

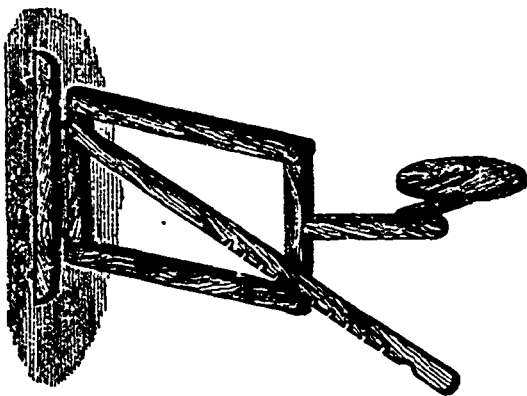
form the intellectual habits that are required for the conduct of industrial operations? Almost with the beginning of education. The Kindergarten teaching is an admirable beginning.

Again,—Technical Education will have a bearing on many things that are taught in the ordinary school course, giving the pupils the ability to use their knowledge for the purpose of bringing about special results, and giving them skill in applying that knowledge in special circumstances.

For instance, it is possible for an apt teacher to gather round his lessons in geography, much that is attractive in the study of nature, and much that is useful in trade and politics.

To show how the Technical Teacher, in the sense in which we are now using the term, would treat a matter of general teaching, and that his method would consist in adding something to what the general teacher would impart without weakening its effect, we may refer to his mode of treating a proposition of Geometry, the Science of Form. There is no science less practical, or more practical, according to the way in which it is taught. It may be little more than an antiquated puzzle in logic, or it may be a mine yielding rich treasures of useful application to the purposes of life.

Suppose the subject to be the parallelogram. The pupils prove that the opposite sides are equal. They discuss the use of this fact in measuring and transferring distances. Then follows the proof that, if the opposite sides are equal, the figure is a parallelogram. The practical consequences are immediately sought for. If the figure keeps the same sides, it remains a parallelogram. Hence, a jointed parallelogram easily changes its form, but once a parallelogram it is always a parallelogram. Here the practical manipulation comes in. A jointed parallelogram is made. It is not a strong structure. We give it strength, however, by the introduction of a diagonal. This leads us at once to the reason for a cross-bar in a gate. The diagonal has a fixed length for each inclination of its sides; we therefore fix the inclination when we fix the length of the diagonal. If one side of a jointed parallelogram be fixed in a horizontal position, the opposite side is horizontal. If a horizontal arm is attached to this, it may move up and down and be always horizontal. The pupils then go to their workshops with some such exercise as the following:—*Devise a jointed parallelogram which shall serve as a universal joint, supporting a horizontal table, that may be placed at any altitude within certain limits, and may occupy any distance from a fixed support within certain limits.* Each would work out the design in his own way. No two designs would be exactly alike, but all would be something like that represented in the figure. Ever afterwards, the parallelogram would be a very different instrument in the hands of these pupils from the vague and shadowy *ABCD* of the pupil who had simply learnt with infinite labour to repeat the text of a Simpsonised Euclid. I expect this little illustration to do much in showing what is the kind of addition to general instruction which Technical Education calls for.



2nd Grade.—The Technical Education which can be carried on in existing ordinary schools may be said to be of the 1st Grade. The 2nd Grade requires special Technical Schools. They should be at first affiliated, and connected with the schools for general education. I often reflect that one of the most important functions of the schoolmaster and schoolmistress is to direct the pupils to congenial and suitable employment on leaving school, and one of the most important of the functions of the Technical Educator is to select from amongst the members of the rising generation those who have most natural aptitude for industrial occupations,

to develop their powers and consecrate them to the most suitable trades and businesses. This can only be done when there is a most intimate alliance between the general and technical schools. Indeed, if it were not for questions of economy, it would be best that these should be combined in one and the same school; but Technical Education is so costly, and good teachers are so rare, that we must be content to secure one good technical school in common with several elementary and higher schools for general education.

Let me here refer again to the necessity for the Technical School receiving its life and spirit from the principal trade or business of the neighbourhood. In a mining district, the applications sought for will have as much reference as possible to mining; in a watchmaking district, to horology; and so on. In London, they must necessarily be of a more general character, with here and there a special charge, as of carving and design, some branch of engineering, brewing, some department of chemistry, dyeing, navigation. These same Technical Schools should take charge of what we may call the 3rd Stage, that is, they should take charge of these selected pupils who possess in a high degree intelligence combined with inventive ingenuity and practical cleverness, and interpose a special training during the few years which intervene between school-life and business. This is the place for me to notice one important object which Technical Education is asked to serve, viz.—to remedy the effects of the decay of the old apprenticeship system. All that was best and most valuable in the old system has vanished, and the little that remains belongs to its worst and least advantageous features. What is to replace this decayed and obsolete system? The answer is, a complete system of Technical Education.

It was formerly reckoned wise that the knowledge of a professional man should be kept secret as capital in trade, and no effort was neglected which would tend to throw a mystery about it. Its maxims and rules were concealed lest others should become as wise as the master, who had paid a heavy price for his initiation. Technical education aims at unveiling this mystery, and making occult knowledge public property; hence it will remove the need for heavy fees to the mystery men.

At the same time, as has been pointed out in an able report by Professor Ayrton, it is not the business of a Technical School to teach the manipulation or routine of a trade, or to become a rival to other manufactories. It is a school where are given general instruction in science, and special instruction in the application of these principles to the particular trade he is following or is able to follow. As our definition shows, it is not the teaching of trades we are considering, but the development of the qualities that are needed in trade.

3rd Grade.—Again, chiefly by means of evening work, education may be continued in these schools after business has been entered into. Here we are naturally led to ask at what age this process of training is to come to an end? It is not necessary to name the higher limit, for it should lose itself in reach. The Technical schools and colleges should be placed where the manufacturer and skilled artisan may carry out experiments under the eyes of scientific men, which he cannot carry out in the factory and workshop. Every industrial art is steadily undergoing change and development. It does not do for the manufacturer to stand still. A Technical School should assist those who are actually in business to penetrate beyond the knowledge of the processes of a manufacture which was at first given to them, and to make new observations and experiments relating to it.

But here a caution is necessary. In building up a system of Technical Education, it is necessary to guard against spending time in patching up defects arising from the want of system in the past. It is too late to mend the matured—we must aim at improving the rising generation.

4th Grade.—The form that Technical Education will assume towards the pupils of the 4th and final Grade, will be that of an University for the training of the more highly educated youth to the practical business of life. As a type of such an institution, we may select the Technical University of Zurich. Zurich is a commercial and manufacturing State—it is the Lancashire of Switzerland. It is also the scene of the labours of that indefatigable apostle of practical education, Pestalozzi. His spirit seems to haunt the land of his former toil, and to inspire his countrymen with the determination to perfect the work he so happily commenced.

In the Technical University of Zurich, everything that is most valuable in the sciences, arts, and manufactures of all other coun-