

Science as an education

In this shortened version of a talk he gave recently on BBC Radio 3, Professor Sir Hermann Bondi, Chief Scientific Adviser to the Ministry of Defence, argues for a view of science as an education of the mind, rather than as professional training

My thesis is that science should be taught like the classics but has increasingly been taught like medicine. A medical education is a professional training with a practising doctor as end product. A classical education (and I would include more than just the classics here) has no such clearly defined end product, but is widely accepted as a good preparation for demanding tasks in administration and management. The reason is that students are taken through the thinking of some of the finest minds humanity has ever known, discuss and debate the difficult, often undecidable questions that these people discussed, and are trained to express themselves by word of mouth as well as by writing and to give a structure to their ideas, however complex or sophisticated the subject.

This is precisely the ability helpful in any senior task; in such a task one always deals with people and it is through argument and discussion, papers and analysis that one arrives at the kind of conclusion, at the kind of leadership, at the kind of consensus this necessary for achieving anything in administration and management. The only criticism must be that classics courses are very short indeed on numeracy, a skill which is of particular importance to administrators and managers who need to analyse statistics critically.

We have had a lot of trouble in recent years with young people not coming forward in the numbers expected to do science. This limited success of science in the all-important field of marketing an academic education is often ascribed, rightly, to the liking of young people to work with people rather than to deal in facts. This attitude reveals a misconception of what science is like, that to me is simply staggering. Science doesn't deal with facts; indeed, fact is an emotion-loaded word for which there is little place in scientific debate. Science is above all a cooperative enterprise. It is a social activity which is perhaps more successful than any other in enabling people of different religion, politics, race, culture and ideology to work together, and it is thus a particularly human subject.

Science reveals its humanity most in

those research issues that are the subject of current debate, discussion and seminar. In these fields there is no certainty, only arguments. These arguments can indeed be supported in an exceptionally important way by experiment, but can also be disproved by a sufficiently careful and ingenious experiment or observation. Science is thus a field in which imagination is of the utmost importance; not, it must be emphasised, untrammelled imagination, but imagination carefully controlled by what can and cannot be tested experimentally.

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When we look at science, not so much as a profession but as an intellectual adventure, it is clear that it has had some of the finest minds that mankind ever produced, grappling with problems a little harder to define than some of the philosophical problems of the ancients, but also problems where, through the test of experiment and observation, human imagination has been brought to its highest peak. This aspect of science does not come across anything like well enough to attract young students.

If it is educational for performers of senior and responsible tasks to be taken through the thoughts of a Plato, is it not just as good, perhaps even better, for them to be taken through the thoughts of a Newton or an Einstein? I say better because of the additional demands of numeracy. I claim that if we conceive of science as a group of subjects offering an education in thinking, communication and particularly the evolution of human ideas generated by an unequalled creativity, originality and imagination, then the education that can be provided

is unsurpassed.

Hitherto the voracious appetite of government and industry for scientists during the 1950s and much of the 1960s propelled the universities into producing the maximum number of professional 'bench' scientists they could, which was thought, to some extent at least, to involve stuffing as much scientific knowledge into them as was possible. I would not wish it to be thought that I view those efforts—in some of which I partook—as bad or disadvantageous; only that the emphasis was confined, incorrectly, to the aim of producing professional scientists.

If one had viewed science as an education of the mind rather than as professional training, naturally students emerging with a first degree would have known less science. But they would have known more about the kingdom of scientific ideas, about how to argue, about the evolution of human thinking and about how scientific debate and the interaction of experiment and theory stimulate creativity.

Further, such an orientation of science courses might also produce better scientists, first because such teaching would attract many of the ablest young people now repelled by the supposedly inhuman face of science, and second because in science itself an ability to argue, debate, and understand the other person's ideas, however imperfectly expressed, is at least as important as sheer scientific knowledge.

It ill-becomes scientists to deplore the fact that so few of them are in parliament, the upper reaches of the Civil Service, the banks, the highest positions in industry. For have science courses been aimed to produce such people? There have been a number of efforts in the past ten or fifteen years to improve the balance. They have had most creditable success in establishing novel courses, but these only affect a very small proportion of the science students and therefore do little to alter the prevailing misconception of what science is.

I do not want it to be thought that science as an education is intellectually less demanding than an education in science. Quite the contrary. And I certainly would not wish to propagate a course that was not really demanding, because that would fail in its purpose: attracting the ablest young people to what is the most exciting area of human enterprise. □