

**THE MANUAL
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EDUCATION, PP. 3-70**

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BY

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THE MANUAL ELEMENT IN EDUCATION.

THE Forty-first Annual Report of the Massachusetts Board of Education (1876-77) contains a paper with the above title; and I gladly comply with the wish of the honorable Board that I should prepare a second paper upon the same subject, embodying such additional experience as may have been gained in our School of Mechanic Arts and other similar schools, together with any information I may have been able to gather since the date of the first paper. My chief aim in this paper will be to furnish such details as may be of service to corporations or individuals, as hints or aids in the establishment of this kind of education.

It is hardly worth while in this connection to consider the way that this element is to find its place in our educational system. Individual opinion may for a time have some influence in directing the current of thought upon this subject; but in the end the needs of the public will control. There is already a wide-felt impression, if not conviction, that something of the kind is necessary; and this conviction is most likely to find expression at first in special mechanic art schools, in centres where the need is most felt. If these schools shall demonstrate their value, not only as training schools for fitting students to enter upon certain lines of industrial activity, but also as schools for furnishing the needed mental discipline, then it seems reasonable to suppose that this element will become more general, and just in proportion to the value in which it is held by the educated and thinking public. The methods of teaching the manual element will become better settled through a larger experience; and there will not be the present lack of teachers properly trained for this kind of education.

The revolution in the method of teaching the physical and

natural sciences now practically completed in the laboratory method, or the method of investigation as it may properly be called, is recognized, not only as best for the acquisition of the required knowledge, but also as best for the discipline it imparts; and in the same way the laboratory method of teaching the mechanic arts will gradually take its place as a practical, and at the same time a disciplinary, element in education.

It is but a few years since the idea of introducing drawing into our schools as an element of general education seemed visionary; and yet to-day it is an accomplished fact in many parts of our own country, and has been for a much longer time in many countries abroad. Drawing is now regarded by many educators as an established factor in elementary education, and destined to work its way into all classes of public schools. It was only after it was plainly seen that there is a wide distinction to be made between drawing as an art and the drawing which pertains to a specific industry of which the former can be considered only in the light of the most general preparation, that the art began to be regarded as a possible fundamental factor in a common education. Until recently but little attention has been given to the same broad distinction, which underlies all the manual processes. The old idea of "trade-schools" — that is, schools for teaching the technical details of specific industries — has become so fixed in the public mind that some writers on the general subject, and some reports of school committees, have advocated the introduction of trades into the public schools. To all who entertain this idea I earnestly commend a paper on "Technical Training in American Schools," by E. E. White, LL.D., president of Purdue University, Indiana, issued by the Bureau of Education in Washington; and, while I entirely agree with the conclusions of the paper referred to as regards the introduction of trades into our public schools, no matter of what grade, I am further convinced on general grounds, and from some opportunity of observing the working of trade or special industrial schools, in contrast with general mechanic art schools, in which drawing and other mechanic arts enter as a proper factor, that trade-schools can only be justified, if at all, in a few exceptional cases depending upon the character of those to be taught, and in some few instances upon the character of the industry, such as practical farming, horticulture, pomology, or any other industry in which the manual ele-

ment forms a very inconsiderable part of the special knowledge required, and does not involve those qualities of precision, consecutiveness, and quantitative relation, which would give it special educational value. To special schools of this class I shall hereafter refer. The arts are few, and the trades many. It is the province of a fundamental general education to deal with generals, leaving to the student the task of finding out how his general knowledge applies in special cases. In short, he learns the *technique* of his trade after he leaves the school, and enters upon his chosen specialty. But it is quite another thing to leave out of his general education all those elements which underlie all industrial pursuits, and particularly if it can be seen that the introduction of these general elements is not only educationally feasible, but desirable for the roundness and unity of the general education, and valuable, no matter what the future of those so educated may be.

Nor does it follow, as some suppose, that, because the manual element is introduced into a course of study in proportion to its value as an educational factor, therefore all who take the course must necessarily become mechanics, any more than it follows that, because all are taught the art of drawing, all must therefore follow some pursuit in which this art enters as a necessary element. But it does follow that these mechanic art shops or laboratories would be used just as laboratories for the teaching of other arts or sciences are used,—first, to teach the subject as a part of the general education, and, second, for the advanced study of those who wish to become specialists in this particular direction; that is, for general and professional education.

It is often asserted, and I think with truth, that American boys are disinclined, for various reasons, to enter upon industrial pursuits, and especially where a long shop apprenticeship is required. My experience is that the objection is oftener on the part of the parents, for the reason that the boy's general education must stop, and because, as a rule, it surrounds him with influences which often prove fatal at this critical period of his life. It is also sometimes thought that social considerations influence the boy as well as his parents. But as soon as school authorities, teachers, and the public generally show their respect for labor, by giving it consideration through educational preparation, no caste feeling will enter into the parents' or boy's choice

of a future career. He will simply consult his taste and aptitudes, and the opportunities that offer, when he is ready to go to work. The experience in our own School of Mechanic Arts for the past five years fully sustains this position. Special technical schools confessedly for the children of the poor would inevitably become caste schools; but a general technical training in some of the manual arts, including drawing, required of all during the proper period, occupying only a few hours per week, say from the age of twelve to sixteen, and before the student has sufficient mental maturity to work successfully in a science laboratory, would have an entirely opposite effect, and be at the same time an excellent preparation for industrial pursuits or for further study, no matter in what direction; for whatever subject cultivates care, close observation, exactness, patience, and method, must be a valuable training and preparation for all studies and pursuits. But few persons, I apprehend, whose education did not include drawing, have not had occasion to regret it, if on no higher ground than their inability to use the pencil or drawing-pen for the simplest purposes with any effect or satisfaction.

Before proceeding to an account of some schools in which the Russian method of mechanic art education is used, I will simply add that the Imperial Technical School of Moscow was the first to show that it is best to teach an art before attempting to apply it; that the mechanic arts can be taught to classes through a graded series of examples by the usual laboratory methods which are used in teaching the sciences. The ideas involved in the system are, first, to entirely separate the *art* from the *trade*,—the *instruction-shops* from the *construction-shops*; second, to teach each art in its own shop; third, to equip each shop with as many places and sets of tools, and thus accommodate as many pupils as the teacher can instruct at the same time; fourth, to design and graduate the series of samples to be worked out in each shop on educational grounds; and, fifth, to adopt the proper tests for proficiency and progress.

It is indeed true, that, after the arts have been learned, the next logical step in a full course is to teach their applications in constructions, either in private works, or as is done in the Moscow school. In such a school, where the curriculum covers six years, and the young engineer is needed in the service immediately upon graduation, and has not the opportunity, for any reason, to learn the details of construction in private works, then the attaching of the works to the school may be justified.

THE IMPERIAL TECHNICAL SCHOOL IN MOSCOW, RUSSIA.

This school is entitled to the leading place in any list of schools giving mechanic art education, on account of the fact that it was the first to put this instruction upon a strictly scientific and educational basis, — first, by separating the laboratories, or instruction-shops, from the manufacturing establishment; and, second, by working out a systematic scheme of instruction in each of the underlying arts.

I. THE ORGANIZATION OF THE SCHOOL.

The old school of Arts and Trades was founded in 1830; and by an imperial decree dated June 1, 1868, this school was re-organized and raised to the rank of the leading polytechnic schools of Europe. The course of instruction is six years, — three of general studies, and three of higher special studies.

The work of the second three years embraces three sections of students, mechanical engineers, technological engineers, and constructing engineers. There is a fourth section, called *practiciens*, formed exclusively of those who show exceptional aptitude for practical work, but whose theoretical studies are insufficient to pass them into the engineering sections. They take much fuller shop courses, which they complete in three years.

To be admitted to the school the applicant must present presumptive evidence of qualification, by presenting one of the following certificates: —

1. A certificate of the seventh class in a gymnasium, giving classical instruction.
2. A certificate of a completed course in a real-school of the first class.
3. A certificate of a course of study taken in a school of equal rank.

Before being definitely admitted he must pass a test examination in the following subjects: —

Russian Language. — Composition on a theme chosen by the professor.

Mathematics. — Arithmetic, algebra, elementary analysis, geometry, and plane trigonometry.

Physics. — A course of general physics.

Drawing. — Freehand and mechanical drawing.

Without the above-named certificates, the applicant must pass an examination embracing all the studies of a real-school of the first class.

The studies of the school combine theory and practice, followed in parallel courses. The extent of the scientific instruction is the same as in the leading polytechnic schools of Europe. The practical studies embrace freehand and mechanical drawing; the art of turning in wood and metals, joinery and pattern-making, fitting, locksmithing, forging, moulding, and casting. For the practical studies, special workshops have been established, furnished with all the pedagogical objects necessary for methodic instruction, which is given by special masters, who demonstrate to the pupils the fundamental principles of hand-work in the mechanic arts. The school possesses in addition large manufacturing works, with all the adjuncts of a first-class establishment.

These works employ salaried workmen, and execute orders annually to the amount of a hundred and fifty to two hundred thousand francs. Still the main aim of the works is to furnish students an example of the conditions of industrial work in all its practical details.

II. THE ADMINISTRATION OF THE SCHOOL, ITS EMPLOYEES AND PUPILS.

Serge Barsheff, honorary curator, privy councillor.

Victor Della-Vos, director, actual councillor of state.

The corps of instruction consists of professors, masters, repeaters, numbering	46
Engineer-in-chief, assistants and foremen	11
Various employees	15
	—
	72
Under officers and soldiers in the employ of the school	84
Workmen employed in the workshops, average number	100
	—
	184
Free boarding students	100
Boarding students, paying twelve hundred francs per year,	200
Day students paying four hundred francs per year	282
	—
	582