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SCIENTIFIC METHOD IN EDUCATION

BY

ELLA FLAGG YOUNG

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ELLA FLAGG YOUNG

PROFESSOR OF EDUCATION

PRINTED FROM VOLUME III

CHICAGO  
THE UNIVERSITY OF CHICAGO PRESS  
1903

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NY



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PRINTED MAY 1, 1903

## SCIENTIFIC METHOD IN EDUCATION

ELLA FLAGG YOUNG

SCIENCE cannot complain of neglect by modern society. Her methods, her discoveries, her inventions, are greeted with appreciative applause. Even her terminology, technical and complicated as it may be, is rapidly absorbed into the popular phraseology of the day. In truth, scientific terms often supply for many a speaker, befogged in his own rhetoric, a happy explanation of the complex and problematical, and a short cut to the conclusion of a controversy. This ready use of the language of science is not, however, all gain, for the very ease with which scientific terms are made to do service helps obscure those implications which are vital to the subject.

So rapidly do new terms crystallize into symbols for that which is explicit only, that the implicit elements soon cease to be included in the meaning of the symbols. In this tendency toward a limitation of the meaning of a comprehensive term, a remarkable retroaction sets in; for that which is ignored because not expressed, there is substituted a phase of traditional belief which the new, rightly understood, negates. This substitution is well illustrated in the application of the theory of evolution. That great theory of life implies more than mere continuity or succession—something like growth or definite change from form to form under the action of immutable laws<sup>1</sup>—“laws of nature.” The ideas involved in the term the “laws of nature” have not received the attention and thought which would give to the popular mind a comprehension of their full significance; but the change which may be effected in opposition to conditions which would obtain if the species were immutable is accepted as possible and supposed to include the natural forces acting in inducing modifications. Having ejected immutable from the conception of species, the ready recipient of new scientific terms rushes on to the conclusion that nothing in the being is immutable, hence the immutability is in an external force. The result is a re-establishment of the conception of external causation, and a change induced by an external force.

It would be a delicate task to attempt a comparison of the retarding influence of opposition to the acceptance of a great theory of life, and the reactionary tendency in a ready acceptance based on a misconception of those conditions which are implied. Tradition is an effective factor in making human society stable. It is active in both attitudes toward the new, but with this difference: in that of opposition, it is a recognized authority; in that of ready acceptance, it is an unseen power supposed to be deposed when in reality it is merely in a new dress.

Few minds are competent to weigh the meaning of that which has been handed down with the meaning of that which is animated by the new spirit. The incompetency

<sup>1</sup> WALLACE, “Evolution,” *The Progress of the Century*, p. 4.

lies not so much in the inability to note the facts involved as in the lack of scientific method in interpreting the underlying principles. The failure to search for and find an hypothesis that makes the life-process basic results in long-continued efforts to include the traditional in the new theory, for tradition deals with facts, not with principles. Pressed for an explanation of the significance of evolution, the advocate who accepts facts without searching for the underlying law falls back upon Darwin's *Descent of Man*, gathering it up in three words: monkey, evolution, man. There is the poor monkey, then the law of evolution seizing him and molding him whether he will or no, and at last man, the outcome of that mighty force working on monkey. It is this reduction of the history of man to that of a unit of a given type, acted upon by an external force and transformed into a new type that gives rise to the question, Why do not monkeys continue to become men? The effective force is to the popular mind very like the jackknife in the transformation of a goose-quill into a pen.

Juggling with theories which have been so long accepted as to take on the authority of established truth is not peculiar to the popular mind. Philosophers and scientists have through like confusion retarded the advance of new ideas. It is not, therefore, strange that teachers and writers on education have halted on the same plane with them, and defined the new in scientific terms freshly coined but with the old significations embodied therein.

It is needless to state that the misconception of evolution which established external causation in full control of the monkey has been equally active in the generally accepted theories of the education of the human being. Naturally, it was agreed that the force which was effective in the evolution of the species must be effective in the development of the individual. That is sound doctrine, but when its advocates proceed to interpret without investigating, to rehabilitate old notions which the investigation would show hostile to the new, the soundness counts for little in the outcome. Although "development" is a word to conjure with in educational circles, the men and women who use it substitute, as a rule, external causation for the law of nature; and change induced by action of the external power, for growth through the activity of nature working in accord with its unchanging law.

The great advance of science which has brought the modern world to her feet, has been due to a habit of mind that subjects all facts to an impartial, sympathetic investigation called scientific. The attitude of the scientist is that of the intelligent seeker after truth. This attitude cannot be taken by one whose premises are false, or whose conclusions are biased by individual likes and dislikes. Scientific method is the method, the attitude of mind, that makes a search for the principle under which facts observed may be explained in their relations and made significant. The principle or "natural law" sought is a statement or formulation worked out by the scientific imagination in getting at the relations and meanings of conditions and sequences observed. It is a law controlling the procedure of the investigator and the practitioner. "We should hold fast to it until either the results to which it leads

involve us in contradictions, or until some other truth becomes plain to us, from which we are able to understand how a proposition, now seen to be false, came to present the appearance of a self-evident truth."<sup>2</sup> When the workers in every branch of modern society began to advocate method in their particular field, it was to be expected that method would be applied to the problems of education, and it was. Educational method has, however, disclaimed the name of science, and rightly too. It started with the expressed aim of setting conditions that would be conducive to the development of the child according to the law of its being. Its terms have been those of evolution and development, but its meanings have been the meanings of pre-Darwinian times. With the magnification of the teacher as the external force, whose chief office was to prepare the nutritious food in layers so that it should be taken in accord with the determined laws of nature, there has been a steady growth of non-scientific methods in the schools. To plan and conduct a recitation so that the learner shall neither hesitate nor stumble have become the alpha and omega of so-called educational method.

Incredible as it may seem, on the one hand, the intellectual world exalts the simplicity and learning, the appreciation and acumen that characterize scientific method; on the other hand, it accepts the complexity and pedantry, the depreciation and slowness of perception that characterize educational methods, and decries method in education instead of condemning that educational method which is not scientific. It is but a few years since the president of Columbia University referred to "the machine methods and dull, uninspiring class exercises of our average academy."<sup>3</sup>

What are the ideas which are fundamental in the present-day conception of the development of the human being? What are the conditions and sequences observed, and what the relations and meanings given them by the scientific imagination of the student of the theory and art of education? The first condition posited by the veriest tyro in thinking on development is the same that is stated by the educational philosopher to be "the great central fact to be kept in view in the study of mind—self-activity."<sup>4</sup> The second condition is an environment that furnishes opportunities for the use of potential powers. "Only a self can be educated . . . a being which is through itself, and not one that is made by surrounding conditions."<sup>5</sup> Theorists in education and teachers not only accept the conditions set by Dr. Harris as fundamental, but very generally express themselves in the same terms that he uses.

It is difficult in a few lines to enter into a discussion of the sequences resulting from the interconnection of the activity, called the human being, and the environment, natural and social. Necessarily they appear in two sets: first, the subjective sequences—sensations, images, and ideas which the activity develops out of the stimuli in the environment; second, the objective sequences—bodily and facial expressions, gestural

<sup>2</sup> LOTZE, *Logic* (translated by BOSANQUET), Vol. II, p. 306.

<sup>4</sup> HARRIS, *Psychologic Foundations of Education*, p. 23.

<sup>3</sup> BUTLER, "Is there a New Education?" *The Meaning of Education*, pp. 76, 77.

<sup>5</sup> *Ibid.*, p. 153.

and verbal language, art and utilitarian productions, through which the self-active being makes itself known to the world. It is by observation of the second, the objective, sequences that the desired information about the subjective sequences of another being is obtained. The scientific imagination can get at the relations and meanings of the subjective data, in so far as it interprets and unifies the objective in a coherent whole.

To this position, as indicative of a demand for a knowledge of psychology on the part of every teacher, some psychologists would seem to take exception; but a careful reading of all they have written on the question shows them fearful that the machines of the experimental-psychological laboratory may become a part of the equipment of the schoolroom, and the theories of the speculating psychologist be incorporated in the educational theory of the teacher of boys and girls.<sup>6</sup> I know of no psychologist of recognized standing who dissents from the opinion that there are some psychological conceptions which should be a part of the mental equipment of the teacher.<sup>7</sup> In all walks and stations in social life we meet persons not supposed to have either a well-developed scientific imagination or an interest in the conceptions of psychology, and yet who evidence the possession in a high degree of the power of observation of the objective signs, and of interpretation of the subjective data from which their significance is derived; and also a scientific imagination which evaluates and unifies the activities of the person observed. The expressions in which they sum up their failure to construct a satisfying, coherent being behind the mental phenomena are familiar—"I can't understand him; his ways are too much for me;" "I can explain to my satisfaction everything she has done thus far, but I have no idea as to what she will do next." These homely remarks are repeated, to remind the reader of the almost general possession of the gift to read the meanings of the acts of others and to project their future acts.

It must be conceded, however, that in observation of the development of mind there is not so general power. It is possible that the doctrine of original sin has made it more difficult to grasp the idea of development as a growth of inherent tendencies in the case of man than in the case of animals and plants. Many approach the study of a developing mind with the accepted formula that it is by inhibition of its natural tendencies and the substitution of other modes of activity that mind grows. No one would attempt to repress the action of the law of its nature in a kitten or a hyacinth bulb and expect a normal cat or plant. As one's conception of the native equipment of the human being, and the development of the impulses<sup>8</sup> and instinctive tendencies becomes clear and definite, there is a comprehension of the idea of the order of growth in power within the subjective sequences.

In educational method there is a common mistake which originates in the perception that the fact or perceptual phase of an object or action is more apparent to a child

<sup>6</sup> MÜNSTERBERG, *Psychology and Education, Psychology and Life*.

<sup>7</sup> JAMES, *Talks to Teachers*, I.

<sup>8</sup> DEWEY, *The Study of Ethics*, chap. iii, secs. ix-xii.



than is the truth or conceptual phase. The resulting mistake lies in the teaching of children in the kindergarten and the primary grades as if the percept were developed in advance of the concept. If the method were psychologic in its premises a conception of the development of the percept and concept together would be active instead of the perception only. Reflection on Baldwin's second element in attention<sup>9</sup> shows easily the beginnings of conceptual activity in the earliest movements of mind.

Educational method has ever recognized attention as the cardinal virtue in the school. It has not, however, defined it as "a function of organization, a function which grows with the growth of knowledge, reflects the state of knowledge, holds in its own integrity the system of data already organized in experience."<sup>10</sup> It has defined attention as concentration only, and that as concentration *upon* a presentation rather than concentration *of* the selected data of the presentation and the data of experience. It has been so oblivious to the unifying activity of attention as to suggest among "exercises for the culture of attention: spelling, by having each child in succession name one letter of the word; pronouncing sentences or lists of unrelated words, and having children reproduce them orally and in writing."<sup>11</sup> The narrow idea of attention embodied in the "suggestions" brings forward the cause of more than half the dullness and inability in children to understand the subject of the recitation; it is the non-recognition of the difference in the dominant types of imagery in children who are of a different type from that provided for by the author of the method, or that of the teacher. This, however, is not the place for an exposition of the specific lines in which educational methods have failed because of their narrow range and unscientific attitude.

Educational method to be of worth should be scientific method applied to the art of teaching. The method of the teacher is simply an attitude of mind like that of the scientist. There are two elements involved, the learning mind and the subject-matter or environment. To have an intimate acquaintance with each, to appreciate the expectant longing of mind, to interpret its responses to stimuli, to form valid conceptions of the activity and assimilating power of each child in the environment made by the subject, is to have a method in teaching which covers the entire range of that great art. It is to have the method of science applied to education. This means that the teacher should have a method applicable to every subject, in every division of the school beginning with the kindergarten and extending through the graduate school. A distinct method for every subject is not necessary any more than a special scientific method for each branch of science would be necessary. Whatever be the subject one is teaching the aim is identical with that of all other subjects taught: to determine how mind is working with the material in its environment, what nourishment it is selecting and assimilating.

The two elements involved cannot be passed by with so slight attention as is given by specifying them as children and subject-matter. To teach children necessitates

<sup>9</sup> BALDWIN, *Mental Development in the Child and the Race*, chap. xi, sec. 2.

<sup>10</sup> *Idem*, *Development and Evolution*, p. 252.

<sup>11</sup> *Systematic Methodology*, p. 96.

a knowledge of the method of mind, the laws of mental activity which are invariable in normal beings—but there is no word which the modern teacher in the elementary school fears more than law thus applied. This fear rests largely upon the interpretation given the meaning of natural law. With a vivid recollection of the logical method of the schools in the past, a method which imposed upon the child and the student the summing up of the adult's conclusions, it has come about that law of mind refers to this logical order, that is, that the term is used in the juridical sense. Because there has been a misunderstanding about the meaning of the law of the mental life or of mental activity, it does not follow that we must be so restricted as to forego forever the use of the word as well as ignore the idea for which it stands. We might illustrate this in the formation of habit: If children try to form certain habits because of a feeling of obligation which has been reasoned out—possibly on the ground that it is their duty to get from the teacher all they can because their parents are trying to give them an education, or because the teacher is put over them and therefore is superior to them—then attention to the formation of habits is the result of obedience to parental or school law. On the other hand, if the material which they have in mind and their interests cause them to attend to the various stimuli coming from the object, and repeat the responses until they are easy, automatic, then the children are following the law of their being and the attention is given and the habit formed because of obedience to natural law. Only a Rousseau would say that because the principle of habit has been, and still is, generally misunderstood as regards its mode of action, mind should be developed without acquiring habits.

The teacher with the grasp of the subject-matter and a knowledge of the laws that underlie mental activity and growth has, as has been suggested before, this end in view: to keep track of the way in which the different minds in the class act upon the stimuli presented. If images and ideas germane to the subject, but not necessarily involved in the perceptions which mind constructs at the first blush, are not projected by the motor activity of attention into the stream of consciousness, then the teacher knows that the stimuli are not stimulating, or that old presentations did not become a part of the capital of the children. Much has been written on the subject of the value of educational psychology to the teacher of mathematics, reading, history, or languages, both pro and con. Great emphasis has been thrown upon the merits of the born teacher, and very properly too. Speaking from the standpoint of the science of education, the born teacher is one who has an inherent tendency to observe and interpret the activity of mind in the early stages of its growth. This inherent tendency gives command of a large amount of unclassified data, just as the interest of the child in animals or plants gives an absolutely necessary accumulation of material with which to proceed in the study of pure science, the pure science of botany or zoölogy. As one does not become a botanist or zoölogist by beginning with the principles and data of pure science, so one cannot understand the life-process of the soul if there be no original observation of the activity of mind preceding the study of

psychology. As in the other sciences, the purely scientific study must be followed by a return to such material as formed the basis of observation and experience in the first stage, so in psychology the applied science must follow the pure science.

In the study of psychology the teacher must go through three stages: first, the observational and introspective; second, the purely scientific and experimental; third, the applied, which is generally termed educational psychology. He does not go through the third, he enters into it. Unfortunately, many who have passed through the first two stages, although they are teachers, do not advance into the third. The majority try to pass from the first to the third, omitting the second. It is the failure of the first class to pass into the third stage and the omission of the second stage by the second class that lie at the bottom of the mistaken reasoning of both classes concerning the methods of the primary grades. It is not difficult for one with an agreeable personality to command the attention of children between the ages of five and ten years by means of a stimulus emanating from that agreeable personality; this possibility has developed a method which might be termed the kindergarten and primary method. It gives certain uniform results without friction.

It is not uncommon to hear the philosophical psychologist who lacks a thorough-going acquaintance with educational psychology say that the primary grades are taught intelligently and successfully, but the grammar grades are not taught satisfactorily. It is not unusual to hear the teacher of young children, the teacher destitute of the knowledge of the pure science of psychology, say that she loves to teach young children, that they learn so much more easily when in the primary grades of work than in the grammar grades.

A supervising teacher of drawing in a system of city schools expressed himself very forcibly one day to the principal of one of the large grammar schools in that city. They had both been in one of the primary rooms of the principal's school. Upon leaving the room the supervisor said: "I cannot understand your tolerating such mediocre work in the lower grades when you have such superior work in the upper grades." The principal replied by asking which the supervisor considered the best grade in that school. The supervisor answered: "The eighth is the best," and added: "As regards merit, the work goes down hill in regular order from the eighth to the first." The principal then said: "Supposing you reverse your statement and begin by mentioning the poorest grade, will you then say the poorest is the first or lowest, and the grades improve in regular order as they ascend from the lowest to the highest?" The supervisor, after glowering for a few moments in thought, said: "Yes, I should be willing to say that, but it indicates a wrong condition; the work should be excellent all along the line." The principal assented, adding, "provided the standard of excellence for each grade is correct." Later on the principal said: "I wish you would think of the four best primary departments in drawing that you supervise." After a few moments the supervisor said: "I have them in mind." The principal then remarked: "I will tell you something about the grammar departments in those four

schools; not one of them ranks among your fifteen best grammar departments." The supervisor was indignant, and accused the principal of having listened to gossip about the work of the drawing department. The principal said: "I do not know which schools you have in mind. I base my statement on an understanding of educational method. If those children we saw in the lower room had been indifferent, unresponsive to the material supplied by the teacher, I should say they were not growing mentally in that environment. If the teacher had dictated the drawing of the lines so that their seeing was largely auditory, or if she had drawn for them so that their seeing was largely through her eyes, even though the results had been excellent reproductions, I should say that the natural law of mental development was unknown to her, and that the children were not doing good work. As it was, each child was intent on seeing for himself the group of objects and producing on paper a sketch of what he saw. The teacher was working on the evidences which each child gave of his seeing power, and of his power to co-ordinate the eye and the hand, the image and its expression. Judged by my standard the work was excellent; the dictation for each child was from within; the criticism was based on the understanding by the teacher of the within activity, as shown by the drawing. Judged by your standard it was a failure; the results should have been strikingly uniform, and more like those of advanced pupils; but the insurmountable difficulty in that kind of work is the exorbitant price paid by the children for their early acquisition, for that which would gratify your and their teacher's vanity. The plasticity of the nervous system, a distinguishing characteristic of the human being, is ignored, and humanity is reduced to the level of the bee and the bird with their equipment of instincts."

In this explanation was an interpretation of the meaning of development in harmony with the idea of law in evolution. The terms were (a) children equipped with impulses to act on stimuli in their physical and social environments, (b) the inherent impulses and tendencies of each child working on an environment which necessitated refining and defining the tendencies; (c) children growing in command of themselves and their environment. The law of nature was understood as originating in the spontaneity of each child, and the activity as resulting in something stronger and better than that which acted at the beginning, and which was an enlargement of experience.

Knowledge of the individual is not based on those data alone which are obtained by study of him at the beginning and end of a given series of acts. There are other data: the images and general notions which work in the process of thought, their clearness, their growth in complexity; the habit of mind, its quality, that is, its rigidity or its flexibility; the attention, the way in which it moves as it searches for and combines facts; the judgment, its dependence or independence. The first element, the children, necessitates a readiness on the part of the teacher in interpreting the contents of mind, clear vision as to their method, and a sympathetic understanding of general conditions which are indicated not only by language expression, but also by

bodily expression. For the parent this may be enough of the psychological element, but for the teacher there must be the scientist's acquaintance with the life-process of the human being. This is necessary for a classification of data in accord with the principle of growth.

The second element involved in teaching is the subject-matter. There should be an acquaintance with this which has been obtained by the psychologic method, that is, through investigation, through observation of sequences, and also by the logical<sup>12</sup> method, that is, through making conscious standards, or norms, of the ends toward which the psychological material points. The two aspects of a subject gained by these two lines of approach put a person in command of what may be called the method of the subject.

It is safe to say that since the publication of Darwin's *Origin of Species*, every subject within the wide domain of knowledge has been reviewed and revised from a new standpoint, and presented anew to the world. Foremost in this new approach to science, art, and literature, is the effort to co-ordinate the development of the science, the theory, or the art with the evolution of the race. The fact that one is not considered a scholar in his chosen subject unless he knows something about the beginnings of the attack of the human mind upon it, and can trace the gradual rise of the race in acquaintance with it and control of it, shows easily how much broader and better fitted is the scholar of today to teach his subject than was the scholar of yesterday. One of the causes of surprise among the unscholarly is the simplicity with which the erudite man talks upon his speciality; it is he that knows only a limited section of his subject who is restricted to the technical vocabulary and the single point of view. The simplicity of the scholar's standpoint indicates the necessity for a broad scholarship on the part of the teacher. Unless the teacher knows the progressive growth of the subject-matter, it is impossible that the material with which he deals in the recitation shall be the images and ideas of the members of the class.

The assertion is made sometimes, that the theory of evolution naturally and rightly throws the emphasis upon method rather than upon fact. Undoubtedly in former times too great stress was laid on fact. To differentiate method and fact so that the emphasis shall be thrown upon either, to the neglect of the other, is to continue the errors of the past. It is highly probable that writers on evolution who assert that the significant question is one of method rather than fact do not mean to separate, to divorce, the two; but, having made the positive assertion, they force themselves to desert the post of the scientist. The same may be said of teachers and writers on education who say the significant question in education is how children learn and not what they learn. If mind learns the new by the functioning of that which it has learned before then it must be most important that the old be not only true, but have a working, a functioning, value also. One who says the aim of the teacher is to discover the method of the growing mind, must make the explanation that the material and its assimilation in the

<sup>12</sup> DEWEY, unpublished lectures on logic.

past are always indicated in the attack at the present moment; this shows the fact side of the lesson to be as important as the method side. On the other hand, that idea of educational method which would make the material of the teacher the perceptions, images, concepts, and judgments of the learner would require so intimate an acquaintance with the subject matter as to make unconscious a close following of its development.<sup>13</sup> It is generally dangerous to make use of analogies between the mind and the body, yet it is safe here to parallel the two. No one would be so rash as to claim that it makes no difference what food a child has, that the only question is how does its stomach attack the food. If the digestive apparatus that once functioned well becomes unable to make the food into chyme, chyle, and blood, we know that the food in the past has not contained elements nutritious for that child.

There are other directions in which evolution has contributed toward a higher ideal of education than in the one of method. When the theory was first offered to the reading public many feared it as an attack upon religion; its entrance into the field of education was neither feared nor desired. As was pointed out in the beginning of this paper, the import of the term was generally accepted by teachers as mechanical change, not as change resulting from the law of being. Slowly but surely the appreciation of natural law as the activity of the inherent tendencies has wrought a marked change in the school in the interpretation of the relation between man and nature. They are no longer treated as opposing forces. They are seen as two activities in the dynamic process of the unity called the world. It is but a short step from a conception of man and nature as parts of the same system, to a conception of the relation between mind and body. The generalizations of the evolutionist are proving efficient forces in educational theory. They are more stimulating to teachers when they form the material with which the educational thinker reaches the conclusions which he formulates in his particular subject. The return to old methods of instruction and school management, the repudiation of the theories which have issued from the investigations of biologists and psychologists have sometimes indicated that the theories have been found wanting because of the readiness with which they were constructed from a few facts. A higher degree of sensitiveness to new facts must mark the teacher if educational method is ever to have that flexibility and constant approach to truth that characterize scientific method. The rapidity with which the conceptions of a great mind are crystallized in educational formulae by those who accept the gospel as presented by the larger mind indicates the failure to be on the alert for facts that cannot be explained under the law as interpreted. Fluidity of mind does not mean a constant change in mental movement; it means a playing about and around everything that is involved in or is germane to the particular subject of thought. With an enlarged perception of the relation of mind and body the idea of the primary activities has undergone a great change. The conception of habit as an established way of doing something that is of use, not because it is established permanently, but because

<sup>13</sup> TOMPKINS, *Philosophy of Teaching*, pp. 5-7

it will be useful in the effort to do new things, necessitates a right-about-face in what is called the training of children.

Helpful as is a conception of the dynamic relations between mind and body in the development of the method of the school, it could never give that upward propulsion which has come through the theories of the sociologist. In the effort to collect and interpret the facts in the social history of man the physical environment is necessarily analyzed, but the stress is laid upon the acts—the life of man. It is in the recognition of the influence of this inheritance that the social surrounding will be elevated and purified because it supplies those stimuli which are destined to develop or warp the life which begins merely with the tendencies to reach out for and react on stimuli. The conception of education which makes the social environment the all-comprehensive factor while prospective in its aim is necessarily retrospective in its search for material. If mankind has made an upward march in the centuries past and in so doing has retained some forms of social life, has changed some and has wholly rejected others, then to feel the movement of intelligence is to project the progressive steps which have been taken in the centuries past.

The history of education brings out in bold relief the tendency of humanity to establish its advances in dogmatic form. This leads us, on the one hand, to a confusion of the experience of the race in the past with the possibilities of experience for the individual in the present; or, on the other hand, to a rejection of the traditions embodied in the rich and varied life of thought and action by means of which mankind has acquired its social heritage, for the ideas of the present only, as embodied in the expressions of the limited range of thought and action of the individual. In educational practice, the outcome of that marvelous revival of learning, that inquiry into the history of man's thoughts and achievements, called the Renaissance, was the setting up for study the verbal expression of the culture of Greece and Rome. The culture of which the Greek and Latin literatures were the embodiment was left for study in later years by the few who attained ripe scholarship. But again, in educational practice, the outcome of reformations founded on the effort to begin the training of mind through activity with subject-matter has been the restriction of the survey to the few phases deemed valuable in the narrow experience of the reformer. The vernacular which is symbolical of the limited experiences of the reformer-teachers and the children rarely develops through their usage in beauty or vigor. They need it to express a small fraction only of the thoughts, emotions, and deeds of the race.

The defects of the conservative or cultural school which in its empiricism neglects the study of mind in its unfolding of power in discrimination and definiteness in the use of the symbols of thought must disappear under the application of the method of science to education. The defects of the radical, or rational, school which in its individualistic trend ignores the movements of human society in the past, undergoing changes in its form and constitution through the action of the immutable laws of its nature,

must also disappear through the application of the method of science to research in the social heritage of the child of today.

Education has always recognized the fact that the past is involved in a cultivated present; the mistake has been that it has considered information about the past rather than activity in the progress of the past as fundamental. The lesson taught by evolution—that life is movement, not rest—has been interpreted as meaning movement in a fixed stage of development, not as movement from simple to complex conditions. With this understanding the theory of the social environment as the true stimulus for consciousness has resulted in the attempt to project the life of the child into a social, ethical, and civil environment which is simply a reduced copy of the life of the present century. This withholds from him those simpler modes of activity which would be the stimuli adapted for the early years of life. For example, it begins the work in manual training with the perfected tools and exact geometrical designs of the skilled mechanic, and so in that development which should be progressive from the early years—as soon as the child has learned to walk and to handle things—constructive activity is deferred until he reaches the higher grammar grades. Nothing can more painfully and perfectly illustrate the failure of this idea of progression in educational theory than the action taken through the suggestions of leaders in education all over the country, action which delays manual and constructive work until children have reached the sixth or seventh grade. Growth from the simple to the complex, and not growth beginning in the complex, is the fundamental in the natural law of life.

Although the theory of the experience of the recapitulation of the race by the individual has been held for centuries, yet it is within very recent years that the element of his activity has been recognized in the word "recapitulates." This is illustrated in the fact that Herbart, who first formulated the "culture epoch" theory as a fundamental in education, refused to apply it to the learning of the sciences. His refusal to permit in education the possibility of the blundering and absurd theorizing of the past shows that in the main he entertained merely a logical presentation of the history of different peoples. Unwillingness to permit the application of the scientific method in the beginning of the study of science—in that term we include nature study, physics, chemistry, and mathematics—shows scientific method to be least regarded in the domain in which it originated.

There is no subject in which there has been less satisfactory advance than in that of science learned in accordance with its own method. It was but yesterday that science gained recognition as a culture element in education. The long debate that was carried on in considering the relative titles of literature and science to rank and standing necessarily delayed the introduction of the study of science by the scientific method, and now that she and her method are established it comes about that she prefers to linger in the halls of the colleges and universities instead of seeking her own in every department of that great organization known as the school. A growing understanding of the method by which mind works and develops shows it to be



the inductive method of the scientist. An acquaintanceship with nature is now being established between the children and the environment, with spontaneous reaching toward her as the beginning, investigation and selection as the advance, and assimilation, nutrition, growth, power—in short, love and knowledge of nature—as the culmination.

The history of the social evolution of the race should be a history of what the race has done, rather than a compilation of its theories; hence the great problem in educational method today is to determine the conditions under which the race has worked in the past and which of those conditions, if reinstated, will develop in consciousness a feeling of upward movement. That conception of evolution as a vital force in education which leaves the child a barbarian at the mercy of the rude and vicious forces in modern civilization has no part in educational method which is scientific. The rudeness of manner, the self-assertion which characterize the American child are a result of his reaction to social stimuli in which social ethics are confused, in which adults are themselves pausing in the early stages of the ethical life and its expression through a mistaken notion that they must pause with the child. When Froebel said, "Let us live with the child," he did not mean the life and experience of the adult should be overwhelmed by the child's life and experience.

There must be thinking in the attitude of the intelligent seeker after truth if there is to be a clear understanding of the problem of the future, and this problem can be faced intelligently only as one has command of the resources and forces which have been evolved out of the past, and knows their natural law. To learn these things one must use the method of science. If the teacher as student can gain an intimate acquaintance with nature and humanity through the attitude of science only, then must the special problem, the development of the individual, be solved only by the use of method called in its specific application educational method.

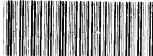
On every hand is a growing recognition of the possibilities of scientific method in education. Many individual teachers in the schools of this country are in intelligent sympathy with the aims and ways of scientific method as applied to education. They can, however, accomplish little that will be of permanent value to educational theory and practice, while they work in schools in which the method is hostile to the new spirit, or in systems of schools in which the administration is so mechanical as to safeguard them against that fluidity and at the same time definiteness that characterize mind in its development.

The work of investigation carried on in schools that are facing, throughout their organization, the questions of education with the attitude of the scientist is valuable beyond compare. Not facts alone, not laws alone are sought. The facts and the laws of nature that explain the marvelous beauty and power of the life-process of the soul, and also those that belong to the world that affords nutrition to the race and the individual, are the material which the educational laboratory investigates.





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