

for practical things may bring about and that is a substitution of lighter but particularly practical subjects for the natural sciences. Trades schools have a valuable work to do but their training is not a substitute for a technical education. Shop work and domestic science are inestimable allies but not substitutes for botany, chemistry, physics and zoölogy.

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## A WORD OF WARNING IN CONNECTION WITH GENERAL SCIENCE.

BY HERBERT BROWNELL,

*Teachers College, University of Nebraska.*

To one familiar with the long continued efforts to promote Nature Study in the public schools and with its precarious existence through many years, together with the disheartening returns from school officials generally concerning the educational results from it as a branch of study, there is ground for apprehension lest the General Science movement only repeat these same experiences. Glowing accounts of wondrous success in nature work in scattered instances emphasize the wide differences between what might be true in elementary science in schools and what all too commonly is attained. Little need exists to dwell even for a moment upon the value in the high school of elementary introductory science work, nor upon the abundance of suitable and well-organized material for the teaching of General Science. Whether a place in the ninth grade of high school can be made for this work will depend upon teaching results where introduced. Arguments upon these points could be only for sake of argument, or because of unwillingness to grant anything in behalf of General Science as a separate branch of study.

On the other hand advocates of such a course need their combined wisdom and effort in at least two other respects if its place in the school curriculum and its full worth in the school work is to be assured.

Of these the most important is of course qualified teachers sufficiently well prepared in this particular branch to make it educationally indispensable in the school curriculum. Not specialists, but teachers competent in this branch even as in other high school work. They may or may not be the "science teacher," and their preparation may well be quite as much "pedagogical" as "scientific." But it is indispensable that they be able

to teach with marked success, teach that which is of exceeding great worth in the lives of the pupils generally, and presumably that which yields greatest aid in the subsequent high school sciences. This preparation may best have come in institutions of established reputation for the training of such teachers. It at least demands the background of a year's high school course in General Science under competent instruction.

In the second place, and it is here that it is desired especially to raise a voice of warning to advocates of General Science, the history of the Nature Study movement emphasizes the need that this later endeavor in the field of elementary science shall from the first be put upon the sure basis of a laboratory branch of study. Through rational laboratory exercises, both simple in requirements and qualitative in character, let the General Science be closely related to the high school sciences rather than made auxiliary to language lessons, to "art," or to "busy work." Then, too, let the course be continuous rather than fragmentary, beginning always in its several subdivisions with the common experiences of youth, and leading by closely related stages over into the realms of applied science and the affairs of life, and just so far as worth of subject-matter and fruitfulness in thought-exercise shall make it possible to go. An "entertainment course," with bits of this and that from the realm of science, is to be ruled out.

Any advance in knowledge and powers of mind in school days is so largely result of exercise in comprehending new relationships both in what has before been known when considered by itself, and then when taken in connection with added new matter, that there is irreparable loss in flitting from topic to topic of wholly unrelated matter simply to satisfy an unwholesome taste for the marvelous in science. Advocates of General Science cannot afford to make so grievous a blunder.

There are numerous books published that treat admirably the elementary phases of natural science, furnishing the facts and discussions well suited for the work under discussion. Very largely this material is rather widely scattered through the many books that have to do with the several high school sciences. It might be advantageous in many ways, and for the convenience of teachers, to bring this material together into narrower compass for the particular ends of the elementary science teaching. But after all, it is the spirit of General Science, as with the Nature Study, to learn in large measure direct from

nature's forms and phenomena. A book in the elementary science may be so used as to hinder rather than help, and made to come in between the pupil and that from which he is to learn. There is a wide difference between a study of nature's ways and works on the one hand, and reading about them on the other. The reading of guide books for travelers, and that only, makes a poor substitute for their use in connection with actual journeyings to the places described, and for personal experiences therewith. The study of the guide book might make one master of names and terms whereby to become able through glib recital of statements to delight ourselves and others. This at its best, however, is poor substitute for the mental stimulus possible in travel.

On the other hand, there are for the General Science all too few laboratory manuals that demand of the individual student a personal experience with the thought-provoking phenomena of the world about him. There is altogether too little use made of the fullness of his experiences as a key wherewith to unlock and open doors into an unknown that is all about him. Aside from valuable information thus acquired and organized as "knowledge worth knowing," such exercises of the laboratory stimulate a sense of power to achieve in the realms of intellect which make the pupil in some degree master of the forces of the natural world as these are seen operating in simple experiments controlled and comprehended by him.

These laboratory exercises may well constitute in some large measure a preparation for the instruction to be given in a succeeding class period. Then it is that there is afforded the best of opportunities for the teacher to give instruction in various related topics of large teaching values, and for which instruction the pupils are ready of comprehension. It may not be out of place to suggest here that such a manual instead of being prepared to accompany some text might very properly leave the teacher free to use material from any and all sources known by him or suggested to him. If there be a text, *let its use be to accompany the manual.*

Where a course in General Science is thus based upon laboratory exercises of an elementary character even the indifferently prepared teacher may be so effectively aided in the class instruction that the disheartening history of the Nature Study movement may be avoided.