Teaching and learning about science and society

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INTRODUCTION

It is a subject that goes by many different names, plain or fancy: *Social Studies in Science; Science of Science; Science and Society; Social Responsibility in Science; Science Theory; Science Policy Studies; Science in a Social Context; Liberal Studies in Science; Social Relations of Science and Technology; History/Philosophy/Sociology of Science/Technology/Knowledge;* etc. Let us call it, cryptically, *STS*, short for *Science, Technology, and Society*.

The diversity of names is characteristic, for it is highly diversified in content and significance. Some people would limit it to philosophical exercises within the groves of academia; others would pursue it politically into the industrial market place, the courts of justice and the councils of government. For some it is an area for dispassionate analysis; for others it is a cause for concern.

STS themes permeate the political, economic and cultural issues of our times. The whole subject is now a major factor in the equations of civilized life. Considered thus broadly, it has escaped the possibility of encapsulation in a single work.

But STS *education* – that is, organized instruction on various aspects of this general subject – is a much more specific topic. In the last decade or so, various courses of study have been tried out, with various objectives, and varying degrees of success, on a wide variety of students in secondary schools, universities, polytechnics and other institutions of higher education.* This development is, of course, itself a consequence of the general interest in STS themes in the political and cultural sphere, but manifests itself much more concretely, in the form of teaching curricula, lecture notes, textbooks and examination syllabuses. This is a topic on which it still seems possible to write in the hope of saying something useful.

* For brevity, all tertiary education will be referred to generically as taking place in *colleges*.

In many ways this educational innovation has made quite remarkable progress. But the movement for STS education is still small and weak by comparison with what it seeks to achieve. It is carried forward almost entirely by personal enthusiasm, with very little backing from the bulk of the scientific and teaching professions. It has not acquired the momentum of an intellectual tradition, nor a central core of academic experience on which its supporters can depend intuitively for guidance. There are dangerous symptoms of fragmentation, goal displacement and disharmony. It is becoming quite difficult, at times, to explain what STS education is *for*, what it should be *about*, and how it should be *taught*.

As a supporter of this movement, I have long felt the lack of an established *rationale* of STS as an educational subject. I had hoped that this might emerge from the continual hum of private argument and public debate that enlivens the community of STS teachers and scholars – but important questions concerning both ends and means seemed never to be asked clearly nor answered convincingly. Nobody seemed to be very perturbed about this; and yet I could not help feeling that our individual efforts might be concerted more effectively if we tried to state the goals to which they were directed and the principles on which they were based.

Of course, this faith in rationality of purpose in a largely incoherent social movement may be quite mistaken. It might be much wiser to leave well alone. Any attempt to construct a definite prescription for STS education by open discussion amongst its supporters would probably split the whole movement irrevocably. Superficially, there seems no consensus beyond a strong feeling that science education is in urgent need of reform in this general direction.

I began to write this book mainly to clarify my own thoughts on this very confused subject. I did not consult anyone about its form or contents, and had no real idea at the beginning how it would come out. But as I proceeded, I got the feeling that this movement has greater underlying unity than appears on the surface. The divergences of opinion are much more about practical matters – the topics to be treated, the intellectual approach, the techniques of teaching and examining – than about fundamental principles. The margin between success and failure with a particular course could more often be attributed to pedagogical factors, such as the interests of the students or the capabilities of the teachers, than to basic differences of aim. In other words, I discovered within STS education a common core of purpose,

and a common fund of experience, on which the whole movement could perhaps begin to rely.

This book has thus become an attempt to bring to light the half-submerged rationale of STS education. By its very nature this cannot be defined precisely. To avoid futile disputes about minutiae, it had to be formulated very theoretically and schematically, without reference to particulars. But it is not just a survey of received opinions, blandly inviting agreement. Even though they have no greater force behind them than the weight of their own argument, I have not pulled my punches on significant issues. What we need is a dynamic educational tradition, where people concerned with science and education are stimulated to take up opposing positions on many controversial issues and yet keep in mind the deeper understanding they have in common. Again, so as not to exacerbate existing differences of opinion, I have presented the case impersonally, entirely on my own account and in my own words, without consultation or quotation of this or that authority.

This could be sufficient justification for excluding all references to published opinions or factual data. But there is also a practical reason for this very 'unscholarly' approach. The available literature is just too uneven, in relevance, scope and quality, to match the pattern and purpose of the book as a whole. Roughly speaking, the situation is as follows:

The first three chapters argue that science education, as conventionally organized in a country such as England, gives a misleading image of the capabilities and social function of science, to research scientists, to technological practitioners, to technical workers, and to the general public. This is a subject on which one might quote easily accessible statistical facts, such as the numbers of students at school and college taking this or that course and entering this or that employment, together with a smattering of wise or foolish views drawn from the very diffuse and tendentious literature on education in the natural sciences. I doubt whether there is better authority to be found there than personal experience and native wit.

Chapters 4–6 are taken up with a schematic 'model' of academic science, of the research and development system of which it is part, and of the social context in which the R & D system is embedded. The characteristic STS themes can be related to various aspects of this model, which thus unifies the subject matter of this new discipline. Here, of course, one might cite *ad nauseam* a very extensive and sophisticated literature on the historical, philosophical, sociological,

political, economic, etc., aspects of science and technology; it must be assumed, however, that anyone reading a book such as this already has keys to the main gates into this intellectual arena.

In the last three chapters, however, dealing with various pedagogic approaches to STS education, as they are or might be put into practice, at various levels, in schools and colleges, for students taking various types of courses, the whole argument is much more empirical. As I have already remarked, there is practically no 'theoretical' literature on this new development, and even the simplest factual data concerning the numbers, sizes, methods and achievements of existing courses is only now becoming available. I do not think it would be fair to those people who are active in teaching about science to put any weight on this information until it has been analysed and followed up in much greater detail.

So the argument is put forward with little specific reference to its intellectual, academic or ideological antecedents or context. Nobody need suppose, however, that this book is disinterested or aloof in intention. The STS movement belongs to our own times, and to our own form of civilization. It impinges sharply on educational institutions, educationalists and teachers. I am writing out of personal experience of such teaching, personal commitment to the subject, and the friendship of a number of other people who have felt the same impact. For simplicity of exposition, I use the nomenclature and categories of the English educational system, with which I am personally familiar, but I think that these could be translated into their approximate North American or Continental European equivalents without breaking the thread of the argument. There may well be lessons also for other countries with more distant traditions, for science education has universal forms.

What is, perhaps, more significant is that the topic of this enquiry cannot be confined to one small corner of the world of education and science. It brings into question the goals of education and of science, their respective roles in society at large, the relationship between scientific and humanistic values, the balance between education, learning and research, the parts to be played by science teachers, scientists and technologists, and many other topics worthy of critical and imaginative thought.

Bristol, 3 October 1979 John Ziman