Teachers studying teaching and learning in their own classrooms

EDUCATIONAL RESEARCH, usually pursued by university scholars, is making its way into the daily life of classroom teachers. Teachers are taking advantage of their data-rich classrooms, where they already spend 160 to 180 days a year, by conducting what is known as action research or teacher research.

During this process, teachers engage in systematic inquiry to answer specific questions about student learning, instructional strategies, social dynamics, or an array of other classroom-centered issues. The results of this research inform others of important findings obtained from actual classrooms and therefore help bridge the notorious gap between theory and practice.

In science education, action research is seen as a way to broaden existing research and promote the exchange of knowledge between university researchers and teachers. Recently, the National Science Teachers Association Board of Directors made recommendations for action research in science education (Kyle et al., 1991) that included:

- Creating an investigative society;
- Engaging teachers as action researchers;
- Conducting research close to the classroom; and
- Pursuing collaborative research between individuals in universities and schools.

Action research can be divided into two types (Feldman, 1996). The first involves teachers reflecting on their teaching and student learning. Data are collected throughout the school year from student work samples, anecdotal notes, and teacher reflections. The second type of action research is a problem-solving process in which teachers focus on a problem and ask questions about it. A plan is developed to collect more information about the problem, draw conclusions, and potentially solve the problem.

RESEARCH IN THE CLASSROOM

Given the importance of action research, we present herein ways to begin action research using the problem-solving process described by Feldman and a step-by-step organizer adapted from How to Conduct Collaborative Action Research, by Richard Sagor (1992), to help teachers conduct classroom investigations. The steps are pre-

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sent in sequential order, yet teachers may occasionally need to cycle back and forth between different steps. This often happens during data collection and data analysis. For example, the teacher may want to collect only a small bit of data and analyze it before collecting additional data.

Teachers who feel uneasy about conducting research alone should seek support within their school from a fellow teacher or an administrator. These individuals can lend moral support or participate in the entire research process. If teachers have difficulty locating interested individuals in their school, they should contact a local university. Many professors and education graduate students are interested in helping teachers conduct classroom research.

**Step 1—Getting Started.** The teacher should become familiar with action research studies published in educational journals. These studies serve as excellent examples of action research. Books containing examples of action research and even reactions from teachers who participated in the process are also excellent resources (see Resources, page 52).

**Step 2—Problem Formulation.** The teacher identifies important classroom-centered problems and issues by stating questions about them: "What differences are observed in student motivation and achievement when activities lead students outside the formal classroom environment?" or "Will informal field trips to zoos and parks improve student achievement and attitudes about science?"

The most important thing to remember during this step is to make questions specific. The teacher should also make sure an answer is attainable. One way to find a focusing question or questions is to record what is happening in the classroom in a journal. The teacher uses the journal to describe problems encountered and possible interventions. This may take a few months, but it will help organize thoughts and focus the investigation.

**Step 3—Data Planning and Collection.** After formulating the questions to answer, the teacher determines what population of students to involve in the study. Will the study include only one ninth-grade class or all ninth-grade classes? Will one class be manipulated in some way while another class serves as a control group?

Next, the teacher determines what data are needed and decides what type of data to collect. For example, if the teacher is investigating whether trips to informal environments will improve science attitude, he or she may want to:
Conduct interviews before and after the trip with students and parents about informal learning experiences (qualitative data collection),

Provide questionnaires before and after the trip (probably quantitative, unless open-ended questions are included), and

Examine student portfolios (qualitative) and course grades (quantitative).

Varied types of data collection will enrich the research results. If the teacher only includes questionnaires when inquiring about student attitude and achievement from learning in informal environments, important information that could have been obtained from interviews, portfolios, and grading is lost. If possible, the teacher should use three different data sources.

**Step 4—Stating Conclusions/Sharing Results.** After gathering and analyzing information, the teacher determines what was learned as a result of the inquiry. It is essential for teachers to share information obtained from their studies to inform other teachers who stand to benefit from the results. This is part of one's professional obligation as both a researcher and a teacher.

**Step 5—Implementing Changes.** This step is presented as the “final” step, yet there is nothing final about it. This step entails putting the results to work in the classroom, which can be accomplished on a small scale by changing instructional strategies or, on a larger scale, by using the results to contribute to a schoolwide improvement plan.

**PLANNING RESEARCH: AN EXAMPLE**

The following example shows how the process can be put into action.

**Problem Formulation.** During the first semester, students seem bored with traditional science labs. Many students are failing science and only partially completing labs during class. Several students inform the teacher that the labs are boring and regimented. The teacher has heard much about constructivism and decides that this problem can be solved by answering the following question: Will creating labs that are more open-ended increase student motivation and achievement?

**Data Planning and Collection.** The teacher decides that a time frame of three months is necessary to collect information and answer the question. The first month will be used to restructure labs, the second month to institute new open-ended labs and collect information, and the third month to analyze data. Data collection will include interviews from randomly selected students who are unmotivated and performing poorly and from students who are performing better. In addition, test results and work samples will be compared to previous scores and products. Interview and test data will be collected two times, but work samples will be collected each week.

**Data Analysis.** The teacher decides that analysis will begin as soon as he or she has a collection from each type of data. For example, after the first interview, the first test scores, and several weekly samples, the teacher will begin early analysis. All information is organized into a matrix showing the results of interviews, previous tests, previous class work, new tests, and new class work (Figure 1). The data are then compared as a whole. The teacher looks for patterns within the group of students selected.

**Stating Conclusions/Sharing Information.** The teacher finds that most students performed better using open-ended labs than using traditional labs taken directly from the textbook. Most students indicated that they enjoyed the labs more and were more excited about coming to class.

**ACTION RESEARCH RESOURCES FOR CLASSROOM TEACHERS**


Because the information collected and analyzed showed that students greatly benefited from open-ended constructivist labs, this information should be shared with the faculty. Also, these outcomes could contribute to a presentation at a local or national science education conference.

**Implementing Changes.** The success of these labs has convinced the teacher that open-ended labs would be nicely integrated into the total science program. The teacher can still use many traditional labs that have proven to be effective. In addition, other teachers in the science department express an interest in changing some of their labs. The teachers decide to restructure at least three labs this year and then share them with one another. This would result in each teacher having nine new open-ended labs.

**BRAINSTORMING AT DEPARTMENT MEETINGS**

As teachers move into the action research process, they will find it helpful to engage in brainstorming and reflective interviewing, which can easily take place in team or department meetings. According to Sagar (1992), as teachers develop possible action research projects, reflective interviewing can help answer the following questions that may be helpful during the planning of research projects:

- Does the issue involve the teaching and learning process?
- Does the teacher have influence concerning the issue?
- Is the teacher both concerned and interested in the issue?

This brainstorming activity serves as an organizer for planning and ultimately leads to important questions that become the springboard for action research projects.

The following questions are examples of questions that developed as a result of brainstorming and reflective interviewing.

- What are some possible causes of lack of student participation in school science fairs?
- What strategies are most effective for improving student writing skills in content area subjects such as science?
- Why are female students less motivated during science labs? What are possible methods and/or activities that can be implemented to motivate these students?
- What are some possible solutions to address the lack of technology in our math and science classrooms? What are possible sources for funding—local business and industry? How can we effectively share computers with other teachers?

**LOOKING AHEAD**

As teachers, we must step up and take responsibility for informing others of important information found within our classrooms. This can be effectively done by systematically collecting and analyzing data, then presenting valuable information to the school or district, or in national journals.

Teaching as a closed-door endeavor must end as we enter the twenty-first century. Most teachers have important information to share. By sharing their findings, teachers become empowered as both learners and inquirers, and discrepancies between university research and actual practice may cease, improving science education for generations of students to come. ☞

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What Counts As Teacher Research? Investigating the Scientific and Mathematical Ideas of Children From Culturally Diverse Backgrounds

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In this article we address questions raised by the research methods used in teacher research by exploring a particular approach to teacher research. This approach is based in teachers' concerns with underachieving children, particularly those who come from diverse cultural and linguistic backgrounds. It grows out of the work of the Brookline Teacher Research Seminar (BTRS), the Chèche Konnen Center (CKC), and the Prospect Center and Archives (Prospect). We report on a conference where experienced teacher researchers from these groups met with newcomers to explore classroom data together. Our goal is to describe what the experienced practitioners had to say to the newcomers.

Children's questions teachers' questions close attention
Shifting perspective altered practice
New ways of thinking about learning.

Gallas, 1999, p. 47

It is clear to anyone familiar with the growing field of teacher research that individual teachers engage in research for many different reasons, collect many different kinds of data, and use many different kinds of methods. What teachers find important and useful to investigate has helped to shape educational research during the past decade.

At the same time, many questions remain among both teachers and researchers about the research methods used in teacher research, about the role of theory in it, about what people are doing when they do it and the values behind it, and about how it can best be used. There have been a
number of attempts to address these questions from both within and outside teacher research (e.g., Anderson, Herr, & Nihlen, 1994; Cochransmith & Lytle, 1999; Dressman, 2000; Fecho & Allen, 2003; Hubbard & Power, 1993; Huberman, 1996; Lampert, 2000).

In this article, we hope to add to this growing research literature by presenting a particular approach to the practice of teacher research. This approach, which is associated with the Brookline Teacher Research Group (BTRS) and the Chèche Konnen Center (CKC), is based in teachers' concerns about issues of equity and on their worries about underachieving children, particularly those from culturally diverse backgrounds. As Fecho and Allen (2003) write in a review of teacher research addressed to issues of equity, "the process of inquiry unfolds from the teacher's sense that the dissonance within his or her practice must be embraced and interrogated" (p. 3). This focus on what Fecho and Allen call dissonance, on what we often call puzzling children, forms the central practice of the teacher research that we open to scrutiny in this article. We do so by reporting on a conference where experienced teacher researchers met with newcomers to the practice to explore data with them. Our goal is to describe what these experienced practitioners had to say to the newcomers (i.e., the important principles and practices on which these teacher researchers focused).

A CONFERENCE ON TEACHER RESEARCH IN SCIENCE AND MATHEMATICS

Approximately 35 teacher researchers and 5 university-based researchers participated in a conference titled Toward the Development of Teacher Research in December, 2000. The conference was funded by The Spencer Foundation, The National Science Foundation, and the U.S. Department of Education Office of Educational Research and Improvement (OERI). Approximately half of the participants were experienced in teacher research, and half were newcomers to the practice. The experienced participants represented various research groups, including BTRS, CKC, Fairfax County Teacher Researcher Group, Philadelphia Teachers' Learning Cooperative, and Prospect Archives and Center for Education and Research (Prospect).

The conference was structured by joint exploration of children's classroom talk and work, with particular attention to the talk and work of puzzling children. A puzzling child is one the teacher finds difficult to understand. As stated previously, often, but not always, this is a child who is not doing well academically, or who is from a linguistic, cultural, ethnic, or socioeconomic background that differs from the teacher's, or the child has
both characteristics. Documenting the talk and work of puzzling children in an attempt to understand the learning situation from their point of view is a central practice of teachers associated with BTRS, CKC, and Prospect. At the conference each participant who was presently teaching was asked to bring data documenting the work or talk of a puzzling child in his or her classroom. These data included many different ways of documenting children’s work (e.g., audiotaping and videotaping and transcribing children’s talk or collecting children’s written work, such as notebooks, drawings, and paintings). In documenting such work, the teacher researcher is able to “stop time” (Phillips, in press) and study aspects of the child’s talk and activity at length and from multiple perspectives.

We chose to focus this conference on teacher research in science and mathematics for two reasons. Although most teacher research has taken place in the context of language and literacy, the number of teachers interested in pursuing moments of dissonance in science and mathematics is growing. We hoped that by providing these teacher researchers with a forum for their work, a critical mass of interest might develop. Moreover, because schools often have circumscribed what counts as scientific or mathematical the range of students’ ideas, talk, and activity can be restricted in the classroom. The students most likely to experience this are, in our experience, students from diverse cultural and linguistic backgrounds. Thus, we were interested in engaging a conversation among teacher researchers about dilemmas and questions they had in this regard.

Experienced practitioners interacted with newcomers in three formats. First, all conference participants brought data to roundtables, in which six to eight colleagues were present. These sessions were informal in nature, lasting anywhere from 45–90 minutes, and allowed experienced practitioners and newcomers to exchange ideas freely. Second, a handful of experienced teacher researchers were asked to present in-progress analyses of their data more formally, in sessions we called Festivals of Data, following the tradition of the Penn Ethnography Forum. Because this data was part of an ongoing study, it was more focused, that is, more organized around a particular concern or idea than the data presented in the roundtables. We wanted novice teacher researchers to experience the stage of a study where there is a developed question and approach but where the data are still largely open to interpretation. Third, we asked Karen Gallas, a nationally recognized teacher researcher, to give a keynote address on a long-term research project she was doing on the role of the imagination in learning. Karen had conclusions to share, as well as further questions and a developed method for her inquiries.
PRACTICES OF TEACHER RESEARCH

We organized this article into three parts, each exploring an important practice that we observed experienced teacher researchers articulating and enacting.

1. Analyzing data: What do experienced teacher researchers do when they look at data?

2. Using knowledge of the discipline: What role does their own learning play in the research they do?

3. Using research literature: How do they use academic research in their own studies?

To explore each practice, we consider examples from the conference.

ANALYZING DATA: WHAT DO EXPERIENCED TEACHER RESEARCHERS DO WHEN THEY LOOK AT DATA?

In this section we examine a conversation that occurred when Pam Heimann, a 3rd-year teacher from Prince George’s County, Maryland, and a relative newcomer to teacher research presented data at a roundtable. Pam presented a concern, a puzzle; although it is not a research question per se, the experienced teacher researchers in her group advised her, through both words and actions, on what she might do to develop a research stance toward her puzzling students and toward her ways of teaching them. In doing so they demonstrated what it means to take seriously the idea that students are always making sense. We present two examples from this conversation to explore what experienced teacher researchers looked for in Pam’s data with this commitment in mind and how the group addressed her concerns.

A Sense of Number

For the second year in a row Pam had chosen to teach the lowest achieving fourth-graders in the school. Many of these children are poor, and most speak Spanish at home. Pam brought data to her roundtable on an aspect of her mathematics teaching that she has found particularly frustrating—in her own words, the children’s lack of number sense. By number sense, she means the feeling for what numbers are in life, the sense of the relationships among numbers that people develop over time and experience and that allows many of us to add 10 and 7 or subtract 1 from 8 without computation. Pam is a person who likes math and enjoys teaching it, but she was disturbed and puzzled by the ways in which many of her students,
who were able to make use of algorithms to add, subtract, and even multiply, nevertheless seemed to know little about the relationships among numbers.

To collect data for the conference, Pam designed a math assignment; she wrote problems that asked the students to add, for example, 1 to 5,499, and 10 to 362. She wrote the problems horizontally rather than in a way that suggested computation. She wanted her students to hold the numbers in their heads and to use their understanding of number to arrive at the answers.

She directed the roundtable participants to look at data from Jorge, whose first language is Spanish. This child, she stated, has great difficulty with these problems. The group began to explore Jorge’s written answers to the questions. Almost the first comment from the group was that the answers from Jorge could not be haphazard. They appeared to be carefully chosen. What was he thinking when he chose this number or that? There was a flurry of activity as the experienced participants began working together to figure out what the child might have been thinking based on what he wrote. They asked questions, such as “Did Pam know what he said while he was doing this?” and looked at erasures to try to discern his thinking process as well as the final answer.

One participant suggested that in one problem where the child had been told to add 1 to 6,399, he may have tried to add 1 everywhere he could. Thus his answer was 7,499 to B. in the following:

B. 6,399 Teacher’s Script: Add one to this number.

He added 1 to 6 and then to 3, but he may have decided that he was unable to add 1 to the 9s because he would not have gotten a one-digit answer. Another participant realized that some of the child’s answers may have been the result of adding vertically, which meant in this case that he added together numbers from different problems.

A BTRS member suggested that the next question to ask might be, “Just where do Pam’s students show number sense?” Earlier, Pam had reported that they have some significant abilities—she had mentioned a conversation on fractions that had come up spontaneously in her classroom. An important part of the teacher researcher’s practice, the BTRS member continued, is to find out where the students are able to think in this way and then use this information to consider why they cannot in other situations. Pam responded by saying she has noticed that her students are fluent at figuring out their place in line, how many places back they are when they line up for lunch, who will get served first, and who will have to wait and for how long. She characterized this kind of thinking as “number line thinking.” Experienced participants suggested that Pam keep exploring
what her children say and do in such contexts to understand both the mathematical task itself more fully and the children's various abilities at dealing with it.

"Like far"

Pam next brought up Jorge's behavior in another context—he was given the number 50 and asked to suggest a number that was very far away from 50. He suggested the number 72. Pam and another teacher also working with Jorge were astonished that he would come up with a number like 72 when he could have said a million or a thousand, something they considered to be really far away. In response, a CKC member related the story of a child who, similar to Jorge, was learning English and is from a family with a limited history of schooling. This child was involved in the task of writing possible “trips” for others to take along a piece of adding machine tape stuck to the floor of his classroom. The tape was 9 m long. The trips children wrote included such directions as walk three steps, twirl, crawl two, run to the end. This child, after watching a number of trips, was suddenly struck by the way that, when you had traveled 5 m down the tape, if you turned around and looked back, 5 m was, as he said with a wondering emphasis, “like far” from the start. Five meters, which is not a long way by most standards, seemed very far in this context.

The group then talked about the role of context in determining what we consider far. Again, they wondered, what was Pam’s student thinking, what context did he have in his mind, when he chose 72? Does Jorge know nothing about far in terms of numbers? Or does Jorge’s answer call for a further investigation into his thoughts on far and also on the ways we use far and the role of various contexts in determining what counts as far, as various participants suggested?

In these examples, the experienced participants demonstrated their belief that children are always making some kind of sense, that they are always working with a meaning that is reasonable in the context they perceive themselves to be in. Therefore, the major suggestion made to Pam by these experienced participants was that she get more information from the children on their ideas, either by observing the children or by exploring their ideas with them in more depth. It is also important to note that experienced participants suggested that exploring the children’s ideas further as part of a mathematical or a scientific conversation was at the same time a way to develop children’s understanding. These practitioners did not view their research as separate from their teaching.
USING KNOWLEDGE OF THE DISCIPLINE: WHAT ROLE DOES PARTICIPANTS' OWN LEARNING PLAY IN THE RESEARCH THEY DO?

Experienced participants spent significant time thinking about scientific and mathematical ideas, even as they considered data on what children said and did. Questions came, often insistently, about, for example, the meaning of an idea in biology, or the way a piece of graphing technology works, or the different kinds of perspective used in maps and paintings and how they work. We present two examples of this kind of thinking because we believe they reflect an attitude toward knowing in science and mathematics that these experienced practitioners find to be crucial to their research.

*Positioning Myself as a Learner*

Ellen Schwartz, a teacher in Northfield, Massachusetts, and a long-time member of Prospect, discussed the value of assuming the learner's perspective in her research. The occasion arose during a discussion of data brought in by a teacher who was new to teacher research. This teacher, Stephanie Davis, shared her students' work with fractions and place value. Stephanie is a sixth-grade teacher in a school in a largely Mexican American neighborhood. She told her roundtable group that she expects her students to know certain things, such as place value in mathematics, but frequently finds they do not. She asked the group to focus on the work of Eduardo, a recent immigrant from Mexico. Eduardo seems to have average math skills, but some of his work makes Stephanie wonder "how he really sees these numbers. What do these values mean to him?" She said she was trying to get better at "asking the right questions" to understand his thinking.

Ellen responded by explaining that in her own work she finds it helpful to try to put herself in what she imagines to be the student's position. She offered an example of how she goes about doing this. Before she teaches place value to her third-graders, she spends time each year solving problems in another number base (e.g., base 12). This practice complicates for her the meanings that numbers have, given their place in a number string, and puts her in contact with her own questions about place value. It makes her aware of what and how much about understanding place value she takes for granted because of her deep familiarity with base 10. "Doing the math lets me position myself as a learner. I always learn something new. And it puts me in a better position to hear what my students are struggling with."

*Showing Me What I Don't Know*

Mary DiSchino, an experienced teacher researcher from CKC, was at the roundtable with Ellen and Stephanie. She shared a videotape and transcript
of a discussion in which her third- and fourth-graders from diverse backgrounds discussed the question, “If an amaryllis grows from a bulb, why would it make seeds?” Gita, a fourth-grader and speaker of English as a second language, asked this question based on the class’s experience growing Wisconsin FastPlants and an amaryllis. The children grew cycles of FastPlants: planting them, raising them, pollinating them, and planting the seeds that were produced by their original plants. At the same time, they planted an amaryllis bulb, watched it grow, pollinated its flowers, and then watched as it produced seedpods. They were trying to figure out what the seedpods, which looked very different from those of FastPlants, might be. Samuel, whose first language was Haitian Creole, said he thought they might be “little, little bulbs.” Gita said she thought that the amaryllis would make other bulbs, not seeds. Mary asked the roundtable participants to explore the transcript with her; she wanted help thinking about whether learning had taken place in this conversation.

After some initial discussion, one participant remarked that he wasn’t sure what bulbs were and how they related to seeds. Ellen agreed, asking what a bulb is. Another participant with extensive knowledge about plants explained that she thought a bulb was a specialized root that develops in certain kinds of plants and allows them to reproduce asexually. Someone then asked, “Does an onion have seeds?” Ellen responded, somewhat surprised herself, that yes, an onion makes both bulbs and seeds. The participant familiar with plants said she thought that new bulbs are produced asexually, so the bulblets are genetically identical to the mother plant, but that seeds are produced through pollination, which involves both father and mother plants. Thus, the “new” seeds will contain genetic material from both parents. Pollination, she suggested, is a way of ensuring variation in a species. Another participant asked why some plants reproduce only through seeds and others reproduce through bulbs and seeds.

Shortly thereafter, one of the experienced teacher researchers wondered if Mary’s children were trying to figure out how the seeds and the bulb worked together to grow new plants. Mary said she thought they were trying to understand a deeper question: If this plant reproduces via bulbs, what was it doing making seeds? In effect, the children were exploring variation. In response, Ellen said she hadn’t thought about variation until that moment; as a gardener, she knows that bulb plants make seeds and bulbs, but she’d never thought about why they did this.

Responding to Ellen, Mary said that she frequently finds herself in a situation of not knowing when her children ask questions about natural phenomena. In fact, she relies on their questions and ideas to push her to the edge of her own knowledge. She looks forward to those moments when
their questions

show me what I don’t know. I could never have predicted Gita’s question. I didn’t know that an amaryllis made seeds . . . . (T)heir questions take me to a different place. I have to learn with them in order to help them learn. We really learn together. . . . which means that I can use what I am learning about how I learn science to help them learn.

For Mary, Ellen, and the other experienced teacher researchers, not knowing is integral to teaching; they expect to learn from and with their children as they teach (see DiSchino, 1987, 1998). While they listen for the ways their students’ questions connect to big ideas in science like variation, they also examine their own understanding of the phenomenon. The experience of bumping up against the limits of one’s understanding is a generative opportunity from their point of view: it keeps the discipline alive for them by forcing them to probe the state of their own understanding. By using children’s ideas as they teach, these experienced teacher researchers not only better understand the meaning the children are making but also become conscious of another resource for learning and teaching—firsthand knowledge about the kinds of contexts and instructional materials that have helped push their own learning forward in science and mathematics. They regularly find that the most challenging questions come from children from culturally diverse backgrounds. These children often say or ask things that the teacher does not expect, thus requiring the teacher to think hard about what she knows and what the child means and is thinking about.

USING THE RESEARCH LITERATURE: HOW DO PRACTITIONERS USE ACADEMIC RESEARCH IN THE STUDIES THEY CONDUCT?

How does the work of others influence the way experienced teacher researchers pursue their research? How does it shape the kinds of questions they ask? How does it influence their theories of teaching and learning? In this section we discuss more finished pieces of research. The first example comes from a Festival of Data, the second from the keynote address. We found that these experienced teacher researchers drew on the research literature in a number of ways.

“There's a Mismatch Between the Question I've Asked and the Responses That I Receive”

Suzanne Pothier, an experienced first- and second-grade teacher researcher from CKC, teaches students from a range of cultural backgrounds. She
discussed her efforts to resolve a question about what she called a “mismatch between the question I’ve asked and the responses that I receive” in her classroom. Suzanne presented a transcript from a discussion that occurred during a unit on motion and force. The children had been exploring Newton’s idea that if an object changes its speed or direction, the change was caused by a force. Suzanne asked the children to roll a toy car down a ramp and observe any changes in speed they could see. Then she asked them to tell a story about the car’s trip.

Sharrone, an African American child who rarely spoke during science class, volunteered a story of a bike speeding down a high hill, going faster and faster, “and if somebody was walking by and then you was coming close to them you might hurt them.” To focus Sharrone on change in speed, Suzanne asked, “If the bike hit a person right here (pointing to the top of the ramp) and then it starts again and hits a person right here (pointing to the bottom of the ramp), who is going to get hurt more?”

Sharrone explained that the person at the top was not going to be hurt because if the biker “saw him he’ll stop before they hit him,” and the person at the bottom might get hurt “because if the bike was going fast” and the person “was looking the other way” and the biker was doing a wheelie, he might “hit the person in the belly because it was too hard to stop.” Arlene, a European American child, told Suzanne that she thought that the person at the top wouldn’t get hurt because the biker “is just getting started and so it’s really slow,” but at the bottom the biker “gets a longer time to start up so it gets really fast and it’s hard for him to stop.” Following this conversation, Suzanne wondered why Sharrone didn’t seem to know that she was asking him to talk about changes in speed but Arlene did. Did he not know that the speed of the bike increased as it went down the hill? Did he not understand her question?

Suzanne told conference participants that as she studied this transcript, she was reminded of research by Gee (1989) that she had read earlier that year. She talked about Gee’s Alligator River Story research, in which he compared the ways in which teenagers from different cultural and socioeconomic backgrounds discussed with their teacher their reactions to a story. Gee’s research suggested that one of the reasons that the students talked in different ways was because they assumed different things about the conversation they were in. For example, the working-class African American students referred to the characters by pronouns rather than their full names because, in Gee’s view, they assumed that their teacher shared their knowledge of the plot and the characters. They did not feel the need to name the already-known characters. Instead they elaborated the thoughts and questions that they considered to be new information for their teacher. The middle- and upper class White students, although they too knew that the teacher knew the story, interpreted the task as one that
required them to act as if she didn't. In effect, students from different backgrounds approached the task and situation differently.

Suzanne reported that these insights helped her develop a perspective on what might have happened during the bicycle discussion. Gee's delineation of the varied social and cultural assumptions people make in relation to the kind of conversation they are in led her to ask, What were Sharrone's, Arlene's and her own views of the conversation? What did they—and what did she—bring in the way of background knowledge and experience that might have led them to different interpretations of the communicative requirements of this event?

Suzanne realized that she and Sharrone might have been operating from different assumptions about what is shared, and therefore, what needs to be made explicit between observers of the same event. She wondered if Sharrone assumed that, because they shared the visual experience of the car (or bicycle, in his story) going down the ramp, she knew that it got "faster and faster," and that the person at the bottom of the hill would get hurt more. When she asked him which person would get hurt more, did he assume she was asking an authentic question, one that did not yet have an answer? Was that why he explained why a person at the bottom could get hit—that is, how events might have conspired to cause the accident—rather than why he would be hurt more than a person at the top?

Suzanne wondered if Arlene held other assumptions about the communicative situation and whether her assumptions were closer to her own than to Sharrone's. Why did she seem to understand that Suzanne wanted to know what she thought about the effect of increasing speed in the two collisions? Why did she talk explicitly about speed in her responses? Was she aware, in a way that Sharrone was not, that in Suzanne's role as teacher she was trying to assess what she was understanding?

As Suzanne studied the transcript, she realized that Sharrone's story was replete with information about change in speed and even laid the groundwork for a discussion of momentum. She also saw how Arlene, whom she had heard in the moment as more on task, built directly off Sharrone's ideas to formulate her own explanation.

Suzanne's reflections on the ways her students responded during this discussion, her further exploration of various contexts and conversations—all in relation to Gee's work and ideas—launched her into an ongoing exploration of the assumptions about meaning that children and teacher bring to communicative situations based on their diverse knowledge and experiences. She told conference participants that her view of what she wants to teach her children has broadened. She wants all her children to be comfortable in a range of communicative situations and to possess a repertoire of responses to draw on in those situations: She wants Sharrone to learn what Arlene knows and Arlene to learn what Sharrone knows. Her
research has led her to see that all children have something to teach, as well as to learn from, one another.

**Investigating the Role of Imagination**

The second example comes from Karen Gallas, a primary school teacher and member of BTRS, who spoke to conference participants about her multiyear inquiry into the role of imagination in learning. Karen began by situating her inquiry. Like others, her study was motivated by a child in her classroom. Denzel, an African American second-grader, had learned to read, but despite Karen’s best attempts he could not be engaged in listening or responding to literature at read-aloud time. Nor was she able to engage him with other texts during other parts of the day. Karen felt that Denzel had not taken the step beyond simply “reading” because he wanted to participate in some way with the text and the class. Karen observed him throughout the year and by June concluded that she had failed him somehow because she had not found a way to bring his imaginative life into contact with school.

During the last days of school, however, Denzel showed Karen that his imagination was indeed alive and well. The following is from Karen’s field notes, which she read to the conference participants.

**Field Notes**

Tuesday: We have our summer-baby birthday party. Parents bring in great food: sushi, cake and strawberries, cookies, cupcakes, juice, and Jello. Ayako’s mom made a raspberry Jello that was just beautiful: layers of white and red gelatin. Denzel had four servings. We went outside to play, and half the class started to make up a line game that sort of resembled Red Rover, but was a line that, like an ocean wave, chased, and then enclosed whomever it caught. They were chanting nonsense rhymes, laughing and falling. Denzel and Alex came out a little late and they watched for a few seconds. Then Denzel came over and asked me if he could go and play catch with his cousin, who was also out on the playground with his class. I said “no”, that I wanted him to play with our class. The children went under a big pine tree that was shady, and conferred. Denzel stood on the edge of the group, listening. Then the children broke apart running in goofy ways, making nonsense sounds. Denzel watched them for a minute, then followed running in a jerky, wobbling manner past me, and he had a big smile on his face, and called out, “Look, Karen, I’m running like Jello!” He continued running after the group, then reached them and
ran on. I stood still, trying to grasp the words, and shocked at the metaphor that had just come out of his mouth. Had I ever heard him use a metaphor before? I don't think so. (Quoted in Gallas, 2001, p. 461)

Karen went on to report a series of dances that Denzel performed on the last day of school for the class. She explained that she had come to realize that she was not seeing Denzel's imagination. It was there, but not in words, and she had not thought to look for it in his physical actions. She explained that although she had not recognized Denzel's imagination in time to help Denzel as she would have liked, this experience started her on a quest to understand both the diverse ways in which the imagination operates and the relationship it has to learning and literacy.

Karen began her study by further challenging her own notions of imagination. Denzel had helped her to see that she had too narrow a view of how the imagination looked and where to find it. To broaden her notion of imagination further, Karen felt that she needed to do three things: She needed to investigate her own uses of imagination, she needed to explore how imagination was conceived of by others in various disciplines, and she needed to collect more instances of imagining from children. During the year following the year she taught Denzel, Karen did not teach. She explored her own imagination by, as she puts it, "recording what passed through my mind when I took my daily two hour walks, when I danced, when I swam. Slowly I began to get a fix on how imagination did and didn't work for me" (Gallas, 2001, p. 463).

Karen also explored the works of many scholars from diverse fields. She read the works of artists who wrote about the development of their imaginative processes. (e.g., Grotowski, 1968; Sartre, 1964). She explored the work of philosophers and theologians who considered the role of imagination (e.g., Corbin, 1969; De Chardin, 1960; Greene, 1995; Sartre, 1961; Warnock, 1976). In addition, she read the work of scientists and sociologists of science who spoke or wrote about the role of imagination in the development of scientific thinking (e.g., Cobb, 1993; Fox-Keller, 1983; Holton, 1973; Ochs, Jacoby, & Gonzales, 1996; Raymo, 1987; Root-Bernstein, 1989; Salk, 1983; Wolpert & Richards, 1997). Finally, she delved back into some of her own favorite thinkers in the field of education to look again at the way they conceived of imagination (e.g., Ashton-Warner, 1963; Gee, 1989; Grumet, 1988).

All this helped Karen to build an expansive sense of the imagination. She explained that this process of exploring others' views on imagination as well as her own experience of it "broadened her ability to look back at Denzel, to better understand the points at which he had and had not made contact with storybooks and other kinds of classroom texts" (p. 488). Denzel's legacy, as she put it, was an expanded space in her teaching for children to
carry out their own purposes as learners. With the attention she paid to this space, she was able to see the imagination alive and well in many children and in many disciplines, including science—in Emily, for example, a child who spent all her free time with insects, a child who believed she could talk to them. As Karen says, what right did she have as the teacher to prevent Emily from pursuing her passion? She was a child who imagined herself as a scientist and, in many ways, as a fellow creature with her insects as well.

Her view of imagination also helped Karen see, as well, the mapmakers in her own classroom. These kindergarteners, after a good deal of work exploring actual maps, began to create their own. Here they explain their three-dimensional map to Karen:

First we found the maps and then we wanted to make our own maps. So we copied from the maps how to draw. Then we started to go on a trip, and then we made calculators on our maps! The calculators reminded us of the telephone and then we put on a T.V. If we don’t have a telephone, we couldn’t call, and we needed to count stuff on the calculator. If we say something on it [the keypad], like . . . . “Is someone having a birthday party here?” . . . It will say “no,” or “yes,” and where it [the party] is. We also made a key for the whole world to unlock wherever you go, and to lock it back up whenever you go away. (Gallas, 2001, p. 476)

With this expanded view of what imagination is and what it does, Karen continues to collect and explore data, to develop spaces for it to come forward, and to articulate for herself and others its relation to children’s identity and their learning.

*Bringing Research to Where You Live*

Although academic researchers use professional literature in various ways depending on their goals and needs, there has been a strong sense among teachers that the professional literature of education has served them poorly and rarely honored what they know and what they wish to know. Teachers often report that their experience of reading educational research has left them feeling that it has little to do with them, their children, or their questions about teaching and learning.

Importantly, Suzanne and Karen recount a different kind of experience. We believe that their experience with research literature was different for at least two reasons. First, each started with her own question about her students’ learning and her own teaching. Thus they sought out the ideas of others to deepen, provide texture, and challenge their own thinking about
what they do as teachers. The ideas, interpretations, and perspectives contained in what they read helped them to “interrupt commonsense frames” (Kidder & Fine, 1997), to go beyond their own assumptions about imagination and norms of communication.

Second, both Karen and Suzanne found it useful to bring their own experience into the mix: for Karen, her ways of imagining and, for Suzanne, her own ways of talking in school. Thus they were able to consider what the literature was claiming in relation to something they knew well, their own experience, as well as in relation to claims or suggestions or theories made in the literature about students and classrooms. Connecting the literature with personal experience in this way helped each to develop a critical stance. The research articles that each read became not an authoritative voice but another perspective in an ongoing internal dialogue of ideas in which these teachers theorized their own experience and their practice.

CONCLUSIONS

Dressman (2000) reviewed a collection of 61 examples of classroom research published in *Language Arts*. The most common genre throughout, he found, was what he called “the good practice narrative,” a paradigm that reports seemingly successful attempts to instantiate theory into practice. He points out that such narratives, by focusing on success in this way, “fail to engage or even mention most of the external factors that give teaching and learning their texture, their contour, and all too often, their outcome” (p. 57). He suggests that the goal of teachers who develop accounts of good practice may be to inspire other teachers. In doing this, their narratives often convey what the writers believe in rather than the details and complexity of what actually happens. The theory, whether it is about the writing process or cooperative learning or constructivist lessons in science, is presented in its power and success. No problems arise, or those that do are not seen as moments to “embrace and interrogate,” to use Fecho and Allen's (2003) words once again.

In contrast, the teacher researchers discussed here choose to focus on moments of confusion and the responses of children they find puzzling in science and mathematics lessons. Their goal is to better understand and delve into something they perceive as problematic, confusing, perhaps even unsuccessful. By documenting students’ talk, activity, and work, they make the busy world of the classroom stand still as they probe beneath standard explanations for problems and listen for their students’ ideas about what they are doing. They question what they themselves know and assume in their active attempts to see the sense each child brings. They use the
theories of others to illuminate and deliberate on what they know and want to know about teaching and learning science and mathematics.

This tradition of teacher research is based on concerns about issues of equity. Interestingly, however, in the teacher discussions, they don’t say very much about race, gender, or ethnicity. Although the discussions we are reporting were in many important ways informed by literature that does discuss these ideas more directly, these teacher researchers approached these issues from a point of view that is firmly situated in their daily dilemmas of practice. There are always children in any classroom who pose particular problems to the teacher, who don’t do well academically, and don’t seem to be easy to help. Who these children are varies, but many of them are poor and come from a culturally diverse background.

The experienced teacher researchers highlighted here show how close observation of children—all children, but especially those who do not do well—can challenge our taken-for-granted assumptions about what ability looks like, about what our own knowledge is, and how we might best teach it. They also demonstrate that children who make puzzling responses do not necessarily have deficient ideas but rather are operating from a world that differs from the one we commonly assume. As we come to understand such worlds, we are better able to teach not only these children but all children because we become more attentive to our basic ways of communicating scientific and mathematical knowledge in the classroom.

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Notes

1 We do not mean to suggest that the practices of BTRS, CKC, and Prospect are identical. In fact, each brings a unique and important perspective and set of practices to examining children’s work. For more information on BTRS, CKC, and Prospect, see Brookline Teacher Researcher Group (in press) and Rosebery and Warren (1998).
2. In this paper we use the following convention regarding names: At first mention we give full names of participants. After that, to maintain the flavor of the conversation itself, we use first names. When publications are cited, of participants or others, we use last names.

References


CINDY BALLINGER is a sociolinguist at the Chèche Konnen Center with principal research interests in classroom discourse in relation to learning within academic disciplines. She is also a teacher, most recently of third- and fourth-grade bilingual students. She is a founding member of the Brookline Teacher Researcher Seminar. She has published articles that address issues of cultural difference in language use in early literacy education; her book Teaching Other People's Children addresses both teachers and researchers, with particular focus on conducting research on language practices as part of the process of teaching in a multicultural classroom. She is involved in a variety of efforts to support the development of teacher research as a part of teaching.

ANN S. ROSEBERY is codirector of the Chèche Konnen Center. Her research focuses on improving science learning and teaching for low-income, racial, ethnic, and linguistic minority children. A central goal of this work has been to document and characterize the range of intellectual resources that children from diverse backgrounds bring to the study of science. Currently she is collaborating with teacher researchers and Chèche Konnen staff to develop innovative pedagogical practices that enable all children to understand and use diverse sense-making resources to learn and do science. Dr. Rosebery was a middle school teacher for 8 years.