CHAPTER 1

Why Inquiry? A Historical and Philosophical Commentary by Peter Dow

There's nothing new about learning science through inquiry. Making observations, asking questions, and pursuing investigations has always been a fundamental human approach to understanding the world. This essay traces the history and philosophy of inquiry, the controversies—past and present—that have surrounded it, and its promise for the future.

Scientific inquiry has its roots in the inherent restlessness of the human mind. We humans have pursued our passion to explore far beyond any other inhabitant of the planet. Curiosity is the basic human trait that has ensured both our survival as a species and our continuous cultural evolution. In American society, scientific inquiry has been the source of both our technological superiority and our economic well-being. Is it surprising, therefore, that we should regard cultivating the skills of inquiry as central to the process of schooling?

In societies where inquiry has flourished, so has human progress. Athens of the fifth century B.C. comes to mind. The Agora—the marketplace where freedom-loving Greeks gathered to discuss the issues of the day—was a crucible of intellectual inquiry led by one of history's most celebrated teachers, Socrates. An indefatigable inquirer, Socrates challenged the youth of the city to think for themselves, to question the wisdom of their elders, and to probe the unsolved mysteries of the natural world.

For a time, Athens thrived on the intellectual ferment that ranged from the scientific and philosophical deliberations of Plato and Aristotle to the literary and artistic achievements of Sophocles and Phidias. Yet Socrates

paid with his life for his endless probing and his uncompromising search for truth. In the end, even sophisticated Athens could not tolerate this unrelenting passion for inquiry.

Few of us can claim lives spent in Socratic dialogue, but we respect the work of this master teacher who took no pay because he claimed to know nothing, and who challenged the young people of Athens to learn how to think for themselves. Minds so trained, we believe, will contribute to the improvement of society and to the advancement of science. We have inherited this passion for inquiry not only from the ancient Greeks, but equally from the Renaissance of Galileo and Leonardo, and the Enlightenment of Locke and Rousseau.

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The 20th century has raised new questions about the power of scientific inquiry. No longer is it certain that the capacity of the inquiring human mind to unlock the secrets of the cosmos is always a net benefit to humanity. As we play out our restless urge to understand and control our surroundings, the power to destroy now rivals the power to invent. Perhaps now, more than ever before, the ability of average citizens to think for themselves may be the best protection in a world of increasing technological and scientific complexity. If so, the skills of skeptical questioning and independent thinking may be essential goals of schooling.

On the eve of World War II, our most celebrated 20th-century educator/philosopher, John Dewey, made a persuasive case for the importance of inquiry-based teaching as a way of preserving values in a world threatened by totalitarianism. The scientific method, he said, "is the only authentic means at our command for getting at the significance of our everyday experiences of the world in which we live" (1938, 111). Dewey believed that the ability to reason scientifically was an essential skill for coping with the complexities of modern life, and he warned that failure to cultivate such skills risked "a return to intellectual and moral authoritarianism" (p. 109). Today, we may need the skills of scientific thinking more than ever, as we cope with the challenges of factual overload in our information age.

For Dewey, inquiry teaching involved allowing children to learn from direct experience and cultivate their natural curiosity. He believed that the essentials of creative thinking were contained in the processes of science, and that intellectual activity was much the same whether in the kindergarten or the scientific laboratory. Organizing learning in this way, he argued, would enable teachers and students to integrate knowledge across the disciplines through the cultivation of disciplined habits of mind, and allow learning to unfold in a way that respected the intellectual growth and age-specific concerns of the child. Although Dewey died without witnessing the information explosion of our own time, he saw the need for cultivating the skills of lifelong, self-directed learning.

More recent educational theorists such as Jean Piaget and Jerome Bruner have added the weight of cognitive research to Dewey's philosophical propositions. Bruner and Kenney's *Studies in Cognitive Growth* (1966) contains a celebrated paper by George Miller, entitled "The Magic Number Seven, Plus or Minus Two," wherein Miller argues that the human mind can only hold approximately seven discrete bits of information at one time. Based on this finding, Bruner later argued for "filling those seven slots of memory with gold." By this he meant helping students grasp the deep conceptual structure that underlies the disciplines, rather than memorizing unconnected facts.

Biologist E. O. Wilson has recently made a similar point in *Consilience* (1998), in which he proposes replacing discipline-based instruction with a return to the unification of knowledge exemplified by the Enlightenment. How can we best accomplish this, in Wilson's view? By implementing (as Dewey argued) a learning process that focuses on examining the world by direct experience. This approach derives knowledge from prolonged observation and experimentation, and from the exploration of fundamental questions. How do organisms eat, avoid being eaten, and survive to reproduce? How do they ensure their survival and the survival of their offspring—thereby avoiding extinction in a world governed by the laws of natural selection? And what is the place of human beings in this world of biological imperatives?

In an inquiry-driven classroom, is there still a role for didactic instruction? This, too, is a question to explore. Clearly, teaching by telling is the most efficient way to get across important facts, concepts, and ways of thinking about things. Yet recent cognitive research would suggest that much of what we "learn" in such contexts has a relatively short half-life in

memory. How can we ensure that what lasts in learning is the "gold" that Bruner proposes?

Unfortunately, pedagogy is not an exact science. Yet the science teaching reforms of the past 40 years have provided growing evidence that instruction designed around the careful examination of real phenomena, and the pursuit of significant questions formulated by both teachers and students, have delivered results in emotional engagement, memory retention, and cognitive understanding that challenge the results of didactic teaching. This is good news: if true, it could liberate schooling from the intellectual authoritarianism that Dewey feared.

If Socrates were alive today, and could visit an American school, there is much that would mystify him. He would be hard-pressed, for instance, to follow the discussion in an advanced-placement high school chemistry or physics class. Yet despite the level of knowledge displayed, he would probably be as critical of intellectual arrogance today as he was in his own time. And he would still argue that the essence of good teaching lies in framing the right questions, regardless of the sophistication of the subject matter.

Perhaps he would be happiest visiting a modern-day elementary school, or even a kindergarten, where learning involves firsthand investigation of the mysteries of the natural world, where the rules of social behavior are assimilated on the playground, and where teachers encourage their students to pursue their own questions and figure things out for themselves. Is this not the Socratic method? And has it not been through most of human history—long before the development of civilization—the primary way to learn?

References

Bruner, J.S., and Kenney, M.J. (1966). *Studies in cognitive growth*. New York: Wiley.

Dewey, J. (1938). *Experience and education*. New York: Macmillan.

Wilson, E.O. (1998). *Consilience: The unity of knowledge*. New York: Knopf.