

Should Science Teaching Involve the History of Science? An Assessment of Kuhn's View

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Abstract. Thomas Kuhn draws the distinction between textbook history of science and history of science proper. The question addressed in the paper is whether Kuhn recommends the inclusion of distortive textbook history in science education. It is argued, *pace* Fuller, that Kuhn does not make normative suggestions. He does not urge the teaching of bad history and he does not aim to deceive the scientists. He highlights the significance of the retrospective history of the textbooks as a condition for the practice of science. If science is to be seen as a practice and not as a set of propositions, then textbook history is instrumental in establishing and expanding the new paradigm. The other kind of history, the history of science proper, can only be taught as part of the students' general education and not as part of science education.

1. Introduction

Textbooks of science education usually include introductory chapters devoted to the history of the corresponding discipline. These chapters mark out great achievements, date great discoveries and honour the heroes of the field. They are not connected to the material that follows and what is said in them is hardly ever taught in class. The most conscientious of the teachers of physics or chemistry do not like to spend time on things they consider peripheral and concentrate instead on the teaching of science proper with emphasis laid not so much on theoretical issues but on the solution of problems and exercises.

The historical reminders of the introductory chapters do not contribute to the scientific education of the students. They are intended to 'humanize' and make familiar a very technical subject matter by presenting a coherent narrative which relates the fight between good and evil – knowledge and ignorance, with its high moments, heroes and ideals. To counterbalance the difficulties of initiation, the students are given models to look up to so that they follow in their steps or even perhaps surpass them.

2. Thomas Kuhn's Position

In his book *The Structure of Scientific Revolutions* (Kuhn 1970), Thomas Kuhn discussed the role of textbooks and, in particular, the image of scientific development that they project:

Textbooks thus begin by truncating the scientist's sense of his discipline's history and then proceed to supply a substitute for what they have eliminated. Characteristically, textbooks of science contain just a bit of history, either in an introductory chapter or, more often, in scattered references to the great lessons of an earlier age. From such references both students and professionals come to feel like participants in a long-standing historical tradition. Yet, the textbook derived tradition in which scientists come to sense their participation is one that, in fact, never existed. For reasons that are both obvious and highly functional, science textbooks (and too many of the older histories of science) refer only to that part of the work of past scientists that can easily be viewed as contributions to the statement and solution of the text's paradigm problems. Partly by selection and partly by distortion, the scientists of earlier ages are implicitly represented as having worked upon the same set of fixed problems and in accordance with the same set of fixed canons that the most recent revolution in scientific theory and method has made seem scientific. No wonder that textbooks and the historical tradition they imply have to be rewritten after each scientific revolution. And no wonder that, as they are rewritten, science once again comes to seem largely cumulative. (Kuhn 1970, pp. 137–138)

In the quoted passage Kuhn maintains, among other things, that:

- Textbooks have an instrumental role in science education.
- History of science, as it appears in textbooks, contributes to science education.
- Textbook history is a substitute for real history and builds the tradition of science.
- Textbook history aims at showing, falsely, that the method of science and the problems that scientists deal with are always the same and always in accordance with what the most recent scientific revolution renders legitimate.

According to Kuhn, textbooks function both on the level of scientific practice and on the level of ideology. On the level of practice, they provide the means (concepts, problems, criteria) for the development of normal science, while on the level of ideology they help construct the scientific tradition that would facilitate the progress of science. They project an image of continuous and constant development, which leads methodically to the ultimate truth. Setbacks and wrong steps are attributed to factors that are external to science (personal idiosyncrasies, poor technical means, etc.) and are put aside.

History of science, in particular, as it is treated in science textbooks, both in the introductory chapters but also in the presentation of the material itself, contributes to securing the establishment of the paradigm that prevails after a period of crisis. Since the new paradigm is not accepted on the basis of

explicit, universally upheld, rational criteria, there emerges the need of its legitimation on different grounds. History becomes a means of persuasion since it is used to illustrate how past achievements were nothing but the first steps in the march towards the truth that the new paradigm carries. Past theories are presented as having a restricted field of application or as approximations compared to the current ones.

History of science as it was practised before Kuhn was catering for the textbooks' demands. It was a version of the so-called *Whig history* which highlighted only those past episodes that were thought to pave the way for future advances in science. But not only history but also philosophy of science before Kuhn, adhered to the image of science projected in the science textbooks. It treated scientific concepts and theories as if they were atemporal and universal.

Kuhn's work challenged many well entrenched ideas. In philosophy he cultivated sensitivity towards change in scientific development, while in history he laid emphasis on the particularities of facts not in order to vindicate modern science but in order to better understand past theories and practices. Yet, perhaps paradoxically, Kuhn acknowledges the educational significance of textbooks and of whig or retrospective history despite their flaws and inadequacies.

While he quotes approvingly Alfred North Whitehead on the unhistorical spirit that animates the scientific community, "A science that hesitates to forget its founders is lost", he notes:

Yet [Whitehead] was not quite right, for the sciences, like other professional enterprises, do need their heroes and do preserve their names. Fortunately, instead of forgetting these heroes, scientists have been able to forget or revise their works. (Kuhn 1970, pp. 138–139)

The word 'fortunately' that Kuhn uses in the above quoted passage is not a recommendation to distort history. It could be taken in this manner if Kuhn's work were meant to interfere directly in the practice of science. But in this case, scientists could just ignore it in the spirit of the saying that philosophy of science is to the scientists what ornithology is to birds. My view, which I will defend further at the end of the paper, is that Kuhn does not attempt to admonish the scientists, nor does he want to offer suggestions. His judgment recognizes the significance of tradition for building any kind of institution, including that of science. He maintains, that is, that history, as it is presented in textbooks, provides scientists and their discipline the past that vindicates current practice. His position, I will argue, is not normative but descriptive. It offers a diagnosis of what is going on in the sciences.

Harvey Siegel in his (1979, p. 111) claims that "Kuhn's view is that science education does, and should, distort the history of science" for reasons that relate to the production of competent scientists. He cites Kuhn (1970, p. 137) who writes that "[i]n the case of textbooks... there are even *good reasons* why, in these matters, they should be systematically

misleading” (emphasis added). Siegel takes “good reasons” to be a clear indication of a prescriptive stand on the part of Kuhn¹ and objects, on the one hand, on moral grounds – students are persons and do not deserve to be misled – and, on the other, by suggesting that, exposure to alternative accounts of the problems, concepts and standards discussed in textbooks, will not actually confuse students but rather enhance their appreciation of the current paradigm (Siegel 1979, pp. 112–113). Again, I believe that “good reasons” can be taken in a purely instrumental sense. Kuhn recognizes – in a descriptive spirit – what it takes to become a good scientist. Siegel is right to object to the manipulation of students, but his objection does not apply to Kuhn. Kuhn does not recommend abusing the trust that students bestow upon teachers and the educational process. He is laying bare how the practice of science develops. He describes the conditions that make it possible. The authors of textbooks, who are usually themselves accomplished scientists, do not set out to deceive their readers. They tell them what they themselves believe. Siegel’s other objection that undistorted history will better equip the student to appreciate the latest paradigm, disregards that, according to Kuhn’s account at least, the merits of the new paradigm are not impartially assessed against older ones. It is only from within the perspective of the new framework that the new paradigm appears superior.²

Fuller’s Interpretation of Kuhn’s View

Steve Fuller in his book *Thomas Kuhn: A Philosophical History of Our Time* (Fuller 2000) is of a different opinion. He believes that Kuhn was an accomplice, even if unwittingly, in political manoeuvres that had to do with science in the period after World War II. The plans, according to Fuller, were those of James Bryant Conant who, among other things, was president of Harvard University (1933–1953), director of the National Defence Research Committee during World War II (which supervised the construction of the first atomic bomb) and mentor of Thomas Kuhn (Fuller 2000, p. 5). Conant, in Fuller’s view, aimed at bringing the general public closer to science, but not too near, for fear that the public would interfere in how science was practised and make exaggerated demands. Conant’s policy allegedly urged the understanding of science and not the judgment and criticism of its practices and results.

In this effort Kuhn, supposedly, not only offered Conant the philosophical coverage to advance his mission but also brought to fruition a covert Platonic plan. In Fuller’s view, the ‘Platonic cult’ (Fuller 2000, p. 52), from Plato to Leo Strauss, urges the dissemination of noble lies to the general public on behalf of a still nobler truth reserved for the elites. It is the

so-called doctrine of double truth which appeases the masses by reinforcing their prejudices (Fuller 2000, p. 33) while the elites, mentally fit to handle the critical use of reason, secure their position of power and ward off the destabilizing effects of lay people's criticism. In the case of science what supposedly has to be protected is the role of science in the military-industrial complex of western societies. So, Kuhn, according to Fuller, undertook to recommend the doctrine of 'historiographical segregationism', i.e., to suggest that there can be two histories of science: one good for the historians and philosophers (the "elite"), and one bad, that is, inaccurate and anachronistic, for the scientists (the "rabble") who need to acquire an ideal image of their discipline (Fuller 2000, p. 27).

[O]n the one hand, a heroic history to motivate scientists in their daily activities; on the other, a messy, dispiriting, yet more down-to-earth history that the professional historian uncovers mainly for consumption by other historians. (Fuller 2000, p. 380)

Fuller believes that when Kuhn recognizes the educational role of the textbook history of science he aims at defending the infrastructure of the political status quo. He wants to protect the authority of science in that infrastructure and to that end he does not mind disillusioning the scientists as regards the history of their discipline. Fuller paints a conservative and reactionary Kuhn who discourages criticism in order to protect the establishment.

Fuller's unusual interpretation is based more on unwarranted presuppositions rather than evidence.³ Yet, what interests us here is not to evaluate Fuller's account but to assess the significance of the distinction attributed to Kuhn between history of science for the scientists (textbook history) and history of science for the historians and philosophers. Fuller maintains that the distinction serves a prescriptive purpose: Kuhn advances and recommends the orderly and heroic history for the scientists as the myth that will entice and blind them. His end in view is to deter and blunt criticism. I believe that the distinction is drawn descriptively: Kuhn reports what is going on, underlining, at the same time, the significance of textbook history in the practice of science. The question to be addressed is whether the distinction drawn by Kuhn between the different kinds of history can help us answer the question of the relevance and significance of the history of science to science education.

Should History of Science be Included in Science Education?

The first thing to consider is whether one should accept the Kuhnian distinction between textbook history and historians' history. If the distinction is accepted, if, moreover, it is taken normatively and if textbook history is taken to be a

travesty of history, then, obviously, this kind of history should not be taught at all. If we were to accept it, it would mean that we would sanction myth, falsity and manipulation of facts. That would be inadmissible in the age that values accuracy and truth. It would mean that we would willingly promote obscurantism and disillusionment in the field where, more than anywhere else, truth is supposed to reign. This practice would also be objectionable on moral grounds, as Siegel pointed out,⁴ since it would mean that we would outright deceive students and treat them as mere means to an end.

If now, the distinction is not accepted, given how objectionable textbook history is, then the question becomes whether science education should include the only history worthy of its name, i.e., the historians' history. In this case, however, a different issue emerges: is there only *one* good history approved by the historians to subsequently consider whether it should be taught? History of science does not seem any different from history in general where it cannot be maintained that there exists just one correct narrative depicting accurately what has happened in the past. Some historiographical narratives are complementary, others in competition, some other incompatible. Yet, the variety of narratives available does not preclude the teaching of history in general. Why should it preclude, in particular, the teaching of the history of the sciences?

In the case of general history, despite the different and often incompatible narratives, it is usually the state itself, either directly through the Ministry of Education, or indirectly through special agencies and committees that express society's priorities, which lays the guiding lines for the teaching of history in the educational institutions. What would be the body that would assume this role in the case of the history of the sciences? If it is the body of the physical scientists, then the history that they will choose to teach would not differ from the textbook history that was rejected in the first place. If it is the historians, then – and leaving their possible disagreements aside – there emerges a different problem: How could the physical scientists accept the teaching of a history of science that would go against what they teach when they initiate students into their discipline? The good history of the historians is exactly the one undermining the certainties of the scientists since it brings to the surface the mistakes, the misunderstandings and the variability of the past. It, therefore, makes plausible the idea that current scientific beliefs may subsequently be rejected as false.

A reasonable suggestion would be to teach the history of the sciences not in relation to the physical sciences but as part of an overall education in the humanities. It could be included in the teaching of general history so that the students get acquainted with the scientific aspect of world culture. This measure would not only enrich the general culture of the students but it would also cultivate an attitude towards science and the scientists that would not be marked by a sense of awe of mythological proportions towards it. It would

contribute to combating *scientism*, the view that attributes to science inflated and unjustifiable authority. When students and the public have a more accurate image of science they will be in a better position to understand and evaluate it.⁵

C.P. Snow and Tom Sorell assign history a different role. C.P. Snow, in his book *The Two Cultures* (1998), speaks of the divide between the scientific and the literary culture and calls for the reform of the educational system in order that mutual understanding is enhanced. In his later essay "The Two Cultures: A Second Look" he recognizes the emergence of a third culture, that of the social sciences (social history, sociology, demography, political science, economics, government, psychology, medicine and social arts) which, he hopes, would mediate between the sciences and the humanities so that contact and communication between them is facilitated (Snow 1998, pp. 69–71).

Tom Sorell has a similar view regarding history and philosophy. He believes that these two disciplines, despite their differences, can bridge the gap between the more accessible and the less accessible sciences.

History is able to show how an earlier and easier to understand stage of physics is related to current stages, and also how very esoteric branches of mathematics developed from the more readily intelligible. History is also able to show how the fragmentation of learning is itself a historical phenomenon, and that subjects from different sides of the supposed divide between the two cultures were once single subjects. Compared to philosophy, history has the advantage of being the more accessible mediator between hard science and the common culture. (Sorell 1991, p. 112)

C.P. Snow does not explain how the social sciences could mediate to improve intelligibility between the two cultures. Tom Sorell, however, is explicit: He presupposes an evolutionary model of scientific development, from more primitive to more advanced stages, and believes that older theories are more easily accessible than the later ones. These views, however, have been severely challenged after Kuhn's work,⁶ so, it would be difficult to accept that history can be used to better understand current science.

To recapitulate: I considered, first, the case of accepting the distinction between historians' history of science and textbook history of science and rejected the teaching of textbook history on the grounds that it would promote the dissemination of *facta ficta*.⁷ Then, I considered the possibility of rejecting the distinction altogether and suggested that it would be reasonable to teach the only history of science worthy of the name (i.e., the historians' history) as part of a humanities curriculum for the general education of students. Is there a third option, in which we would preserve the distinction and yet we would not reject the teaching of textbook history?

This third option emerges in the work of T.S. Kuhn.⁸ Kuhn upholds the distinction, but does not make normative suggestions. He does not proceed to recommend the teaching of textbook history after drawing the distinction between textbook history and the historians' history. Nor does he aim to

deceive the scientists by recognizing the significance of textbook history in science education. He does not assume the role of an expert telling scientists what is best for them to do. He highlights the importance of the bad history of textbooks because he perceives science as a practice and not as a set of propositions forming a theory. If he had taken science to be merely a set of true statements, it wouldn't make sense to include in it false propositions like the ones fabricated by textbook history or to maintain that true statements be conveyed to and instilled into students by means of false ones. Because he understands science as a practice, he recognizes the conditions that make it possible. One of these conditions is the retrospective reading of history. It is an indispensable part of the new paradigm of physics to allow Newtonian mechanics the place of the limiting case in a more general theory even if, strictly speaking, Newtonian physics may not be a limiting case of the theory of relativity. According to Kuhn, the new paradigm needs to make such moves, in order to even be considered a candidate for replacing the old paradigm and eventually get established. This kind of rhetoric is not a pre-text. As Michael Friedman (2001, p. 66) puts it, the new paradigm, should show that it contains the previous constitutive framework as a limiting case and, thus, to project itself as the culmination of a convergent sequence.⁹ In other words, it is an essential part of science development that history is distorted.¹⁰

Thomas Nickles, in his article aptly titled "Good Science as Bad History" (1992),¹¹ emphasizes how effective retrospective or whiggish history is in scientific development and he cites Herbert Butterfield, who claims that we are all "exultant and unrepentant whigs",¹² to maintain that

...whiggism has been politically and culturally valuable as the chief mechanism for wedding past to future, for legitimating future change by reference to past policies, traditions and cultural forms that are whiggishly adapted to the program of the reformists. Thus whiggism helps to solve the major problem we face as we *make* history, as we alter our former ways of life, as "we live forward (in the words of Dewey¹³). (emphasis in the original, Nickles 1992, p. 113)

Nickles's point is that whiggism is invaluable in the practice of science; it guides future action and it is the condition for doing good research (Nickles 1992, p. 98).

Even Nietzsche, who expressed so many reservations for the study of history in his second *Untimely Meditation* (1983), which is entitled "On the Uses and Disadvantages of History for Life", acknowledged that what he called monumental history, i.e., history that relates the great deeds of great figures across the millennia, despite the fact that it distorts, beautifies or even invents the past with deceptive analogies, despite the fact that it has no use for absolute veracity and it makes what is dissimilar look similar (Nietzsche 1983, pp. 70–71), yet, this kind of history serves life when it is subordinate to

life (Nietzsche 1983 p. 67). Even if it makes “the past suffer” (p. 74), it proves useful when it is employed for the purposes of life, when it motivates us to act, to take part in the relay-race (p. 68) of our glorious ancestors who inspire us to follow in their great steps.

Conclusion

If we, now, take these considerations and apply them to science, it can be maintained that the monumental history of the textbooks is an indelible condition of scientific practice. The heroes of the past, despite the fact, or because their work is distorted and misread, function as models that prescribe what scientists ought to do. This, I take it, is Kuhn's view regarding textbook history: that it is conducive to forming the scientists' course of action. This is, in effect, the reason Kuhn included in his paradigms not only scientific laws and theories but also elements that could be labeled ideological.

So, my answer to the question, whether history of science should be included in science education, is that, if science is to preserve even the remotest relation to what we know of science today, then, we cannot but teach it the way scientists do, i.e., with the help of textbooks. The other kind of history, the history of the historians, can only be taught as part of the students' general education.¹⁴

Notes

¹ In Siegel (1978) this view is attributed to a hypothetical proponent of Kuhn's descriptive account of science education because, according to Siegel, the only person who could prescribe this description is Kuhn himself and it's not clear that he does" (Siegel 1978, p. 306, n. 16).

² Friedman in his (2001) agrees with Kuhn. Siegel, on the other hand, in an earlier paper of his (1978, p. 307) is less resolute as to whether a particular kind of science education is more effective in producing competent scientists. He claims that it is an empirical matter to be settled by empirical investigation.

³ I defend this claim in Kindi (2003).

⁴ See Siegel (1978, p. 113).

⁵ This seems to be the function of the *Harvard Project Physics Course* that Siegel describes in his (1979).

⁶ Kuhn has spoken explicitly about the difficulty to make sense of old texts. His experience as a historian led him to identify the notorious problem of the incommensurability of concepts. Even if the terms in the course of history remain the same in a discipline, their meaning may change considerably or even radically.

⁷ This claim does not of course speak of textbooks which exist, or might exist that include accurate histories of the disciplines. In that case, it is then an empirical matter to assess whether this history is actually taught and what the effects of this different kind of education are on the practice and development of the sciences.

⁸ For a detailed and thorough review of Kuhn's overall impact on science education see Matthews (2004).

⁹ Friedman claims that only retrospectively (i.e., once a new framework is in place) that we can speak of inter-paradigm convergence. “It is only from the point of view of the new framework that the earlier framework can be seen as a special case, so that, accordingly, our evolving space of conceptual possibilities can be truly seen as expanding (and thus as preserving, as far as possible, that which was there before)” (Friedman 2001, p. 101).

¹⁰ One might argue that since Kuhn considers textbook history an essential part of scientific practice, his account is normative and not descriptive. This would follow if one assumes that Kuhn also considers the specific scientific practice worth preserving. In that case he would indeed be thought as recommending the teaching of textbook history in order to sustain the practice. But in what sense can it be said that Kuhn wants the specific practice to be preserved? Even if we credit him with such a view, this view would not follow from a particular Kuhnian conception of science. Kuhn did not offer reasons why the actual practice of science, or some other, is justified and preferable. He did not try, as Popper did, to say what science ought to be like and what we ought to do to promote it. He looked at the actual practice of science and described what makes it possible. I take his account to be similar, in its descriptive part, to P. Strawson’s “descriptive metaphysics” (1985) where one investigates and describes the connections between mutually supportive and mutually dependent parts of a conceptual whole. In Kuhn’s case he describes the mutually supportive parts that make up the practice of science, one of them being textbook history.

¹¹ Nickles writes that his working title for the same paper was “Whiggism as good science and bad history” (Nickles 1992, p. 98).

¹² This phrase is from Butterfield (1944). It is, of course, well known that Herbert Butterfield coined the phrase and cautioned us against the whig interpretations of history in his homonymous book *Butterfield* (1931). Nickles maintains that Butterfield in his later books “mellowed” (Nickles 1992, p. 99).

¹³ Nickles is referring the reader to Dewey (1917).

¹⁴ I would like to thank Professor Michael Matthews and an anonymous referee for their suggestions and criticism that helped me to improve an earlier version of the paper.

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