Teaching Teachers

Managing Hands-on Inquiry

By Alan D. Rossman

In the past decade, we’ve seen hundreds of reports that call for sweeping changes in the ways and means of science education. Many of these reports call for a shift away from conventional teaching in favor of methods that actively involve students in hands-on, inquiry experiences. These methods, centered on student investigation and problem solving, cultivate positive attitudes toward science and learning in general.

A New Approach

We know that adopting hands-on, inquiry-based methods can bring great rewards. Teachers who use these methods successfully are almost guaranteed higher student enthusiasm and involvement, and deeper understanding of content and concepts. In addition, the autonomy students experience enables them to learn to think for themselves, both critically and creatively.

A recent, informal survey conducted by the Chicago Botanic Garden revealed an interesting and relevant paradox. The respondents (elementary teachers from Chicago’s public schools) devoted only about 10 percent of their science-teaching time to the inquiry approach, yet 100 percent of these same teachers agreed that hands-on inquiry is the best way to teach science. Why, then, if teachers are so convinced of the benefits of inquiry teaching methods, are they reluctant to use them?

Understanding the Risks

Many teachers perceive hands-on inquiry methods as more “risky” than conventional teaching methods. They are often daunted by the possibility that “things could go wrong.” It is true that as students manipulate science materials and inquire on their own, the element of risk increases. Yet these risks are manageable and should not prevent teachers from adopting an inquiry approach.

Navigating the risks means accepting a change in the relationship between teacher and learner. In contrast to conventional, didactic forms of teaching, hands-on inquiry redistributes the responsibility for learning to students and increases the importance of their interaction with materials. As the teacher’s role changes from that of presenter to guide (facilitator), the role of the student changes from passive recipient of information to participant in the creation of understanding. Under these conditions, there is a fundamental shift from an emphasis on teaching to an emphasis on learning. From these shifting roles and the transfer of responsibility emerges the need for a different approach to classroom management.

Managing the Risks

Effectively managing the hands-on inquiry classroom can mean the difference between chaos and real learning. In order to break down the barriers and reduce instructional risks, the following guidelines should be con-

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sidered before, during, and after hands-on inquiry:

- **Plan and prepare.** Inquiry lessons need to be planned carefully. In order for students to take a more active and independent role in learning, your instructions must be clear. Planning will also help you use the available time most efficiently. Prepare and organize all materials before class begins. Pretest activities and materials so that you can anticipate and address difficulties and possible sources of confusion.

- **Create problem intrigue.** Problems to solve and questions to investigate are at the heart of inquiry. The problem should captivate students' attention, be meaningful, and allow a wide range of individual responses. It should also serve to enliven, extend, and reinforce the content under study. There will never be a shortage of suitable problems—just listen to students' questions and go from there!

- **Give students the responsibility of solving the problem.** Hands-on inquiry implies that students should be responsible for solving a given problem. To some degree, you must withdraw once the lesson is under way and accept a higher level of student self-direction, confusion, and noise. The role of "facilitator" may be unfamiliar, but it is essential in order to tap the true value of the inquiry approach. You must also ensure that all materials and resources that might be required by students in the course of the inquiry experience are available or attainable. In this manner, students are further enabled to approach problems independently.

- **Offer feedback and guidance.** Students, especially younger children or those new to inquiry, require both individual and group feedback and guidance on a regular basis. Your feedback can make students aware of the strategies and ideas they are developing and applying. You must also strike the delicate balance between the chances for student success on one hand and the level of student dependence on the other hand. Finding this balance hinges on students' abilities, their familiarity with the method, and the nature of the problems under study.

- **Debrief.** Reserve time after the inquiry activity to evaluate the experience thoroughly. Through discussion, you can tie the results of the lesson to the ongoing classroom curriculum and explore the variety of student approaches and findings. This debriefing also provides an ideal forum for students to learn from each other and for you to assess their progress and build on their understanding.

- **Anticipate, prevent, monitor, and adapt.** Anticipate the range of management problems that might arise and then take whatever steps are necessary to prevent them. Be actively involved and ever vigilant, monitoring classroom activity throughout the lesson. This will allow you to identify and respond to any difficulties before they escalate. Adapt to any problems that
arise once the lesson is under way, but keep the focus on the activity. Responding flexibly with "on the spot" management decisions is a regular aspect of life in the hands-on, inquiry classroom.

Teaching Risk-taking
Encouraging teachers to move away from traditional methods of teaching science to more student-centered, open-ended methods is not easy. The most persuasive reports, the most compelling data, and the most articulate advocates will do little to calm the very real and reasonable anxieties teachers may have. Instead, it is essential that inservice and preservice teachers witness firsthand the power of a well-managed, hands-on, inquiry classroom to inspire students and motivate them toward meaningful learning.

Naturalistic observations, modeling, demonstrations, and case-study videotapes can provide convincing evidence of the potential of these methods. Then, teachers need to try hands-on activities in a risk-free workshop or small, supportive teaching environment. With sensitive, insightful peer feedback and continued trials, the management principles for inquiry methods will become routine. Teachers can then confidently begin shifting their classroom orientation to include active, investigative, student-centered methods in their instructional repertoire.

J. Richard Suchman wrote, "Inquiry is more than a method of science. Inquiry is science. It is at the center of the scientific way of life" (1968). Hands-on inquiry should also be central to our science teaching. By demystifying the risk associated with the technique, we can encourage more teachers to try hands-on inquiry in their classrooms.

Resources

Additional Topic Resources