THE BEST EDUCATION FOR AN ENGINEER.[1]

AN admirable address, well thought out, well delivered, and received with bursts of applause, which were so enthusiastic that they sounded like volleys of musketry. We are still in the early days of the history of technical education, and such deliberate expression of opinion by those who are connected with the engineering industry are much needed on the subject of the early training of the engineer; and when the speaker is Sir Andrew Noble, in whose works 30,000 gain their living, and when, in addition, he says what he really thinks, and does not merely confine himself to complimentary remarks about the College in which he is speaking, his address cannot fail to command close attention.

On two important occasions captains of industry, when referring to the early education of those who afterwards go to the City and Guilds Technical Colleges, have enlarged on the value of a classical training—Mr. Alexander Siemens in 1892, and now Sir Andrew Noble. Now, why is this?

A considerable proportion of those who have made their mark undoubtedly received a classical education, but one asks, Was it the classical education that made them famous, or was it their great natural ability, and consequent success, that made the reputation of classical education? Or is there some other and deeper reason for this advocacy of the study of the language and literature of the peoples who, near the beginning of our era, occupied a small portion of the earth as we now know it? Not certainly the argument so frequently urged—urged even by Sir Andrew Noble in this address—that a student of science should study classics to better understand the meaning of scientific terms. This will teach him that "geometry" means "land surveying," and leave him disappointed that six books of Euclid do not enable him to measure an irregularly shaped field; his Greek will tell him that a "logarithm" is a "proportion number," but a book of them will still be Greek to him. That it is a mĭcrophone that is used in sending a message to a tēlēphonē will provoke a laugh from the man in the street, and if to a knowledge of classical grammar the student of science adds that of his own language, he will realise that one reason why it is so difficult to obtain a "reliable" measuring instrument is because such a thing is impossible, for the verb "to rely" must be followed by the preposition "on."

No! such a utilitarian argument in favour of classical study is rather a confession of weakness. Nor—as is so often alleged—is a classical study of importance because it facilitates the learning of modern languages. For many are the Dutch, the Poles and the Russians who talk with exasperating volubility in one's own language, wherever one may have been born, but who know less Greek and Latin than an Eton boy whose linguistic powers are as insular as himself.

A study of the classics and a public school education are frequently regarded as synonymous, and so the advantages of the one are confounded with the advantages of the other. At the present time, when so much attention is devoted in secondary and technical schools to *matter* rather than to *manner*, when the aim apparently is to turn out scientific encyclopædias rather than fairly well-informed people with cultivated manners, the following opinion expressed by Sir Andrew Noble should be taken to heart by every engineering student:

"Speaking as an employer of labour, I should say that we find a pleasant speech and manner, tact in dealing with others, and some power of organisation of the utmost value; and it is precisely those qualities which a boy acquires, or ought to acquire, in his *later* years at a public school. Without such qualities even the highest scientific attainments will never make a captain of industry, and in selecting candidates for appointments the man of business distinctly prefers a youth who has had the benefit of some years at a good school."

But this polish, we urge, might equally well be acquired were the study of Japanese or the production and use of the electric current, or the action of mechanical forces, substituted by a *thoughtful* teacher in a public school for that of Greek and Latin. For that cultivation, which we all value so highly, is not produced by the association of a lad with *dead* writers of exceptional ability, but with *living* lads of his own standing, coming, like himself, from homes where refinement and right feeling pervade, and all, like himself, bent on preserving a tradition which, though sometimes foolish, sometimes rough or even brutal, still tends on the whole towards civilisation. It is not so much the *study* as the *life* of a public school boy that is so valuable in forming his character.

But if that be the case, is Sir Andrew justified in deducing the following conclusion?

"My own impression with regard to early education is that, as a sharpener of the young intellect, and as a mental discipline, it would be difficult to improve upon the curriculum which is now in force at our public schools, and which, in the main, has been in force for so many centuries."

The curriculum of a public school is, we think, not exempt from the rule that what man has devised can always be improved. A classical education, the staple of the public school curriculum, has undoubtedly the great advantage that some of the greatest thinkers in the past spent the early part of their lives in receiving it, and the latter portion in giving it to others. It is, therefore, the particular form of training that has been carefully thought out, and its development is the result of long years of trial and error. Further, it possesses another advantage, the value of which does not seem to have received the recognition it deserves, and this is that when the merest dullard is puzzling out some passage with the aid of dictionary and grammar, he is really engaged in a small way on precisely the same kind of work that enchants the greatest scientific investigator, viz. finding out for himself something that he wants to know.

Now this by no means characterises the work of all the students in a well-fitted modern laboratory. Not a few, following the instructions, spend hours taking readings of instruments and tabulating the results, but fail to find out what is the meaning of these results, or even what is the object of the experiment itself. They have, in fact, been laboriously grinding at the handle of the barrel organ, but have been mentally deaf to the tune that it played.

Heartily then do we join with Sir Andrew Noble in deprecating training of this kind—whatever it may be called—and agree with him that even when all technical study is postponed until after school and college life:—

"Those men who, with fair abilities, have received a really good education, have been taught to use their minds, and who, by contact with other students, have acquired habits of application, amply make up for their late start by the power of mind and grip that they bring to their work."

But can these qualities, we ask, only be acquired by confining a boy's attention to the study of words and ideas, and by excluding all study of nature and things? Sir Andrew himself states:—

"In nine cases out of ten, I should say, any knowledge acquired by a boy before he is sixteen can have but a slight intrinsic value. Up to that age, it is not *what* he learns that we have to look at, but *how* he learns; it is the habit of discipline, of mental application, of power in attacking a subject, that are so valuable; not, generally, any definite piece of knowledge he may have gained."

Now surely "the habit of discipline, of mental application, of power in attacking a subject" is exactly what

[1] Inaugural Address of the Session 1899-1900 of the City and Guilds Central Technical College, given at the College, Exhibition Road, by Sir Andrew Noble, K.C.B., F.R.S., on Tuesday, October 3.

can be learnt from a *proper* study of science, and, so far from any knowledge acquired by a boy before he is sixteen having but a slight intrinsic value, is it not a fact that all knowledge requiring mechanical dexterity, such as reading, writing, arithmetic, riding, swimming, talking foreign languages, playing a musical instrument, &c., can be far better acquired before the age of sixteen than later, and are not all these examples of knowledge possessing intrinsic value?

We are, however, quite at one with Sir Andrew in thinking that

"the age at which a boy should seriously begin any special studies, with a view to fit him technically for the profession he may have decided to follow, should not be earlier than seventeen or eighteen."

But should not a sharp distinction be drawn between learning technology and acquiring the elementary principles of science? His warning that the zest for your life's work may be weakened by embarking on it too early certainly furnishes a potent, probably the most important, reason why lads who intend to become engineers should wait until they are eighteen, or at any rate seventeen, years old before they commence their professional education; for then, as is said in the address, they will be

"fresh and keen when others, who have been hammering away at semi-technical work from early boyhood, have become stale and are less vigorous."

For the same reason also, time devoted by a lad to learning off strings of scientific facts would be misspent, but not so, we think, would time given by even a child to the acquisition of scientific habits of thought. We do not defer teaching a lad the principles of morality until he is seventeen or eighteen for fear he should become tired of living a moral life, why then should the risk that a lad might weary of leading an intellectual one frighten us into excluding the principles of science from a good education?

In the address, "science, mechanical drawing, and such like" are classed together as things that may with advantage be omitted from the training of a lad before entering Elswick, provided he has had a good education. But can an education of the present day be termed "good" which lacks a training in those mental qualities which are classed under the head of scientific?

Great stress was laid by Sir Andrew Noble on the value of the knowledge which a person has gained for himself. He cited the results which "dauntless energy, untiring industry and patient search after truth" had achieved for Lord Armstrong, Watt, Stephenson and Faraday, but only as a proof "that a special technical education is not an absolute necessity." Do not the lives of these men, however, teach us much more than this, viz. that the particular system of education, classical, mathematical, scientific, artistic or technical—in fact, any system of education ever invented—is less than nothing in enabling a man to rise to the top in comparison with the determination to succeed and the brains to do it?

The reason why certain branches of industry have almost abandoned this country, and why new branches that have been developed abroad have hardly taken root with us, is a topic deeply interesting to the manufacturer, but generally rather distasteful to the student, since he would prefer to be told that everything was done better, more cheaply and more expeditiously in his own country than in any other. Sir Andrew Noble, however, made even the part of his address which dealt with this subject appeal strongly to his audience, and for a remedy he thought that it was

"to theoretic and technical knowledge that we must chiefly look. Consider, as an illustration, electricity in the service of man. Think of its innumerable applications, and of the number of hands dependent upon its industries. But for one man capable of designing or improving these powerful machines or delicate instruments, there are a thousand ready and able to carry out their designs. But it is the former who are the salt of the earth, and those who have the management of large concerns know well how to value them."

His patriotic statement (for it is true patriotism to help your own countrymen to learn the truth even if it be distasteful) that the success of our German competitors was *not* due "to their putting on the market inferior goods specially got up to imitate those of a superior class," but "to the far greater opportunities of technical study which are afforded in Germany," was as bold as we believe it to be true. For we were recently informed by an English manufacturer that certain things manufactured in England are now being stamped "Made in Germany," in order to obtain a readier sale for them in our own country.

But in addition to greater facilities being needed in Great Britain for the study of the applications of science to industry, greater belief in the value of such study is wanted, not only on the part of the English manufacturer, but also on the part of the English student. "You younger men," said Sir Andrew, "must do your part by seeking to avail yourselves to the uttermost of any such opportunities provided," and it might be added that the reason why that future "important commercial rival, Japan, is developing its manufacturing powers with an energy that is as remarkable as it is unexampled" is because even thirty years ago its young students absorbed with eagerness and rapt attention every scrap of scientific teaching which they could obtain. And they did so partly for their own personal benefit, but far more because each one felt that on his own exertions depended the fame and future of his mother country. W. E. A.

RESEARCH WORK AND THE OPENING OF THE MEDICAL SCHOOLS.

IN one sense at least, viz. his intellectual life, the medical student, natural enough in other respects, seems somewhat at variance with nature; his intellectual spring occurs simultaneously with nature's autumn. Brown October sees him change the abstractness of the class-room for the concreteness of the laboratory. Further, each successive autumn, after a period of summer hibernation, marks the advent of some change in his studies. The fully fledged doctor, too, whose daily round obliterates all distinction between term time and vacation, becomes infected in October with a revival of intellectuality, and whets his appetite by an attendance at the inaugural address delivered at his school, where he gets new knowledge or old dished-up afresh, and becomes generally imbued with the spirit of the time.

This year at least the medical student will not be able to lay any shortcomings which may occur during the ensuing academical year to the charge of insufficient or inadequate advice at its onset. At both the London and provincial schools the inaugural addresses, with regard to depth of meaning and also attractive eloquence, have left little to be desired.

In a short article such as the present it would be impossible to adequately reproduce, even in the most abridged form, the various "motifs" pervading the speeches delivered. One, however, constantly recurring, may be somewhat enlarged upon. Here and there and everywhere in the inaugural addresses we find the position of research to medicine and the medical profession cropping up. Occasionally this subject is mooted in the grossly material form, when, for instance, Sir James Crichton Brown frankly told his hearers at Manchester that although 70,000*l.* was an adequate sum so far,