Philosophy of Science: An Overview for Educators*

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DESCRIPTION OF PHILOSOPHY OF SCIENCE AND ITS RATIONALE

From the point of view of knowledge (or epistemologically), science is a method of inquiry about the things and structures in the world. Conceived of as a social human activity, science is an important institution or practice constitutive of the modern world. Science has been heralded for much of the good in the world and much of its progress. It has also been blamed for many of the world’s problems. Yet, scientific knowledge is often held to be the major intellectual accomplishment of the Western world.

Buildings, buildings, best-selling books, museums, journals, and television programs are dedicated to science. Many people directly or indirectly earn their livelihod by their participation in or connection with some aspect of science. Governments, corporations, and private foundations spend billions to support scientific research. Yet, despite science’s multi-aspected ubiquity, there remain inadequately answered questions about what science is, how to characterize the nature of its practitioners’ activities, and what is the significance of the whole enterprise.

Philosophy of science, in attempting to understand these issues, studies the activities of scientists and the nature and character of scientific theories. It looks at the structure of the practice and products of this peculiar human activity. The domain examined is science and scientists as they now are, once were, and, sometimes, as they might be. Philosophy of science is concerned with the methods that scientists use in discovery, and to elaborate and confirm theories. Also, the philosophy of science is concerned with the effects of science on the activities and interests of nonscientists and nonscientific institutions and practices that are part of society – past and present.

Why is philosophy of science important? Why is it worth understanding and thinking about? The simplest answer is also the best. Philosophy of science, like philosophy in general, is a discipline that tries to expose the underlying presuppositions that structure important practices and institutions of life. It subjects the structures of life and thought to critical examination. In short, it makes us think about what we are doing and why.

* This is a chapter in R.W. Bybee et al. (eds.). Teaching About the History and Nature of Science and Technology: Background Papers, BSCS, Colorado Springs, CO, 1992.
It scrutinizes the goals and purposes of human activities, then questions the methods and procedures by which those goals and purposes are attained. In doing so, it attempts to justify the goals and improve the procedures. Arguably, such self-conscious criticism of one’s own practices is a distinguishing feature of intelligent human behavior. It might even be the best definition of intelligence.

In less abstract terms, philosophy makes people think about what they are doing. Philosophy of science takes science and subjects it to critical thought. Now part of the fun of science, as in most interesting human activities, lies in thinking about how and why it is done, and how it might be done better. In this way, philosophy is the discipline that studies the history and structure of inquiry, for asking critical questions that any curious and self-conscious practitioner would be asking. It goes further by attempting to systematically and rigorously examine and codify such questioning.

From a disciplinary view within philosophy, philosophy of science raises more precise questions. Epistemologically, it asks what the nature and essential characteristics of scientific knowledge are, how this knowledge is obtained, how it is codified and presented, how it is subjected to scrutiny, and how it is warranted or validated. From a metaphysical point of view, philosophy of science examines the kinds and natures of things in the world, in so far as science deals with them. It critically analyzes the assumptions of scientists about the basic or fundamental physical, biological, and social ‘stuff’ that we need to think about when trying to understand the world. Ethically, philosophy of science directs questions towards the value systems that scientists have and asks how these values affect the practices and conclusions of science. Ethical issues also arise in considering the effects that science has on the values of the people affected, directly or indirectly, by science. Other ethical dilemmas arise when considering how science affects decision making and problem solving. Interesting issues in political philosophy dealing with science policy and regulations and questions about the aesthetic nature of scientific theories also arise in the philosophy of science.

For our purposes, the epistemological point of view is paramount. Science, as it is taught and practiced in an educational setting, should be concerned with questions about the nature and adequacy of knowledge. It was from this point of view that W. V. O. Quine once wrote ‘philosophy of science is philosophy enough’.

From a pedagogical point of view, which is most crucial for this essay, asking students to reflect upon their activities when engaging in science, or studying science, is a way to enable them to understand themselves and their motivations more clearly. Having them ask— at whatever level—many of the questions that philosophers of science ask, actively engages them in the process of inquiry and challenges them to increase understanding of what they are doing. Reflecting about the goals and procedures of problem solving helps one solve problems better. It also enables one to