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GIVING THE PROJECT METHOD A TRIAL.¹

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"Probably the greatest and commonest mistake that we all make is to forget that learning is a necessary incident of dealing with real situations. We even go so far as to assume that the mind is naturally averse to learning—which is like assuming that the digestive organs are averse to food and have either to be coaxed or bullied into having anything to do with it. Existing methods of instruction give plenty of evidence in support of a belief that minds are opposed to learning—to their own exercise. We fail to see that such aversion is in reality a condemnation of our methods; a sign that we are presenting material for which the mind in its existing state of growth has no need, or else presenting it in such ways as to cover up the real need."²

These words of Professor Dewey are indicative of the reform so popularly advocated today. The movement is by no means a new one. In the field of science, it had many admirers in the days of Ferguson. To come to a more recent period, we find Henry Kiddle, who was superintendent of New York City schools from 1870 to 1879, attempting to give the child a broad survey and definite understanding of those phenomena vital to him, to prepare him for "dealing with real situations." Seaver, superintendent of Boston schools, a couple of years later strenuously opposed formula studies and showed his contempt for pouring words into students instead of taking their experiences and building upon them. In his report of 1881, we read: "How many of our textbooks begin, not with the suggestion of concrete illustrations, but with abstract definitions, and still more ab-

¹Abstract of address given to the Physics Club of New York, January, 1916.

²Dewey, *Schools of Tomorrow*, page 4.

stract 'first principles'—blind guides to the blind teacher, and sources of perplexity to teachers who are not blind."

In 1904, Dr. Balliet organized a science course at Springfield, Mass. He drew his material from local environment and from those things associated with the interests and experiences of the pupil. The qualitative side of experiments was emphasized. He aimed to give a minimum of principles and a maximum of applications, to enable the child to interpret his physical environment. During the past decade, attempts similar to Dr. Balliet's have been carried on all over the country. The most recent endeavor to overcome the aversion to learning which Professor Dewey speaks of, is found in the introduction of the project method in science.

At the beginning of this school year, I was asked to take a sixth-year class of boys in the Horace Mann School and give them general science in accordance with the suggestions set forth by Professor Woodhull in "Science Teaching by Projects."³ This, to my delight, meant that there was to be no textbook used as a text, no outline of a course of study. I want to confess that up to this time I had had little experience with boys of this age. In order to get a start, I distributed sheets containing a list of suggestive projects, and asked the boys to report on library cards the three (their own or a choice from the list) which appealed to them most from the viewpoint of either interest or importance. Projects such as the following were suggested: Refrigeration, Mining, Coal and Its Uses, Rock Formations, The Universe, Sun and Moon, Tides, Submarines, Airships, Flies, Sewage Disposal, Butter Manufacture, Sugar Industry, Incubating Chickens, Clothing—Textiles, Dyeing, Motors and Dynamos, Wireless, Telegraph and Telephone, Life of Edison, Pasteur, Faraday, etc. It was not surprising to find that the submarine was the first choice, due, undoubtedly, to the fact that it was being discussed in the press so widely at that time. When the project was complete—for us—the boys knew as much about Archimedes' principle (though that term was not used) as any intelligent youth need ever care to know. The kind of power used, the importance of the storage battery, the possibilities for ventilation and the method for stepping out of a boat under water were some of the subjects discussed. The question of periscopes arose, as a result of which most of the boys voluntarily constructed models at home, and through this, I am con-

³SCHOOL SCIENCE AND MATHEMATICS, March, 1915.

vinced, acquired a valuable understanding of reflection of light.

It was just about this time that I had occasion to teach pressure of fluids to a class of college students. I might add that this college course aims to give practical explanations of physical phenomena, avoiding all detailed and intricate side issues. But in spite of all efforts to thus simplify the work, it took some little time to get an answer to the question: "How much pressure would there be on a water faucet fourteen feet below the tank?" On the other hand in discussing with the twelve-year-old boys the curved shape of the submarine's cross section, I made the same statement to them that I had made to the college girls the day before, namely, that a column of water one foot high presses with a force of approximately one-half pound on each square inch of surface. Upon asking the boys how much pressure per square inch there would be if the submarine were a hundred feet below the surface, there was no hesitancy in their shouting the answer. Can this contrast be attributed to anything but the factor of motivation, problem, project, interest, which was present in the one case and not in the other?

In "American Traits," Dr. Münsterberg writes: "I still remember how my father spoke to me when I was a boy of twelve. I was insisting that Latin would be of no use to me, as I should become a poet or a physicist. He answered: 'If a lively boy has to follow a country road, it is a natural and good thing for him to stroll a hundred times from the way and pick flowers and run for butterflies over the fields on both sides of the road. But if we say to him, "You need not keep the road, follow your butterflies," where will he find himself at nightfall?"'

Time and again we hear of students who cannot keep to Münsterberg's country road—formal schooling. And often these students in later life prove themselves to be extremely capable; yet in spite of their ability to overcome obstacles of every sort they were not able during their school days to cope with the hardships of following the selected path. The main road, the one built by tradition, the present course of study, is not necessarily the best. Sometimes young men are given opportunity to chase butterflies, and in so doing not only pass through more beautiful fields, but avoid many unnecessary curves of the road and attain sooner the true goal Münsterberg is striving toward.

To return to the work at the Horace Mann School: This week we have been studying forests. Lantern slides, borrowed from the American Museum of Natural History, played an important

rôle. Some of the boys wanted to "chase butterflies" and set out to do some research work. Some one says, "Twelve-year-old boys doing research!" But we cannot doubt that this is the age most responsive to the suggestion to inquire; most receptive to the answers to "why" and "how." Here are some of the topics they related in class: "Sawmills;" "Gathering and Preparing Maple Syrup;" "Experience on a Lumber Raft;" "Dangers to Trees."

The class meets, fortunately, in the Teachers College physics lecture room and laboratory where the boys have opportunity to get acquainted with all sorts of appliances before, after and sometimes during class. They pass from hydraulic ram to water motor, from automobile to dynamo, from pumps to gas engines, steam engines and storage batteries. This gives them a first-hand knowledge of the essentials of science. In the same way, they are encouraged to gather information outside of school and collect clippings from newspapers, magazines and advertisements which are then kept in their notebooks.

The course follows the path of the boys' natural desire, but they are restrained here and there from following material which, in so far as I can determine, appears to be of little value to them. In contrast to the criticism Professor Dewey makes regarding older methods, these boys are not averse to learning and there is seldom a time when interest lags. Moreover, I find that what they learn is not a veneer soon lost.

Following is a list of theses on general science, summing up one attitude toward a course in this science.

1. General science endeavors to give to all pupils a genuine understanding of everyday phenomena, leaving for later study, by those who wish to specialize, the highly organized, special sciences.

2. It aims to supply a fund of useful information and solve general problems, thus engaging whatever sciences it will.

3. It should, wherever possible, create a curiosity on the part of the pupil. This curiosity should be satisfied in some cases by information from the teacher, in others by further observation and suggested readings.

4. It trains pupils in habits of investigation, of clear thinking, and of application of acquired knowledge to useful ends.

5. It should deal with the common scientific environment of the youth and center itself about the interests and desires of the pupil, the teacher at all times keeping in mind the unity of the whole.

6. The method should be by projects, which may cover a period of one hour or extend through several weeks.

7. Tendencies to be avoided:

(a) An eclectic course of a little from each of the sciences as they have been arbitrarily defined by man.

(b) Believing nothing in science is educational unless it is thorough.

(c) The slavish use of crystallized general science in the form of a textbook.

SOME PRESENT LABORATORY METHODS INDICTED.

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Present methods of conducting laboratory work seem to include some absurdities. Eminent educators argued that the inception of the laboratory method of teaching would develop ingenuity and facilitate scientific reasoning. Now, this way of teaching has been in vogue for some time, yet the product turned out is neither more ingenious in his action nor scientific in his reasoning than the individual developed by the old school of education. Unquestionably, the laboratory method is a latent force that may stimulate the development of a more intelligent and ingenious citizen if conducted under correct conditions.

So far as my own laboratory work goes, so far as I have observed the laboratory work of others, and in so far as laboratory manuals have been perused, present ways of dealing with a pupil in the laboratory are quite similar to tactics pursued in fattening a goose. Let us imagine that the goose is caged. We prepare a pill and push it to him, expect him to swallow it and call it good. If he gets fat, we count ourselves fortunate, and if he remains lean, we say it was just our luck. Similarly, let us picture the student in the confines of the laboratory. Do we tell him what is to be done and then allow him to so arrange materials at hand that he attains the goal? Do we ask him to do any constructive thinking, reasoning from the known to the unknown? Upon your life, we do no such thing! We penalize ingenuity and curb any outcrop of methodical reasoning if it does not coincide with our own. We put into the hands of the learner a set of printed directions with glaring offsets as follows: TITLE, OBJECT, APPARATUS, METHOD, SKETCH, CONCLU-