CHAPTER 5

Lessons Learned: Addressing Common Misconceptions About Inquiry
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In this chapter, one teacher's discovery of the power of inquiry, and her experiences integrating it into the classroom, shed some light on common questions and concerns of science educators considering inquiry in the classroom.

For the past 20 years, I have been experimenting with various approaches to hands-on learning with both students and teachers. As my experience and confidence have grown, my teaching has evolved from a more structured and prescribed hands-on approach (teacher-centered) to providing opportunities for more open-ended inquiry (student-centered). The shift has been gradual and incremental as I have reflected, practiced, refined my thinking, and collaborated with colleagues to explore new territory. In the process, I have had to become both a teacher and a learner—looking ever more closely at the inquiry process. In essence, I have become an inquirer into inquiry.

Although the word "inquiry" is mentioned a lot these days, there is quite a bit of confusion about what it means and how it is best done. Few educators have had the opportunity to experience inquiry first-hand: We didn't learn this way when we were students, and we weren't taught to teach this way. Most recently, I have been working as a professional developer, helping educators from all over the country find ways to infuse inquiry into K–5 classrooms. What follows are thoughts that address some of the most common questions and concerns I hear about inquiry.

Inquiry is not an either/or proposition.

Although inquiry-based teaching is indicated as a central feature of science education in both the *National Science Education Standards* and *Benchmarks for Science Literacy*,[1] neither document recognizes it as the sole approach. Science teaching should encompass a wide range of methods. Even within the realm of inquiry teaching, there is a wide spectrum of approaches.

Teachers must decide on a method that is most productive for accomplishing their particular objectives in learning, such as developing conceptual understanding, being able to do inquiry investigations, and experiencing what science is. Hands-on activities, reading, class discussions, teacher demonstrations, skill-building activities, films, videos, inquiry investigations, and so on are all important tools when used appropriately. For educators, the goal is to create a balance in terms of pedagogical approaches, student-driven investigations, and teacher direction. We weaken the possibility for successful science education reform when we draw too tight a line between inquiry and other educational methodologies.

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All hands-on is not inquiry; not all inquiry is hands-on.

There are many high-quality, hands-on science curricula and materials that are available for classrooms today. However, using hands-on methods does not always ensure effective science teaching, nor is it necessarily indicative of an inquiry-based approach. When children are doing inquiry, they have opportunities to raise their own questions, and then plan, design, and conduct investigations to help them answer some of those questions. They are given ample time to reflect, engage in dialogue to develop their conceptual ideas, and defend their findings to others.

To teach science as inquiry, a teacher has to allow children some ownership of the process—which means giving the children opportunities

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[1] American Association for the Advancement of Science, Project 2061.

to get connected with questions that are of interest to them, and find ways to answer those questions. This does not mean that every child must work from his or her own question, or pursue an independent investigation. Very productive investigations can result from a class working on the same question, or small groups of children working on different questions.

Inquiry in hands-on learning is often distinguished by the amount of flexibility a teacher allows in order for children to develop individual curiosity and ways to solve problems. This is different from a situation in which a teacher poses a question and then directs all the students to take the same pathway to find a common solution. In the case of inquiry, the teacher may have a very good idea of what scientific concepts he would like the children to learn, but he allows for a lot of variation in the children's investigations, recognizing that there may be many solutions to the same problem.

While an inquiry approach implies active learning and the development of higher-order thinking skills, hands-on methods are not the only ways to achieve these goals. Other resources are important for stimulating questions and providing information. Books, articles, information on the Internet, and personal conferences or interviews can all be used to provoke initial interest in a topic from which research or investigations may emerge. On the other hand, these same resources might become secondary materials, providing additional support once investigations have begun.

No dichotomy exists between content and process.

In this era of science education reform, there are many conflicting viewpoints about the nature of effective science education: Should the primary focus be content or process? Both are critical, and emphasizing one to the exclusion of the other is not beneficial to students.

Engaging in inquiry provides opportunities to help children develop ways of understanding the world around them. In her book *Primary Science, Taking the Plunge*, Wynne Harlen says that children have to "build up concepts which help them link their experiences together; they must learn ways of gaining and organizing information and of applying and testing ideas. This contributes to children's ability to making better sense of things around them....Learning science can bring a double benefit because science is both a method and a set of ideas: both a process and a product. The processes of science provide a way of finding out information, testing ideas and seeking explanation. The products of science are ideas which can be applied in helping to understand new experiences."

Ideally, the processes used in doing scientific inquiry and the development of conceptual understanding and knowledge work in concert; they must go hand in hand. However, the seamless interweaving of process and content depends on both the teachers' and the students' experience and confidence in doing inquiry. Teachers find that they often move back and forth, emphasizing process skills and scientific content, bringing one into focus for critical examination while the other remains in the background. Teachers have to help students develop skills to be good investigators. With ample practice, these skills develop and grow over time.

Inquiry teaching is not chaotic— it is a carefully choreographed activity.

Although inquiry teaching demands a different relationship between teacher and student than more traditional methods, it requires a high level of organization, planning, and structure, both by the teacher and the students. In essence, a classroom environment that is supportive and conducive to doing inquiry must be consciously developed. The teacher must create a climate for doing inquiry.

In order for inquiry to be effective, a teacher must lay a foundation in which students can begin to take more responsibility for their own learning.

The teacher's role in the inquiry classroom is a very active and dynamic one. Acting as a facilitator, or guide, the teacher identifies a set of carefully crafted "big ideas"—a conceptual framework from which children develop their investigations. This conceptual framework is the basis for guiding students to learn something deeper about a scientific concept.

During the inquiry process, the teacher walks around the room, interacting with groups of students as they experiment. He listens to their questions and ideas, continuously assessing their progress and determining the appropriate next steps for their learning. He gathers the class together at strategic moments to give additional information through lectures, demonstrations, or discussions.

In order for inquiry to be effective, a teacher must lay a foundation in which students can begin to take more responsibility for their own learning. He must create a rich physical environment in which children learn how to organize and manage materials. And he must develop a supportive social environment in which students can work collaboratively in small and large groups, participate in discourse, and learn to respect each other's ideas.

Reference

Harlen, W. (1988). *Primary science, taking the plunge.* Portsmouth, NH: Heinemann.