

MISCELLANEOUS.

SCIENCE TEACHING.

This is an iconoclastic age. Nothing seems to be too sacred for the destructive force of the revolutionary reformer. The most revered institutions of religion, economic theories of time-honored authority, social distinctions whose claims have never been mentioned—all these have felt the desecrating touch of the spirit of the age, which is neither humble nor reverent. Even education, whose evolution almost from time immemorial had gone no further than to modify in some degree the trivium and quadrivium of the ancients, is sharing in the universal change. The new era in science to which Bacon's doctrine of experiment gave rise was an epoch in philosophic method, but its practical effect upon educational method was not destined to be felt for many generations. Though here and there one arose to dispute the arrogant despotism of the classics, and like the voice of one crying in the wilderness, proclaimed the benefits of scientific studies, yet the worship of literary form and classic beauty continued almost supreme until the present century, indeed almost to the present generation.

At that time, however, a change began in educational views which, if not as yet so universal, is at least even more revolutionary than that great intellectual upheaval which followed the discovery of the classic in the fifteenth century, viz.: The introduction of scientific study into our colleges and universities. * * * From the moment the child first puts forth his hand and finds that one object is hard and that another is soft, he is a learner of the facts of science. As he learns to walk, every step he takes, every fall he suffers, every blow he receives from projecting table or chair increases his knowledge of the relations, which his organism sustains to matter apart from itself; that is, his experiences have added something to his little store of scientific truth. When, a few months later, he is throwing objects into the water that goes dancing past his door, and sees that the stones fall quickly to the bottom while the sticks and grasses are borne away in the current, again he observes a phenomena and probably makes a deduction from them which a life time of scientific study would not modify.

Once more, look at that bare-footed urchin mounted high on his stilts and confidently testing his skill in the deepest mud-pool; question that child whose well constructed kite is piercing the distant clouds; follow yonder tardy school-boy whose passion for nest hunting has made him truant from school. You will probably find to your chagrin that the first not only knows but makes intelligent use of the laws of equilibration which you had forgotten; that the next pities your ignorance of the dynamoics of buoyancy; that the third is better authority in the ornithology of his region than you who have read every page of Cones and Baird and Huxley. I do not mean to say that these embryonic scientists would make use of the terms which you would employ of these they probably never even heard—but there is no doubt whatever that in

many cases the very children whom we so love to patronize and awe with our large sounding words, have a more available knowledge of the domestic sciences than we ourselves who pose as their teachers.

The plea of the advocates of science teaching in the common schools is not, then, a plea for the introduction of any innovation into the life of a child; they merely urge that the natural yearnings of the child be gratified; that he be not compelled always to grope blindly after knowledge which it is his inalienable right to enjoy; that he no longer be required to suffer because of his inability to discover, unaided, the correlations of the facts which he acquires. In a word, it is urged that the teacher and nature co-operate in that most sublime work of either, the development of a human soul into symmetry, beauty and completeness.

Admitting, however, not only the value of science teaching, but also the pupils' fitness to receive it, some serious questions must still be answered. How can another subject so extensive as this be crowded into our school courses which already are oppressive with their weight? When the call for lighter work and less grind in our schools is so universal, is it, in all seriousness, proposed to fasten another burden upon the backs of our sinking children? Or if that is not contemplated, must we, to gratify the vanity of a few innovators, witness the banishment from our schools of arithmetic and geography and grammar, studies which have satisfied the needs of our children for unnumbered generations.

In reply to these excited but reasonable questions, permit me to say that it is not to increase, but to lighten the burdens of our children that the study of science is urged; it is not with a view to the destruction of existing subjects that we advocate another; it is that the old may be given new life, may acquire new meaning, may be brought into close harmony with the nature of the beings for whose use they are intended.

But I would have you notice that the fundamental principle of operation to be employed in the introduction of science into common schools is based on the natural correlations existing between it and all the other studies of the curriculum. To a very general disregard of the correlations which ramify through and between all the subjects taught in our schools are chargeable very many of the evils which affect the elementary teaching of today. Not only are the ordinary school studies, reading, arithmetic, geography and history often taught as if there were no common bond between them, but the same superficial view of knowledge which permits this, leads also to a disregard of the relations of these subjects to the conditions of ordinary life and experience. More thoughtful considerations, however, make it plain that just as the mind, though capable of manifesting its activities in varying modes, is after all a spiritual unity; as all forms of energy are correlated and convertible into other forms; so the apparently endless variations and contrasts of human knowledge are only

modifications of truth, which in all its multiple relations is invariably harmonious and consistent.

Holding in view then this principle of correlation, I venture to suggest that the science work of school, especially in the more elementary classes, can be used as the basis of instruction in every other subject. When a child is learning to read the process is greatly facilitated if he is given matter for reading in which his interest has been awakened by previous examination through sense perception. I am stating no new principle here; it is one which has been more or less consistently used by the best primary teachers since the methods of the new education were brought to light. When some of us were children we were, at stated intervals, called to the teacher's chair and with primers in hand were taught to say in sing-song tones: "It is an ox." "Can I go up?" "He can go up too." And when a page of such inspiring literature had been gone through, we were sent back to our seats with the pleasant injunction, italicized by a few passes of the ferule, to sit perfectly still and make no noise.

Today, as far as educational emancipation has been reached, the little child possibly empty-handed but with joyful anticipation, goes to meet his teacher for the reading lesson. And no wonder the pupil's interest is kindled; for first of all the teacher puts in the hand of each of her little ones some attractive object, perhaps a bright purple grape. Then appears the evidences of genuine art, for by skillful questioning she draws from her class just the statements that she wants to use, and in the exact order best adapted to her purpose. As the children from their own discoveries develop thoughts about the objects in their hands, their own words are quickly written upon the board. In this way, in freest conversation and real, delightful earnest study, eight, ten, twelve minutes go by; when lo! on the board before them stands the reading lesson vitalized in every word by the thought which the children had put into it. No longer any question about its adaptation to the class; for it is their own. No ground for criticism that the lesson is unrelated to the other lessons of the day; for the development from first to last is an ideal exercise in oral language and in it is involved the study of number, form, size and color. But this is not all. After the reading of the sentences singly, and as a collection, the board is cleaned and the children return to their seats, each with a new grape about which now, after the study in class, they are going to write all they can for the written language lesson which comes by and by.

This is all excellent and serves my purpose well in showing that the facts of science can be learned in connection with the regular studies of the school, with no waste of time and with manifest increase of effectiveness.

But the plan just indicated is merely one aspect of an intelligent, effective method of teaching, reading and of correlating it with language and other studies. In this, however, science teaching is only incidental; the importance of science in itself is not taken into account, and the ends of science are but imperfectly subserved. This is about as far as we have gone. What is needed, however, is that a carefully arranged course in