

modern schools, where it is an integral part of the discipline, from the preparatory classes upwards.

I may be permitted to sketch what I conceive to be the proper place of science in schools. Let me premise that no one knows better than the science teacher, whose science is the acquisition, as it were, of his lifetime, that nothing like completeness of knowledge in any subject of science can be imparted in 104 hours. The number of lessons is given as a brief and direct answer to the question as to the length of time necessary to prepare a class for the Government examination. All that could be accomplished, or even aimed at, in such a course, would be to furnish the pupils' minds with an interesting and important store of scientific facts, as a nucleus for research, and to direct their future tastes. Examination is not the end of science-teaching in schools. Its purpose is mainly mental discipline. The logic of science, practised in its inductions and deductions, calls into exercise the powers of observation and memory, of reflection, of drawing inferences, and of generalization; exercises as invigorating to the mind as physical exercise to the muscles.

As a consequence, science-teaching should be continuous in school, not merely at certain seasons, or confined to one department. The basis should be laid in the infant school, where so much of the instruction is oral in the form of "object lessons." The time, too often lost through the "objectless" character of loose and promiscuous lessons, becomes invaluable in teaching and training where science directs the course. As examples, the elementary principles of well-being, cannot merely be taught, but can be drawn from quite young children, and in a manner exciting their keenest interest, in a series of lessons on "common things," or more correctly "vital things," such as are suggested by the first few pages of Mr. William Ellis's book, "Progressive Lessons in Social Science." In an equally simple manner, the foundation may be laid for an extended knowledge of physiology, connected with the laws of health, and of natural history. Lessons on a "tooth," a "snail-shell," or a "flower," need but to be mentioned to suggest at once, how much there is of scientific interest, without being so called, connected with their structure and functions, which the skilful teacher would, in the most delightful manner, implant in the young mind as a fertile germ of a desire for further scientific knowledge. Thus science, as science, is not the sole purpose served. *The desire to know* grows into the intensest of our pleasures, and makes happiness even of our difficulties. Where this desire is judiciously educated, the "wearisome bitterness of learning" never appears, but all is eager delight. It is self culture from infancy. In these truths lies a solution of the time table difficulty. In the course of such lessons as I have barely shadowed, young children acquire the power of handling the instruments of knowledge, reading, writing, computing, by a happy instinct. By so much therefore, the time has been profitably diverted from the direct teaching of these dry instruments, while the mind has also been strengthened and furnished with truth. Dr. Hodgson, at the late Social Science Congress, related a simple domestic incident that bears on this point. "Papa," said his little boy, four years of age, "Why does my cousin have lessons to do at night?" "Because," answered papa, "her parents wish her to learn." "But don't I learn," pursued the inquisitive child, "by what you talk to me about, papa? and I don't have any lessons." Children thus equipped will obviously be better prepared and turn to better account, school middle-age, where science-teaching would be extended and more formally systematic. The mental discipline, the same in kind but greater in degree, would proceed, and the collateral advantages of science would tell upon the school work still more than before. In the practice of taking "Notes," and reproducing the science lessons, facility in composition, power of expression, correct grammar, are all acquired, while the improved mind is able to turn to better account the diminished number of lessons in the rules of literature proper.

Reaching the highest classes of a school, the subjects of study

multiply in one direction more rapidly than they diminish in another. The student, however, has become skilful in the use of his tools, and reading, writing, arithmetic, grammar, geography, history, simply as such, are reduced to the minimum of instruction. Language and science combine to apply and to complete the knowledge of these subjects. The influence of the earlier teaching and training develops itself here, in the self-reliance of the pupils, the resultant of all the forces up to this point, called education. The self-reliance, in its turn, makes the last stage of school life a natural link with the after business of the world, and shades off any abrupt transition from the duties of childhood to those of adolescence. Granting that children, in the way of receiving science instruction, are likely to spend four years at school,—and many to their advantage spend more,—the question remains, as to the best mode of spreading science instruction over this period. I have already given an opinion, that two allied subjects could be profitably taught together. If each alliance occupied a year, *i.e.*, a six months' elementary course and six months' examination course, no less than eight subjects of science would be reasonably well acquired, during the four years of school attendance. Meanwhile the mental discipline will have made the power of investigation strong, and with the power will have come the taste to pursue truth for the love of it.

1st, As a community, we have a right to require that our children should be equipped before leaving school with an insight into the laws of conduct, and social well-being founded thereupon, in the conviction that the possession of such knowledge tends to its being acted upon. 2d, That they should know so much of the structure and functions of their own bodies, as to give them an impulse towards obedience to the laws of health. 3rd, That their minds should have become so far disciplined as to develop a self-reliance in adapting their knowledge to their vocations, and also in the further pursuit of truth as the most elevated of their enjoyments.

Let us dwell for a moment upon the conditions surrounding man from birth. Mere existence is eminently material. His wants may be summarized under the heads of food, the means of warmth, and of rest; involving raw materials,—the gift of nature, and labour,—the energy of man. From raw materials we are naturally led to the consideration of the earth of which they are the produce, and to the study of the laws by which nature is governed.

What a wide field of research does this view of the matter open up! We gather from it the true meaning of object lessons, which, in their full significance, should comprise the economic history of produce from the animal, vegetable, and mineral kingdoms, and lay the foundation of the whole range of useful science teaching. Were we to stop short at economic botany, economic zoology, and economic mineralogy, a vast power of usefulness would be put into the possession of our pupils; but we need not stop short. Round such teaching clusters all the physical sciences, and the philosophy of industrial life. Chemistry and familiarity with the microscope, are essential to a real knowledge of a raw substance; and physical geography, the science of sciences, is, as it were, the universal medium,—absorbing and containing both physical science and natural philosophy.

Again, produce, in its raw state, is only at the threshold of its history; processes of manufacture and of after distribution and consumption follow, the methods and reason of which are not less important branches of knowledge than is the nature of the substance itself. Thus we get launched into moral science, for we cannot refer to the subject of human labour, its modes and aims, without confronting the laws of conduct, which enable man to live and labour in communities, and to enjoy the blessings of civilization. In order to vitalize such a science scheme, based upon object lessons and physical geography, every school should be a repository of specimens of raw produce. Man has gained his knowledge of the uses of raw materials by possessing them. No amount of abstract reasoning would have led him to discover the manifold uses of iron, without first seeing, handling,