I have felt that the rather exceptional experience of having been sent with Mr. James Swinburne in 1881 to start a new industry first in France, and subsequently in England, France, Belgium, and Germany, and later again in Paris, has enabled me to form an opinion of the difference between English and Continental methods, especially as regards the adaptability of the hands to the work to be done. In the first place, the foreigner surpasses the English work-hand in general personal neatness, and orderliness in work, and especially so in elementary education. On the other hand, the English girl has more initiative, courage, and nerve to overcome difficult processes, but the lack of neatness necessitates selecting very young girls, who give promise of tidy habits, and carefully training them, but often the most elementary education has already been forgotten.

Since I sketched out the substance of this address, the interesting series of papers read before the British Association at Sheffield have come to hand, and I am glad to see many of them strongly support my argument that a more practical form of education is required. Sir G. Reid, in his short address at the British Association meeting, says publicly what I have often said privately, that the modern student's knowledge is too much of the nature of a "gramophone record"; the information is there, but the human aspect is missing, and I think in many cases the effort of acquiring knowledge has so benumbed the power of using it, that it is only useful as a reference or as a book would be. The present system tends to regard the successful passing of examinations as proof of the scholar's knowledge, but I contend that it only proves his ability to pass examinations, and the true proof of the efficiency of his education is the ability to earn a good living for himself and a social position somewhat better than that inherited from his parents.

Consider how rapidly a good engineering draughtsman or architect can take in the whole detail of a design and point out errors before the
quickest readers could possibly understand a tenth part of it, if described in writing, and how very few people are able to make even a tolerably good sketch. Every journalist is realising the value of illustration, but I am afraid that our schools still do not sufficiently insist on drawing being generally taught, but that they rather regard it as an extra. Sir John Gorst, in the address he gave at this College, said, "It is advised that more technical and practical instruction should be given to the children of our elementary schools by replacing the 'book schools' with what German educationists call 'work schools.'"

Mr. Blair in the early part of his paper at Sheffield referred to a case of a mechanical engineer with first-class honours finding it extremely difficult to obtain a post until he obtained influence to aid him. I can well understand the position. I have had to go through batches of letters from candidates applying for posts, and assist others in the same work, and even when a highly trained man is wanted, a long list of examinations successfully passed tends to depreciate the chance of success of the candidate, since it not only indicates a lack of practical experience, but shows a long experience at learning just how to grasp the particular information required for passing examinations without spending time on the many side issues that a less successful but equally studious man may have been observing, and which are essential in a man if he is to be of use in a factory. Again, a man who has devoted his energies to examination passing has obviously been gathering his information from books, whereas, in a factory, he will soon find that the process or processes he has to deal with are already far in advance of the best books on the subject, and his work will consist of a very close observation of the process (not books) and the noting of each slight alteration.

Another very striking point made by Mr. Blair illustrates the waste that goes on in connection with the training of engineers, from a certain number of whom he succeeded in getting particulars as regards their future. He showed that under 30 per cent. are at engineering work, and 70 per cent. are engaged in teaching. Employers are blamed for not taking advantage of the theoretically trained man, and indeed are accused of prejudice against him, but I think any feeling they have is far surpassed by the rather open want of appreciation often shown by the theoretical student for his practical associates either in the college or works, resulting in the breach between the practical and theoretical sections of a works which often leads to want of efficiency, especially in the theoretical departments. Personally I think this breach between the theoretical and practical departments accounts for the inefficiency of much of our present work.

In 1884, when I went to Lille to assist in the fitting up of the Lille factory, Mr. C. H. Stearn drew my special attention to having the platinum leading-in wires of the lamps clean. I have found that the highly trained student is apt to consider such a little question as dirt on a piece of wire as a matter for the foreman to see to rather than for himself to investigate. I had found it was possible to get the wires
actually sealed into the glass perfectly clean, and yet, when the lamp was finished, the wires in some cases were dirty, or at least black. By following the matter up, I discovered that the glass was being decomposed, and the oxide of lead in it was being converted into metallic lead on one pole, and on my reporting the discovery to Mr. Stearn, he pushed the experiment still further, and succeeded in getting indications of gas being given off at the opposite pole. I have mentioned this matter in some detail because I know of many somewhat similar cases where the want of a closer touch between the scientific and practical ability of a factory has caused heavy losses. For real economy or efficiency we must go still further, and have not only the practical and theoretical departments working together, but also the commercial department.

From a theoretical point of view I think education must consist of two primary processes, namely, the impressing of a picture on the brain, and the cultivation of the brain in such a way as to enable it readily to receive the pictures, and to call them to mind at will. Profitable education must consist of the opportunities given to the brain of obtaining records and the choice and permanency of the records obtained, but supposing we have a large collection of good records, they are of little use unless they can be called to the front at appropriate moments, and even then it requires another and I think a still greater faculty, namely, that of seeing how to fit in the various somewhat similar pictures or impressions in such a way as to make them of use when new conditions occur, and so enable the brain to form a new picture, and continually draw from its stock of records until what is called a completely new idea has been developed.

Let me take for example the present method of making an incandescent lamp. In La Lumière Electrique, April 30, 1892, M. Falcou drew attention to there being ten different methods of constructing incandescent lamps, and especially referred to a design of my own which, to a non-practical man, looks very like the Edison design, but which actually introduced a saving of many thousands of pounds per year. Every engineer knows that sharp corners should be avoided, especially when large differences in temperature occur, such as in castings, and the same also applies to glass work.

What I want to draw special attention to is the system that the brain has of adapting the various pictures or parts of them, one to another, until the idea is complete, and I contend that the overcrowding of the brain with records seems to crowd out the faculty of putting together the various ideas, or maybe the impression gets so permanent a set that it can only see the thing exactly as it was. I think, to some extent, this can be taken as an explanation why some inventors or originators are bad spellers, for they only have a general idea how the word is written, whereas the brain that cannot see another way of spelling is (shall I say for my own sake?) wanting in originality. Of course, there must be a proper balance of ideas, or, I might say, intensity of the pictures, and I believe to a great extent the rapid
progress that other nations have made as compared with ourselves is owing to a better view of the ultimate object.

I am told that in Germany a clear understanding of the problem to be treated is regarded as of paramount importance. In France I know, from many professional friends, that one of the most difficult examinations that a professional teacher has to pass is that of lecturing to his examiners as if they were young students, thus being restricted to the most simple language. I cannot but feel that in some cases at home our lecturers assume that their audiences have a greater interest, or knowledge of the subject, than is often the case. America, again, is a most striking example. Their success, I consider, is due to their clear view of what might be called the meeting-point of every problem, namely, does it pay? The very suggestion of the word, I know, grates on the delicate ears of some pure scientists, or professional men, and yet even ½ per cent. greater efficiency in a machine, or the suggestion that a little bit of powder-like radium can have any superfluous energy, is of immense interest. Then why not also study how to show the rising generation, by a few simple pictures, all that we have so laboriously learnt, and thus leave their minds and brains clear enough to grasp the much larger field of knowledge that is every day opening up before them?

Many of my friends accuse, nay, even blame me, for finding imperfections in my own countrymen, but I maintain that it is by seeing our own deficiencies that we can hope to maintain the lead that we used to have in many industries, which is certainly less to-day than it used to be, and I am afraid has not been replaced by any new industry. Take, for example, America, who, although she pays 10 to 20 per cent. higher wages, can, and is, selling thousands of pounds' worth of machinery in England. Germany is not only selling large quantities of small electrical fittings, but also considerable quantities of heavy electrical machinery.

While in Paris I visited the paper-mill of a friend, and was much impressed by his mentioning that he bought scrap paper in England, was re-making it, and selling it again in England. From a Board of Trade return point of view it would increase our exports and imports, but is it economy? I tried to get a local paper-maker to take up the idea, but I found that the mill had been shut up because it did not pay.

We used to be large glass workers, but our workmen would not use our improved methods. The trade went to Germany, who did do so. When we wanted glass workers for lamp making, we had to go to Germany for them, and pay from £5 to £8 per week for a poor day's work, with the result that we trained girls, who now, by the aid of machinery, do twelve times the amount of work. At first it was feared that the business of incandescent lamp making would eventually become a German business, and one English maker still imports large quantities of German-made lamps for the English market, but we can certainly claim to be selling a large quantity of English-made lamps
abroad. On the other hand, I think it must be admitted that Germany sets the pace as regards electric lamp bulb making. Of course, many millions of bulbs are made in England, but I do not know of any one being able to export them at a profit, and why not? Is it the labour or the capital? The materials are as near to us, and, I believe, quite as cheap. Some people suggest other reforms than a more practical education, and, indeed, one large manufacturer, who often advocates drastic reforms (at least as revolutionary as I want) has proved that even the long-established Continental business of telephone making can be wrested from the foreigner (who has the advantage of good wood supplies) and made at a profit in England; and I contend the secret is simply a good or real combination of capital and labour, theory and practice, backed, of course, by good commercial ability.

I have already expressed the hope that my hearers will not accuse me of depreciating the abilities of the Britishers, for nothing is further from my mind. When once stirred to action, I believe no nationality is more capable, either individually or collectively, of working either for its own good or that of the world in general. Gentlemen, the problem is how can we be roused up sufficiently to obtain a majority in favour of greater efficiency in life and learning.