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Focus: Textbooks in the Sciences

Introduction: The Secret Lives of Textbooks

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ABSTRACT

Textbooks have a low status in the history of science because they have been seen as mere repositories for scientific knowledge. But historians have recently shown how they play a number of roles that can illuminate different aspects of the history of science, from priority disputes to pedagogical practices. The essays in this Focus section aim to expand our vision of textbooks further by showing how they perform various hybrid functions in scientific development.

LOCATING TEXTBOOKS ON THE EPISTEMOLOGICAL LANDSCAPE

WHY DO TEXTBOOKS HAVE LOW STATUS in the history of science? To answer that question, I sketch the "received view" of scientific development, which combines a linear model of scientific production with a trickle-down model of scientific consumption (see Figure 1). Probably no one has ever accepted the received view in this simplistic form, but this sketch is useful for understanding the low status of textbooks in the history of science. In this framework, textbooks are passive receptacles of the bounties of scientific creativity and research. They serve as showcases for accumulated knowledge but do not contribute to scientific development. Their main role is to initiate the student into the well-established views and practices of specific scientific communities. For example, in several writings, including an

essay revealingly entitled “The Function of Dogma in Scientific Research,” Thomas Kuhn presented textbooks in the natural sciences as repositories of exemplars from the reigning paradigm within a field. Their main role, he claimed, is to “indoctrinate” students into the wisdom of the elders.1

(21KB)

Figure 1. The received view of scientific development.

Open New Window

Over the last twenty years or so, sociologists, historians, and philosophers of science have dismantled the received view of knowledge production.2 Historians of science have also discredited the “trickle-down” model of scientific popularization.3 In addition, recent work in the history of the book, pedagogy in science, and scientific communication has stimulated interest in science textbooks.

In the last decade, a growing number of historians of science have analyzed various texts used as textbooks and the roles they have played over time.4 Here, I can only point to some of the interesting things we can do by studying textbooks:

Explore their role in pedagogical and training practices to understand how scientists acquire knowledge of their specialized fields, learn what counts as science, and decide which paths are worth investigating.5

Study how they help form new disciplines in science in order to illuminate efforts to remake the disciplinary map of science.6

Trace the development of ideas by following the changing presentation of a particular concept, hypothesis, or view over time in different textbooks.7

Reveal the epistemological concerns of a field and the weight given to different tools and methods for reaching knowledge.[8]

Explore how scientists use textbooks in priority disputes.[9]

Illuminate the social context of science by analyzing how secular and religious influences, state decisions about education, economic pressures, and other social forces affect the production and commercialization of textbooks.[10]

This list is not exhaustive, but it should suffice to convince us that textbooks are important in the scientific enterprise. The essays in this Focus section encourage us to broaden our studies of textbooks in the history of science.

FURTHER AREAS TO EXPLORE

Examining the translations of three different chemistry textbooks from the 1860s from the “provincial” Russian language into the “metropolitan” German language, Michael Gordin shows how they became essential tools in disputes about credit and international recognition. His analysis also exposes limitations in the standard assumptions about the relationship between the center and the periphery in scientific development and exchange. Adam Shapiro illuminates how educational institutions in the United States after World War II helped regulate the production of textbooks and thereby exerted a strong influence on young students' perceptions of science. My essay questions the view that textbooks report scientific results but do not shape the process of scientific development. Focusing on the presentation of Harry Harlow's work on maternal deprivation in rhesus monkeys in psychology textbooks from the late 1950s to 1975, I argue that many textbooks provided meta-analyses of those experiments and their implications for human infant development. David Kaiser presents two physics books of the 1970s that became hybrid objects and reached hybrid audiences. Though they were first subject to the negotiations of authors and publishers who decided what “categories” they belonged in, Kaiser's analysis demonstrates that the lives of textbooks can diverge from their producers' expectations.

Although these essays deal with diverse fields (chemistry, biology, psychology, and physics) in different periods and places, one salient theme runs through them: the ability of textbooks to break free from the

constraints normally imposed by their genre. We encounter textbooks that function much like scientific texts (Gordin, Vicedo) and others that move into the popular arena while at the same time popular books are brought into the classroom (Kaiser). Although we cannot forget that at many levels state supervision, academic trends, and market forces impose limits on the plasticity of the genre (Shapiro), the stories presented here reveal that authors' intentions and readers' responses sometimes transcend those limits. Thus, these essays emphasize the plasticity of textbooks and their ability to play hybrid roles.

If historians of science decide to go beyond common views of textbooks, we will find that their changing functions in diverse fields have much to teach us about scientific development. I will mention just two areas worth pursuing: the roles of textbooks in the history of epistemology and in the history of science popularization. The analysis of how textbooks present results and methods of research can help illuminate the historical trajectory of what Peter Galison has called the “toolkit of argumentation and demonstration” in the sciences. What role have textbooks played in supporting and legitimizing specific tools and procedures to justify knowledge claims at different points in history?[11] Textbooks can also help us analyze the complex ways in which we acquire our beliefs in and about the different sciences. Textbooks are read not only by students in a specific discipline, but also by teachers who choose among them for their classes, by reviewers, by competitors, and by a large number of students who will not pursue further studies in the specialized field. At the college level, thousands of undergraduate students use textbooks in different courses. While a textbook provides specific training for those who continue in the relevant area, the same text serves as a source of more general scientific ideas for those who move on to other areas. In that way, introductory textbooks influence scientists in a discipline—but also nonscientists and scientists in other fields. They influence different audiences in different ways, sometimes providing specialized knowledge in one field, and other times contributing to a more “popular” general understanding of other areas.

This Focus section also suggests that, as we expand our views about textbooks, we will find little uniformity among the different sciences. Indeed, the study of textbooks can increase our awareness of the diversity of the sciences in different times and places. That will be a very good thing.

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[2] It is impossible to cite here all the relevant literature, but it would include the following very influential history of science books: Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton Univ. Press, 1985); Martin J. S. Rudwick, *The Great Devonian Controversy: The Shaping of Scientific Knowledge among Gentlemanly Specialists* (Chicago: Univ. Chicago Press, 1985); Peter Galison, *Image and Logic* (Chicago: Univ. Chicago Press, 1997); and Mario Biagioli, *Galileo, Courtier* (Chicago: Univ. Chicago Press, 1994).

[3] See, e.g., James A. Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of* Vestiges of the Natural History of Creation (Chicago: Univ. Chicago Press, 2000); and Bernard Lightman, *Victorian Popularizers of Science: Designing Nature for New Audiences* (Chicago: Univ. Chicago Press, 2007). See also Terry Shinn and Richard Whitley, eds., *Expository Science: Forms and Functions of Popularisation* (Dordrecht: Reidel, 1985); and Andreas W. Daum, "Varieties of Popular Science and the Transformations of Public Knowledge," *Isis*, 2009, *100*:319–332.

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