the exclusion of) traditional views of assessment, and more emphasis on assessment of what is highly valued in learning: rich, well-structured knowledge, and understanding and reasoning. They also call for the involvement of students in their own assessment. See Resource B, Table B.1, "NSES: Changing Emphases for Assessment," for a summary of these Standards.

In the following chapters we discuss many aspects of continuous assessment: the context for continuous assessment, teaching beliefs that support it, the techniques and tools, and the analysis that promotes the use of the data. We will begin to address the challenges of facilitating inquiry and continuous assessment. And finally, we offer you a description of professional development that will help you use children's everyday experiences to inform instruction and your own teaching practices.

Vignette
Continuous Assessment

ONE TEACHER'S EXPERIENCE

Even though I was an experienced fifth- and sixth-grade teacher, teaching science was a challenge. I had little interest in science, and had avoided those courses throughout high school and college. This was especially true of the physical science content. I knew little of the content I was supposed to cover.

Learning to Facilitate Inquiry

One of the first units I was supposed to teach was a motion unit, complete with balls, ramps, and other materials. Throughout the unit, groups of students rotated through several stations, each with a card explaining how they should explore the materials. I only focused on making sure that the students saw the intended phenomena that each material could provide. When students used the materials in ways other than what was described by the task card, I was quick to correct them. I asked them not to explore other ideas or share their station results with others. I didn't want to spoil the surprise for groups who had not yet worked on a certain activity, presuming that only one surprise was possible—the one directed by the activity card.

When I visited one of my students at one of the motion stations, she asked, "What is supposed to happen with this stuff?"

"The card just asks that you observe what happens," I replied.

"Well, Mr. Clarke, it's supposed to do something that you want or else you wouldn't have us doing it."

At the end of the unit, I must admit that I found myself bored by my students' oral reports, which reflected the same structured approach that I had used in the investigation. Could this boredom have been a result of simply going through the motions of what I imagined was inquiry? If I was trying to get students to just verify science concepts, was that real inquiry? Was that real science? I wondered how to change the mechanical feel toward science that both my students and I experienced.

For a science unit later that year, I decided to use some assessment approaches (that I had learned in the Continuous Assessment in Science Project), which focused on student conceptual development. I began by brainstorming a list of questions about my science teaching and about my students:

What ideas do my students have about particular science concepts?

How do these change over time?

How can I begin to really listen to the ideas of my students?

How do student conceptions change as a result of focused inquiry investigations?

How can I stimulate more free-flowing discussions in science—ones that are more like the discussions we have when my students talk about characters in books or current events?

How can I stimulate both classroom science inquiry and student discussion?

How can I extend the initial stages of the inquiry process into fuller, more complete investigations?

I was interested both in conducting my own inquiry into my students' understanding of science concepts and in trying to refine my methods of science teaching. My plan was to use my list of questions as a guide.

I started by planning a "waves circus," a set of activity stations with hands-on materials and written questions that encourage exploration of these materials. As I unpacked the Slinkies, ropes, sheets, rubber hoses, and water troughs for the next day's opening lesson, I started jiggling things around to satisfy my own curiosity. As I shook a long silver spring attached to an eyehook I realized that I was doing my own inquiry, learning about waves! I noticed that I could generate different patterns depending on how quickly or slowly I shook the stretched spring. I watched the waves rebounding back at me when they reached the opposite wall. This was fun! Maybe, I thought, my students could learn about wave patterns and have fun too.

Recording and Reflecting on Continuous Assessment Data

I announced on the first day of the explorations: "Now that I've shown you all the materials and you know who your partners are, your directions for each of the stations will be the same. Use the materials to make waves and observe what happens. Discuss what you see and what you learn with your partners. I won't be interrupting you much. Instead, I'll be watching and listening and trying to write down what I hear you talking about." The students wriggled with anticipation.

Although my students worked in small groups and at workstations like they had in the motion study, there the similarities ended. Gone were my precise direction cards. Gone was the expectation that the students on this first day would record voluminous observations as they were working with the materials. Gone was my frenetic Groucho Marx–like classroom management, where I had darted from group to group asking clipped questions and hearing, but not truly listening to their ideas, all the while scanning the room for behaviors that weren't in sync with the direction cards. Small groups of students circulated from station to station reading the task cards, and interacting with Slinkies, jump ropes, water in long troughs, an oscilloscope (that I borrowed from a teacher at a nearby college), and with objects placed on a stretched bed sheet. As the student scientists went about their tasks, I listened closely to their comments, and made notes as I went along. I also used a tape recording to capture students discussing their investigations.

We even invented a way of talking about student investigations that we called "Tell and Show," which allowed students who hadn't been to a particular station to see what other students had learned there. Students insisted on both talking about and demonstrating what they had learned when they reported out to the class. By doing this we generated a class list of questions:

What is really moving in a wave?

How do waves begin?

What are different kinds of waves?

What are some differences and similarities of waves in various media?

Just what are waves and how do they move?

That night when I transcribed the notes onto the computer, I was amazed by the comments of one student, Josh. During the activity Josh had actually directed the group, advised on how to use the bed sheet, and had offered an idea about extending the activity. Here it was mid-February and the first time I'd heard Josh's "science voice" all year! It wasn't just that Josh spoke so much as it was the ease with which he participated and the confidence he displayed that caused me to reassess my view of his skills. Until that day I had witnessed a kid who was not interested much in school, displayed language limitations, and was unexcited about the possibilities of learning (or at least those that had, to date, been offered to him).

In the waves exploration, Josh's true voice had been heard sharing ideas about something in which he was clearly interested. I had a hunch that one reason he was so much more involved was because I wasn't speaking with or asking questions of the group. By remaining silent, I got out of my students' way and let the conversation develop among them and at their own level.

Over the next week, I transcribed some of the discussion comments from my notes and the audiotape. I made copies for the students, and they were very enthusiastic about seeing their spoken words in print. Even the slower readers devoured the transcriptions, scanning the text for their own names and their comments.

After a few mornings of the groups circulating through the wave stations, each group selected a station with which to begin a more extended inquiry investigation, articulating their own "investigable questions" and collecting data to test their ideas. One group was interested in finding a way to record the movement of a wave on paper. They decided to attach a Magic Marker to a Slinky in such a way that, as they generated various Slinky waves, the marker jiggled designs on some paper. I could hear their excitement as they honed their Slinky jiggling technique and discussed ways to improve the performance of their invention in order to get better and better "jiggle tracks," some of which I recorded with a video camera.

Sharing Continuous Assessment Data With Students to Deepen Conceptual Understanding

One of the students asked if she could watch the video that we had been making, which had picked up the wave motion when one student moved the Slinky back and forth on the rug and when another student twisted the Slinky like a giant screw. As the students watched the tape, I encouraged them to look carefully at both the Slinky movement and the drawings, and they began to point out the different kinds of waves and the various ways that the marker moved. Afterwards, they wrote and drew diagrams in their "science jotters" explaining the various wave patterns. These jotters encourage many forms of keeping investigation notes: pictures with labels, lists, and charts, along with written comments. The data took on a life of their own as students became more and more engaged with thinking about what had happened. Their reflections caused us to ask, "What could be measured in a given wave? What words do scientists use to describe waves? How else could you generate a Slinky wave?"

Toward the end of the unit we had a science discussion group where I asked the class to look at the transcripts that I had made of their initial wave discussions. I asked, "Have any of your ideas changed?"

"Oh yes," said one girl, and pointed out a remark she had originally made. "Remember what I thought then? It's on page two; the part about waves bouncing off each other? Well, now I think they pass through each other because of the experiment we did today." The discussion was animated, and the students often used examples from their investigations to show what they had learned.

Reflecting on Continuous Assessment Data to Inform Teacher Practice

Reflecting on what had occurred over the few weeks of this investigation was an exciting and humbling experience. Exciting, because I vaguely sensed being on the verge of possibilities—for myself as a teacher, and for the students and me as learners. It was humbling, and oddly unnerving, because I wasn't involved in the students' learning experiences in any of the ways that I had been throughout my previous teaching experience. I remembered that my visceral reaction of excitement was tempered by my discomfort in having been actively "invisible" at times in the classroom that first morning. My own understanding of the role of a teacher in a science-learning environment was in a state of disequilibrium.

My science teaching is now layered with daily discussions among my students and me, and among the students themselves, and with self-reflective moments in their writings and drawings that lead to new questions, further investigations, and conceptual growth. I have begun to witness students taking risks and shedding old ideas, and replacing them with newer, more sophisticated understandings that are based on real-life experiences.

My classroom has become one that honors reflection, revisiting, and documenting. I have begun to open up my students to their own ideas, as well as to the concepts, processes, and dispositions of science. I had explored student knowledge that I never knew existed, and learned more effective ways to facilitate an inquiry approach. As a result of my success in this new approach, assessment has become a driving force behind my teaching rather than an end product.

I continue to tinker with and improve my strategies, and have found that the habit of science discussion has become well established. This habit was evident in a recent language arts class when we were preparing to begin a biography of Benjamin Franklin. When I got to the part about "preparing a question about the book that could lead to a good discussion with your classmates," my student Eliza asked: "Like we do for science discussion groups?"

"Yes," I replied with a chuckle, "Like we do for science groups."

—Graham Clarke,
Sixth-Grade Teacher