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# The Place of Science in a Liberal Education (1913)\*

By Bertrand Russell

## I.

SCIENCE, to the ordinary reader of newspapers, is represented by a varying selection of sensational triumphs, such as wireless telegraphy and aeroplanes, radio-activity and the marvels of modern alchemy. It is not of this aspect of science that I wish to speak. Science, in this aspect, consists of detached up-to-date fragments, interesting only until they are replaced by something newer and more up-to-date, displaying nothing of the systems of patiently constructed knowledge out of which, almost as a casual incident, have come the practically useful results which interest the man in the street. The increased command over the forces of nature which is derived from science is undoubtedly an amply sufficient reason for encouraging scientific research, but this reason has been so often urged and is so easily appreciated that other reasons, to my mind quite as important, are apt to be overlooked. It is with these other reasons, especially with the intrinsic value of a scientific habit of mind in forming our outlook on the world, that I shall be concerned in what follows.

The instance of wireless telegraphy will serve to illustrate the difference between the two points of view. Almost all the serious intellectual labour required for the [p.34] possibility of this invention is due to three men—Faraday, Maxwell, and Hertz. In alternating layers of experiment and theory these three men built up the modern theory of electromagnetism, and demonstrated the identity of light with electromagnetic waves. The system which they discovered is one of profound intellectual interest, bringing together and unifying an endless variety of apparently detached phenomena, and displaying a cumulative mental power which cannot but afford delight to every generous spirit. The mechanical details which remained to be adjusted in order to utilise their discoveries for a practical system of telegraphy demanded, no doubt, very considerable ingenuity, but had not that broad sweep and that universality which could give them intrinsic interest as an object of disinterested contemplation.

From the point of view of training the mind, of giving that well-informed, impersonal outlook which constitutes culture in the good sense of this much-misused word, it seems to be generally held indisputable that a literary education is superior to one based on science. Even the warmest advocates of science are apt to rest their claims on the contention that culture ought to be sacrificed to utility. Those men of science who respect culture, when they associate with men learned in the classics, are apt to admit, not merely politely, but sincerely, a certain inferiority on their side, compensated doubtless by the services which science renders to humanity, but none the less real. And so long as this attitude exists among men of science, it tends to verify itself: the intrinsically valuable aspects of science tend to be sacrificed to the merely useful, and little attempt is made to preserve that leisurely, systematic survey by which the finer quality of mind is formed and nourished.

[p.35] But even if there be, in present fact, any such inferiority as is supposed in the educational value of science, this is, I believe, not the fault of science itself, but the fault of the spirit in which science is taught. If its full possibilities were realised by those who teach it, I believe that its capacity of producing those habits of mind which constitute the highest mental excellence would be at least as great as that of literature, and more particularly of Greek and Latin literature. In saying this I have no wish whatever to disparage a classical education. I have not myself enjoyed its benefits, and my knowledge of Greek and Latin authors is derived almost wholly from translations. But I am firmly persuaded that the Greeks fully deserve all the admiration that is bestowed upon them, and that it is a very great and serious loss to be unacquainted with their writings. It is not by attacking them, but by drawing attention to neglected excellences in science, that I wish to conduct my argument.

One defect, however, does seem inherent in a purely classical education—namely, a too exclusive emphasis on the past. By the study of what is absolutely ended and can never be renewed, a habit of criticism towards the present and the future is engendered. The qualities in which the present excels are qualities to which the study of the past does not

direct attention, and to which, therefore, the student of Greek civilisation may easily become blind. In what is new and growing there is apt to be something crude, insolent, even a little vulgar, which is shocking to the man of sensitive taste; quivering from the rough contact, he retires to the trim gardens of a polished past, forgetting that they were reclaimed from the wilderness by men as rough and earth-soiled as those from whom he shrinks in his own day. The habit of being unable to recognise merit [p.36] until it is dead is too apt to be the result of a purely bookish life, and a culture based wholly on the past will seldom be able to pierce through everyday surroundings to the essential splendour of contemporary things, or to the hope of still greater splendour in the future.

"My eyes saw not the men of old;  
And now their age away has rolled.  
I weep to think I shall not see  
The heroes of posterity."

So says the Chinese poet; but such impartiality is rare in the more pugnacious atmosphere of the West, where the champions of past and future fight a never-ending battle, instead of combining to seek out the merits of both.

This consideration, which militates not only against the exclusive study of the classics, but against every form of culture which has become static, traditional, and academic, leads inevitably to the fundamental question: What is the true end of education? But before attempting to answer this question it will be well to define the sense in which we are to use the word "education." For this purpose I shall distinguish the sense in which I mean to use it from two others, both perfectly legitimate, the one broader and the other narrower than the sense in which I mean to use the word.

In the broader sense, education will include not only what we learn through instruction, but all that we learn through personal experience—the formation of character through the education of life. Of this aspect of education, vitally important as it is, I will say nothing, since its consideration would introduce topics quite foreign to the question with which we are concerned.

In the narrower sense, education may be confined to instruction, the imparting of definite information [p.37] on various subjects, because such information, in and for itself, is useful in daily life. Elementary education—reading, writing, and arithmetic—is almost wholly of this kind. But instruction, necessary as it is, does not *per se* constitute education in the sense in which I wish to consider it.

Education, in the sense in which I mean it, may be defined as *the formation, by means of instruction, of certain mental habits and a certain outlook on life and the world*. It remains to ask ourselves, what mental habits, and what sort of outlook, can be hoped for as the result of instruction? When we have answered this question we can attempt to decide what science has to contribute to the formation of the habits and outlook which we desire.

Our whole life is built about a certain number—not a very small number—of primary instincts and impulses. Only what is in some way connected with these instincts and impulses appears to us desirable or important; there is no faculty, whether "reason" or "virtue" or whatever it may be called, that can take our active life and our hopes and fears outside the region controlled by these first movers of all desire. Each of them is like a queen-bee, aided by a hive of workers gathering honey; but when the queen is gone the workers languish and die, and the cells remain empty of their expected sweetness. So with each primary impulse in civilised man: it is surrounded and protected by a busy swarm of attendant derivative desires, which store up in its service whatever honey the surrounding world affords. But if the queen-impulse dies, the death-dealing influence, though retarded a little by habit, spreads slowly through all the subsidiary impulses, and a whole tract of life becomes inexplicably colourless. What was formerly full of zest, and so obviously worth doing that it raised [p.38] no questions, has now grown dreary and purposeless: with a sense of disillusion we inquire the meaning of life, and decide, perhaps, that all is vanity. The search for an outside meaning that can *compel* an inner response must always be disappointed: all "meaning" must be at bottom related to our primary desires, and when they are extinct no miracle can restore to the world the value which they reflected upon it.

The purpose of education, therefore, cannot be to create any primary impulse which is lacking in the uneducated; the purpose can only be to enlarge the scope of those that human nature provides, by increasing the number and variety of attendant thoughts, and

by showing where the most permanent satisfaction is to be found. Under the impulse of a Calvinistic horror of the "natural man," this obvious truth has been too often misconceived in the training of the young; "nature" has been falsely regarded as excluding all that is best in what is natural, and the endeavour to teach virtue has led to the production of stunted and contorted hypocrites instead of full-grown human beings. From such mistakes in education a better psychology or a kinder heart is beginning to preserve the present generation; we need, therefore, waste no more words on the theory that the purpose of education is to thwart or eradicate nature.

But although nature must supply the initial force of desire, nature is not, in the civilised man, the spasmodic, fragmentary, and yet violent set of impulses that it is in the savage. Each impulse has its constitutional ministry of thought and knowledge and reflection, through which possible conflicts of impulses are foreseen, and temporary impulses are controlled by the unifying impulse which may be called wisdom. In this way [p.39] education destroys the crudity of instinct, and increases through knowledge the wealth and variety of the individual's contacts with the outside world, making him no longer an isolated fighting unit, but a citizen of the universe, embracing distant countries, remote regions of space, and vast stretches of past and future within the circle of his interests. It is this simultaneous softening in the insistence of desire and enlargement of its scope that is the chief moral end of education.

Closely connected with this moral end is the more purely intellectual aim of education, the endeavour to make us see and imagine the world in an objective manner, as far as possible as it is in itself, and not merely through the distorting medium of personal desire. The complete attainment of such an objective view is no doubt an ideal, indefinitely approachable, but not actually and fully realisable. Education, considered as a process of forming our mental habits and our outlook on the world, is to be judged successful in proportion as its outcome approximates to this ideal; in proportion, that is to say, as it gives us a true view of our place in society, of the relation of the whole human society to its nonhuman environment, and of the nature of the nonhuman world as it is in itself apart from our desires and interests. If this standard is admitted, we can return to the consideration of science, inquiring how far science contributes to such an aim, and whether it is in any respect superior to its rivals in educational practice.

## II.

Two opposite and at first sight conflicting merits belong to science as against literature and art. The one, which is not inherently necessary, but is certainly true [p.40] at the present day, is hopefulness as to the future of human achievement, and in particular as to the useful work that may be accomplished by any intelligent student. This merit and the cheerful outlook which it engenders prevent what might otherwise be the depressing effect of another aspect of science, to my mind also a merit, and perhaps its greatest merit—I mean the irrelevance of human passions and of the whole subjective apparatus where scientific truth is concerned. Each of these reasons for preferring the study of science requires some amplification. Let us begin with the first.

In the study of literature or art our attention is perpetually riveted upon the past: the men of Greece or of the Renaissance did better than any men do now; the triumphs of former ages, so far from facilitating fresh triumphs in our own age, actually increase the difficulty of fresh triumphs by rendering originality harder of attainment; not only is artistic achievement not cumulative, but it seems even to depend upon a certain freshness and *naïveté* of impulse and vision which civilisation tends to destroy. Hence comes, to those who have been nourished on the literary and artistic productions of former ages, a certain peevishness and undue fastidiousness towards the present, from which there seems no escape except into the deliberate vandalism which ignores tradition and in the search after originality achieves only the eccentric. But in such vandalism there is none of the simplicity and spontaneity out of which great art springs: theory is still the canker in its core, and insincerity destroys the advantages of a merely pretended ignorance.

The despair thus arising from an education which suggests no pre-eminent mental activity except that of artistic creation is wholly absent from an education [p.41] which gives the knowledge of scientific method. The discovery of scientific method, except in pure mathematics, is a thing of yesterday; speaking broadly, we may say that it dates from Galileo. Yet already it has transformed the world, and its success proceeds with ever-accelerating velocity. In science men have discovered an activity of the very highest value in which they are no longer, as in art, dependent for progress upon the appearance of continually greater genius, for in science the successors stand upon the shoulders of their predecessors; where one man of supreme genius has invented a method, a thousand

lesser men can apply it. No transcendent ability is required in order to make useful discoveries in science; the edifice of science needs its masons, bricklayers, and common labourers as well as its foremen, master-builders, and architects. In art nothing worth doing can be done without genius; in science even a very moderate capacity can contribute to a supreme achievement.

In science the man of real genius is the man who invents a new method. The notable discoveries are often made by his successors, who can apply the method with fresh vigour, unimpaired by the previous labour of perfecting it; but the mental calibre of the thought required for their work, however brilliant, is not so great as that required by the first inventor of the method. There are in science immense numbers of different methods, appropriate to different classes of problems; but over and above them all, there is something not easily definable, which may be called *the* method of science. It was formerly customary to identify this with the inductive method, and to associate it with the name of Bacon. But the true inductive method was not discovered by Bacon, and the true method of science [p.42] is something which includes deduction as much as induction, logic and mathematics as much as botany and geology. I shall not attempt the difficult task of stating what the scientific method is, but I will try to indicate the temper of mind out of which the scientific method grows, which is the second of the two merits that were mentioned above as belonging to a scientific education.

The kernel of the scientific outlook is a thing so simple, so obvious, so seemingly trivial, that the mention of it may almost excite derision. The kernel of the scientific outlook is the refusal to regard our own desires, tastes, and interests as affording a key to the understanding of the world. Stated thus baldly, this may seem no more than a trite truism. But to remember it consistently in matters arousing our passionate partisanship is by no means easy, especially where the available evidence is uncertain and inconclusive. A few illustrations will make this clear.

Aristotle, I understand, considered that the stars must move in circles because the circle is the most perfect curve. In the absence of evidence to the contrary, he allowed himself to decide a question of fact by an appeal to æsthetico-moral considerations. In such a case it is at once obvious to us that this appeal was unjustifiable. We know now how to ascertain as a fact the way in which the heavenly bodies move, and we know that they do not move in circles, or even in accurate ellipses, or in any other kind of simply describable curve. This may be painful to a certain hankering after simplicity of pattern in the universe, but we know that in astronomy such feelings are irrelevant. Easy as this knowledge seems now, we owe it to the courage and insight of the first inventors of scientific method, and more especially of Galileo.

[p.43] We may take as another illustration Malthus's doctrine of population. This illustration is all the better for the fact that his actual doctrine is now known to be largely erroneous. It is not his conclusions that are valuable, but the temper and method of his inquiry. As everyone knows, it was to him that Darwin owed an essential part of his theory of natural selection, and this was only possible because Malthus's outlook was truly scientific. His great merit lies in considering man not as the object of praise or blame, but as a part of nature, a thing with a certain characteristic behaviour from which certain consequences must follow. If the behaviour is not quite what Malthus supposed, if the consequences are not quite what he inferred, that may falsify his conclusions, but does not impair the value of his method. The objections which were made when his doctrine was new—that it was horrible and depressing, that people ought not to act as he said they did, and so on—were all such as implied an unscientific attitude of mind; as against all of them, his calm determination to treat man as a natural phenomenon marks an important advance over the reformers of the eighteenth century and the Revolution.

Under the influence of Darwinism the scientific attitude towards man has now become fairly common, and is to some people quite natural, though to most it is still a difficult and artificial intellectual contortion. There is, however, one study which is as yet almost wholly untouched by the scientific spirit—I mean the study of philosophy. Philosophers and the public imagine that the scientific spirit must pervade pages that bristle with allusions to ions, germ-plasms, and the eyes of shell-fish. But as the devil can quote Scripture, so the philosopher can quote science. The scientific spirit is not an affair of [p.44] quotation, of externally acquired information, any more than manners are an affair of the etiquette-book. The scientific attitude of mind involves a sweeping away of all other desires in the interests of the desire to know—it involves suppression of hopes and fears, loves and hates, and the whole subjective emotional life, until we become subdued to the material, able to see it frankly, without preconceptions, without bias, without any wish except to see it as it is, and without any belief that what it is must be determined by some relation,

positive or negative, to what we should like it to be, or to what we can easily imagine it to be.

Now in philosophy this attitude of mind has not as yet been achieved. A certain self-absorption, not personal, but human, has marked almost all attempts to conceive the universe as a whole. Mind, or some aspect of it—thought or will or sentience—has been regarded as the pattern after which the universe is to be conceived, for no better reason, at bottom, than that such a universe would not seem strange, and would give us the cosy feeling that every place is like home. To conceive the universe as essentially progressive or essentially deteriorating, for example, is to give to our hopes and fears a cosmic importance which may, of course, be justified, but which we have as yet no reason to suppose justified. Until we have learnt to think of it in ethically neutral terms, we have not arrived at a scientific attitude in philosophy; and until we have arrived at such an attitude, it is hardly to be hoped that philosophy will achieve any solid results.

I have spoken so far largely of the negative aspect of the scientific spirit, but it is from the positive aspect that its value is derived. The instinct of constructiveness, which is one of the chief incentives to artistic creation, can find in scientific systems a satisfaction more massive than any epic poem. Disinterested curiosity, which is the source of almost all intellectual effort, finds with astonished delight that science can unveil secrets which might well have seemed for ever undiscoverable. The desire for a larger life and wider interests, for an escape from private circumstances, and even from the whole recurring human cycle of birth and death, is fulfilled by the impersonal cosmic outlook of science as by nothing else. To all these must be added, as contributing to the happiness of the man of science, the admiration of splendid achievement, and the consciousness of inestimable utility to the human race. A life devoted to science is therefore a happy life, and its happiness is derived from the very best sources that are open to dwellers on this troubled and passionate planet.

\* Bertrand Russell, "Science as an Element in Culture," *The New Statesman* 1 (May 24 and 31, 1913) Repr. as "The Place of Science in a Liberal Education," *Mysticism and Logic and Other Essays*, London, Longmans, Green, and Co., 1918, pp. 33-25 Page numbers are to ML 1918