SCIENCE

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CONTENTS:

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*NATURE STUDY AND MORAL CULTURE.**

IN making a plea for nature study as a means of moral culture I do not wish to make an over-statement, nor to claim for such study any occult or exclusive power. It is not for us to say, so much nature in the schools, so much virtue in the scholars. The character of the teacher is a factor which must always be counted in. But the best teacher is the one that comes nearest to nature, the one who is most effective in developing individual wisdom. To seek knowledge is better than to have knowledge.

The essence of character building lies in action. Precepts of virtue are useless unless they are built into life. At birth or before, "the gate of gifts is closed." It is the art of life, out of variant and contradictory materials passed down to us from our ancestors, to build up a coherent and effective individual character. Character building is action, not imitation. The chief value of nature study in character building is that, like life itself, it deals with realities. The experience of living is of itself a form of nature study. One must, in life, make his own observations, frame his own inductions, and apply them in action as he goes along. The habit of finding out the best thing to do next and then doing it is the basis of character. A strong character is built up by doing, not by imitation, nor

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by feeling, nor by suggestion. Nature study if it be genuine is essentially doing. This is the basis of its effectiveness as a moral agent. To deal with truth is necessary if we are to know truth when we see it in action. To know truth precedes all sound morality. There is a great impulse to virtue in knowing something well. To know it well is to come in direct contact with its facts or laws; to feel that its qualities and forces are inevitable. To do this is the essence of natures study in all its forms.

The claim has been made that history treats of the actions of men, and that it therefore gives the student the basis of right conduct. But neither of these propositions is true. History treats of the records of the acts of men and nations. But it does not involve the action of the student himself. The men and women who act in history are not the boys and girls we are training. Their lives are developed through their own efforts, not by contemplation of the efforts of others. They work out their problem of action more surely by dissecting frogs or hatching butterflies than by what we tell them of Lycurgus or Joan of Arc. Their reason for virtuous action must lie in their own knowledge of what is right, not in the fact that Lincoln or Washington or William Tell or some other half-mythical personage would have done so and so under like conditions. The rocks and shells, the frogs and lilies, always tell the absolute truth. Association with these, under right direction, will build up a habit of truthfulness, which the lying story of the cherry tree is powerless to effect. If history is to be an agency for moral training it must become a nature study. It must be the study of original documents. When it is studied in this way it has the value of other nature studies. But it is carried on under great limitations. Its manuscripts are scarce, while every leaf on the tree is an original document. When a thousand are used or used up, the archives of nature are just as full as ever. From the intimate affinity with the problems of life, the problems of nature study derive a large part of their value. Because life deals with realities, the visible agents of the overmastering fates, it is well that our children should study the real rather than the conventional. Let them come in contact with the inevitable instead of the made-up, with laws and forces which can be traced in objects and forms actually before them rather than with those which seem arbitrary or which remain inscrutable. To use concrete illustrations, there is a greater moral value in the study of magnets than in the distinction between shall and will, in the study of birds or rocks than in that of diacritical marks or postage stamps, in the development of a frog than in the longer or the shorter catechism, in the study of things than in the study of abstractions. There is doubtless a law underlying abstractions and conventionalities, a law of catechisms, or postage stamps, or grammatical solecisms, but it does not appear to the student. Its consideration does not strengthen his impression of inevitable truth. There is the greatest moral value as well as intellectual value in the independence that comes from knowing, and knowing that one knows and why he knows. This gives a spinal column to character, which is not found in the flabby goodness of imitation or the hysteric virtue of suggestion. Knowing what is right and why it is right before doing it is the basis of greatness of character.

The nervous system of the animal or the man is essentially a device to make action effective and to keep it safe. The animal is a machine in action. Toward the end of motion all other mental processes tend. All functions of the brain, all forms of nerve impulse, are modifications of the simple reflex action, the automatic transfer of

sensations derived from external objects into movements of the body.

The sensory nerves furnish the animal or man all knowledge of the external world. The brain, sitting in absolute darkness, judges these sensations, and sends out corresponding impulses to action. The sensory nerves are the brain's sole teachers; the motor nerves and through them the muscles are the brain's only servants. The untrained brain learns its lessons poorly and its commands are vacillating and ineffective. In like manner the brain which has been misused shows its defects in ill-chosen action, the action against which nature protests through her whip of misery. In this fact that nerve alteration means ineffective action, lying brain and lying nerves, rests the great argument for temperance, the great argument against all forms of nerve tampering, from the coffee habit to the 'protracted meeting.'

The senses are intensely practical in their relation to life. The processes of natural selection make and keep them so. Only those phases of reality which our ancestors could render into action are shown to us by our senses. If we can do nothing in any case, we know nothing about it. The senses tell us essential truth about rocks and trees, food and shelter, friends and enemies. They answer no problems in chemistry. They tell us nothing about atom or molecule. They give us no ultimate facts. Whatever is so small that we cannot handle it is too small to be seen. Whatever is too distant to be reached is not truthfully reported. The 'X-rays' of light we cannot see, because our ancestors could not use them. The sun and stars, the clouds and the sky, are not at all what they appear to be. The truthfulness of the senses fails as the square of the distance increases. Were it not so we should be smothered by truth. We should be overwhelmed by the multiplicity of our own sensations, and truthful response in action would become impossible. Hyperæsthesia of any or all of the senses is a source of confusion, not of strength. It is essentially a phase of disease and shows itself in ineffectiveness, not in increased power. Besides the actual sensations, the so-called realities, the brain retains also the sensations which have been and are not wholly lost. Memory pictures crowd the mind, mingling with pictures which are brought in afresh by the senses. The force of suggestion causes the mental states or conditions of one person to repeat themselves in another. Abnormal conditions of the brain itself furnish another series of feelings with which the brain must deal. Moreover the brain is charged with impulses to action passed on from generation to generation, surviving because they are useful. With all these arises the necessity for choice as a function of the mind. The mind must neglect or suppress all sensations which it cannot weave into action. The dog sees nothing that does not belong to its little world. The man in search of mushrooms, 'tramples down oak trees in his walks.' To select the sensations that concern us is the basis of the power of attention. The suppression of undesired actions is the function of the will. To find data for choice among the possible motor responses is a function of the intellect. Intellectual persistency is the essence of individual character.

As the conditions of life become more complex it becomes necessary for action to be more carefully selected. Wisdom is the parent of virtue. Knowing what should be done logically precedes doing it. Good impulses and good intentions do not make action right or safe. In the long run action is tested, not by its motives, but by its results.

The child when he comes into the world has everything to learn. His nervous system is charged with tendencies to reaction

and impulses to motion, which have their origin in survivals from ancestral experience. Exact knowledge by which his own actions can be made exact must come through his own experience. The experience of others must be expressed in terms of his own before it becomes wisdom. Wisdom is knowing what it is best to do next. Virtue is doing it. Doing right becomes habit if it is pursued long enough. It becomes a 'second nature' or a higher heredity. The formation of a higher heredity of wisdom and virtue of knowing right and doing right is the essence of character building. The moral character is based on knowing the best, choosing the best and doing the best. It cannot be built up on imitation. By imitation, suggestion and conventionality the masses are formed and controlled. To build up a man is a noble process, demanding materials and methods of a higher order. The function of individual education is to break up the masses. Only the robust man can make history. Others may adorn it, disfigure it or vulgarize it. The growth of man is the assertion of individuality.

The first relation of the child to external things is expressed in this: What can I do with it? What is its relation to me? The sensation goes over into thought, the thought into action. Thus the impression of the object is built into the little universe of his mind. The object and the action it implies are closely associated. As more objects are apprehended, more complex relations arise, but the primal condition remains. What can I do with it? Sensation, thought, action—this is the natural sequence of each completed mental process. As volition passes over into action, so does science into art, knowledge into power, wisdom into virtue.

By the study of realities wisdom is built up. In the relation of objects he can touch and move, the child comes to find the limitations of his power, the laws that govern phenomena and to which his actions must be in obedience. So long as he deals with realities these laws stand in their proper relation. "So simple, so natural, so true," says Agassiz. "This is the charm of dealing with nature herself. She brings us back to absolute truth so often as we wander."

So long as a child is led from one reality to another, never lost in words or in abstractions, so long this natural relation remains. "What can I do with it?" is the beginning of wisdom. "What is it to me?" is the basis of personal virtue.

So long as a child remains about the home of his boyhood he knows which way is north and which is east. He does not need to orient himself, because in his short trips he never loses his sense of space direction. But let him take a rapid journey in the cars or in the night and he may find himself in strange relations. The sun no longer rises in the east, the sense of reality in direction is gone, and it is a painful effort for him to join the new impressions to the old. The process of orientation is a difficult one, and if facing the sunrise in the morning were a deed of necessity in his religion this deed would not be accurately performed.

This homely illustration applies to the child. He is taken from his little world of realities, a world in which the sun rises in the east, the dogs bark, the grasshopper leaps, and the water falls, and the relations of cause and effect appear simple and natural. In these simple relations moral laws become evident. "The burnt child dreads the fire," and this dread shows itself in action. The child learns what to do next, and to some extent does it. By practice in personal responsibility in little things, he can be led to wisdom in large ones. For the power to do great things in the moral world comes from doing the right

in small things. It is not often that a man who knows that there is a right does the wrong. Men who do wrong are either ignorant that there is a right or else they have failed in their orientation and look upon right as wrong. It is the clinching of good purposes with good actions that makes the man. This is the higher heredity; that is not the gift of father or mother, but is the man's own work on himself. The impression of realities is the basis of sound morals as well as of sound intellect. By adding near things to near, the child tends to grow into wisdom. 'Knowledge set in order' is science.

Nature study is the beginning of science. It is the science of the child. To the child training in methods of acquiring knowledge is more valuable than knowledge itself. In general throughout life sound methods are more important than sound information. Self-direction is more important than innocence. The fool may be innocent; only the sane and the wise can be virtuous.

It is the function of science to find out the real nature of the universe. Its purpose is to eliminate the personal equation and the human equation in statements of truth. By methods of precision of thought and instruments of precision in observation it seeks to make our knowledge of the small, the distant, the invisible, the mysterious, as accurate as our knowledge of the common things men have handled for ages. It seeks to make our knowledge of common things exact and precise that exactness and precision may be translated into action. The ultimate end of science, as well as its initial impulse, is the regulation of human conduct. To make right action possible and prevalent is the function of science. The 'world as it is' is the province of science. In proportion as our actions conform to the conditions of the world as it is do we find the world beautiful, glorious, divine. The truth of the 'world as it is' must be the ultimate inspiration of art, poetry and religion. The world, as men have agreed to say it is, is quite another matter. The less our children hear of this, the less they will have to unlearn in their future development.

When a child is taken from nature to the schools he is usually brought into an atmosphere of conventionality. Here he is not to do, but to imitate; not to see nor to handle, nor create, but to remember. He is, moreover, to remember not his own realities, but the written or spoken ideas of others. He is dragged through a wilderness of grammar with thickets of diacritical marks into the desert of metaphysics. He is taught to do right, not because right action is in the nature of things, the nature of himself and the things about him, but because he will be punished somehow if he does not.

He is brought into a medley of words without ideas. He is taught declensions and conjugations without number in his own and other tongues. He learns things easily by rote, so his teachers fill him with rote learning. Hence grammar and language have become stereotyped as education, without a thought as to whether undigested words may be intellectual poison. And as the good heart depends on the good brain, undigested ideas become moral poison as well.

In such manner the child is bound to lose his orientation as to the forces which surround him in life. If he does not recover it he will live in a world of mixed fancies and realities. Nonsense will seem half truth, and his appreciation of truth will be vitiated by its lack of clearness of definition, by its close relation to nonsense. That this is no slight defect can be shown in every community. There is no intellectual craze so absurd as not to have a following among educated men and women. There is no scheme for the renovation of

the social order so silly that educated men will not invest their money in it. There is no medical fraud so shameless that educated men will not give it their certificate. There is no nonsense so unscientific that men called educated will not accept it as science. It should be a function of the schools to build up common sense. Folly should be crowded out of the schools. We have built costly lunatic asylums for its accommodation. That our schools are in a degree responsible for current follies there can be no doubt. We have among us many teachers who have never seen a truth in their lives. There are many who have never felt the impact of an idea. There are many who have lost their own orientation in their youth, and who have never since been able to point out the sunrise to others. It is no extravagance of language to say that diacritical marks lead to the cocoaine habit, nor that the ethics of metaphysics points the way to the higher foolishness. There are many links in the chain of decadence, but its finger posts all point downward.

"Three roots bear up dominion, knowledge, will, the third obedience." This statement which Lowell applies to nations belongs to the individual man as well. It is written in the structure of his brain: Knowledge, Volition, Action; and all three elements must be sound if action is to be safe or effective.

But obedience must be active, not passive. The obedience of the lower animals is automatic, and therefore in its limits measurably perfect. Lack of obedience means the extinction of the race. Only the obedient survive, and hence comes about obedience to 'sealed orders,' obedience by reflex action in which the will takes little part.

In the early stages of human development the instincts of obedience were dominant. Great among these was the instinct of conventionality by which each man follows the path others have found safe. The Church and the State, organizations of the strong, have assumed the direction of the weak. It has often resulted that the wiser this direction the greater the weakness it was called on to control. The 'sealed orders' of human institutions took the place of the automatism of instinct. Against 'sealed orders' the individual man has been in constant protest. The 'Warfare of Science' was part of this long struggle. The Reformation, the Revival of Learning, the Growth of Democracy, are all phases of this great conflict. The function of democracy is not good government. If that were all it would not deserve the efforts spent on it. Better government than any king or congress or democracy has yet given could be obtained through the automatic processes of competitive examinations. By this we could get along with one-half our number of rulers and at one-fourth the present cost. Even an ordinary intelligence office or employment bureau for statesmen would serve us better than we are served by caucus and convention. But not for long. The people who could be ruled in this way would be a people not worth saving. But this is not the point at issue. Government too good as well as too bad may have a baneful influence on men. Its character is a secondary matter. The function of self-government is to intensify individual responsibility, to promote abortive attempts at wisdom, through which true wisdom may come at last. Democracy is a nature study on a grand scale. The Republic is a huge laboratory of civics, a laboratory in which strange experiments are performed, but by which, as in other laboratories, wisdom may arise from experience, and having arisen may work itself out into virtue.

"The oldest and best endowed university in the world," Dr. Parkhurst tells us, "is life itself." "Problems tumble easily apart in the field that refuse to give up their secret in the study or even in the closet.

Reality is what educates us, and reality never comes so close to us with all its powers of discipline as when we encounter it in action. In books we find truth in black and white, but in the rush of events we see truth at work. It is only when truth is busy and we are ourselves personally mixed up in its activities that we learn of how much we are capable, or win the power by which these capabilities can be made over into effect."

Mr. Jackman has well said: "Children always start with imitation, and very few people ever get beyond it. The true moral act, however, is one performed in accordance with a known law that is just as natural as the law which determines which way a stone shall fall. The individual becomes moral in the highest sense when he chooses to obey this law by acting in accordance with it."

Conventionality is not morality and may co-exist with vice as well as with virtue; for the obedience which lasts is the product of individual knowledge and will. It is the progressive response to higher and higher laws and as the individual comes to recognize them in his own experience. The welfare of man is not primarily security from deception and evil influences. It goes with the growth of his power to recognize illusions and to base his action on realities. Obedience induced by deception cannot be permanent. Wrong information, it is true, may lead to right action, as falsehood may secure obedience to a natural law which would otherwise be violated. But in the long run, men and nations pay dearly for every illusion they cherish. For every sick man healed at Denver or Lourdes, ten well men will be made sick. Faith cure and patent medicine feed on the same victims. For every Schlatter who is worshipped as a saint, some equally harmless lunatic will be stoned as a witch. This scientific age is beset by the non-science which its altruism has made safe. The development of the common sense of the people has given security to a vast cloud of follies, which would be destroyed in the unchecked competition of life. It is the soundness of our age which has made what we call its decadence possible. It is the undercurrent of science which has given security to human life, a security which obtains for fools as well as for sages.

For protection against all these follies which so soon fall into vices or decay into insanity, we must look to the schools. A sound recognition of cause and effect in human affairs is our best safeguard. The old common sense of the 'unhighschooled man,' aided by instruments of precision and directed by logic, must be carried over into the schools. Clear thinking and clean acting, we believe, is a product of the study of nature. When men have made themselves wise, in the wisdom which may be completed in action, they have never failed to make themselves good. When men have become wise with the lore of others, the learning which ends in self and does not spend itself in action, they have been neither virtuous nor happy. "Much study is a weariness of the flesh." Thought, without action, ends in intense fatigue of soul, the disgust with all the 'sorry scheme of things entire,' which is the mark of the unwholesome and insane philosophy of pessimism. This philosophy finds its condemnation in the fact that it has never yet been translated into pure and helpful life.

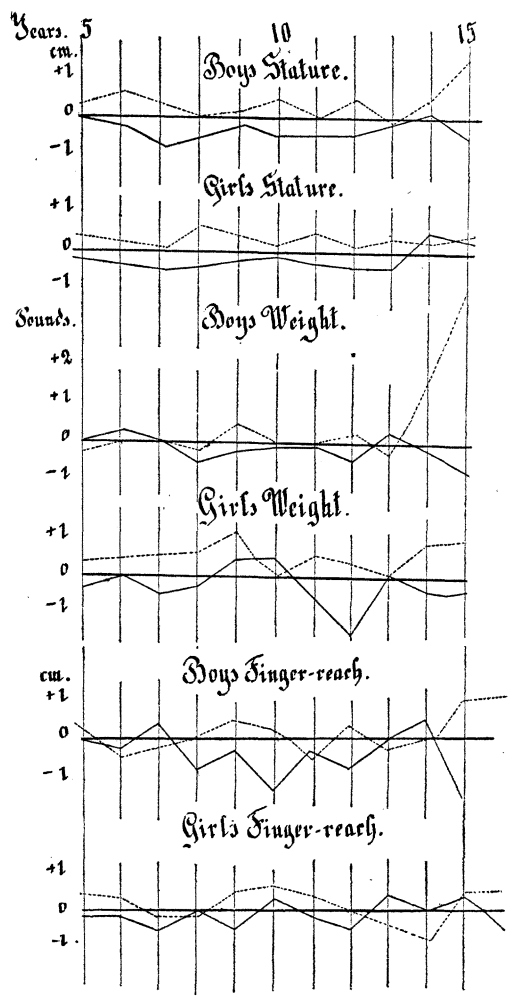
With our children the study of words and abstractions alone may in its degreee produce the same results. Nature studies have long been valued as a 'means of grace' because they arouse the enthusiasm, the love of work, which belongs to open-eyed youth. The child blasé with moral precepts and irregular conjugations turns with delight to the unrolling of ferns and the song of birds. There is a moral training in clearness and

tangibility. An occult impulse to vice is hidden in all vagueness and in all teachings meant to be heard, but not to be understood. Nature is never obscure, never occult, never esoteric. She must be questioned in earnest, else she will not reply. But to every serious question she returns a serious answer. 'Simple, natural and true' should make the impression of simplicity and truth. Truth and virtue are but opposite sides of the same shield. As leaves pass over into flowers and flowers into fruit, so are wisdom, virtue and happiness inseparably related.

David Starr Jordan.

OBSERVATIONS ON THE RELATION OF PHYSICAL DEVELOPMENT TO INTELLECTUAL ABILITY, MADE ON THE SCHOOL CHILDREN OF TORONTO, CANADA.

In the spring of 1892 Dr. Franz Boas, then of Clark University, Worcester, Mass., obtained the necessary permission from the Toronto School Board to make anthropometric observations upon the school children of that city. The observations were made by the teachers of the various schools upon the children under their immediate charge. The teachers were instructed as to the method of taking the measurements by Mr. A. F. Chamberlain of Clark University, and the subsequent work was carried on under his immediate supervision. The measurements made by the teachers were stature, weight and finger reach. Besides the statistical information regarding age, sex, parentage, etc., the teachers were also requested to group the children as to their mental ability into three as nearly as possible equal divisions of 'good,' 'average' and 'poor.' They were to make their estimate, not on the mere class standing, which would be influenced by such irrelevant matters as regularity and punctuality of attendance, etc., but upon the observed natural intellectual quickness, general aptitude for assimilation of ideas and initiative. At the same time that these observations were carried on, a similar series of observations was being made in Worcester. There it was soon made manifest that any such classification of children's mental ability would be very greatly influenced by the mental calibre of the teacher making such classification, and in all cases it rested almost exclusively upon the markings of the class book. There was a further fact which was brought



very sharply to my notice, and that was that in most class rooms there were *no poor scholars*. The teachers were perfectly will-