

CULTURE IN THE EDUCATION OF ENGINEERS.*

By William L. Saunders.

At one of the meetings of the American Institute of Mining Engineers, held in the hall of the Sheffield Scientific School at New Haven, a discussion arose as to whether or not sufficient importance was given to cultural studies in our scientific schools. A diagram was exhibited showing graphically the relative proportion that culture bore to other studies in the various colleges. In some there was a wide distribution of cultural work, in others the proportion was small, and in a few cases it was shown that these studies were entirely omitted in the curriculum. During recess a group of students were discussing the subject; one of them, a senior, said, "I don't see why they should learn a person culture in a scientific school." This remark, made in my presence, so impressed me as a concrete example of neglect in true educational lines that it has been chosen as a text for what is to follow.

Education in its broadest sense is mental and moral training. High schools and colleges differ from common schools in that they aim at higher planes of mental and moral life. The small boy is taught by stuffing, as one puts sawdust in a doll; this is because his mind has not grown to the stage when it can think for itself. Impressions are received and transfixed by memory; the process is one of mental photography; the moral code is learned by rote as though it were the multiplication table. Not so with the older, the college student; his highest aim in education is to learn to think for himself. "If you are a student force yourself to think independently; if a teacher compel your youth to express their own minds," writes Dr. Osborn of Columbia; and again, "The lesson of Huxley's life and the result of my own experience is that productive thinking is the chief means as well as the chief end of education."

Now what is productive thinking? Let me answer this question by giving you Huxley's definition of culture: "The pursuit of any art or science with the view of its improvement." The storage process is of paramount importance only when applied to elementary education. It is but the auxiliary of the scholar who has passed from the junior to the senior stage of student life, and who aims to do things in the world. The pursuit of facts is a mathematical study. We learn of things that exist as a result of divine and human creation. The earth is round and it is composed of land and water. Water is hydrogen and oxygen combined. The square of the hypotenuse of a right angle triangle is equal to the sum of the square of the other two sides. How elementary are these facts! It is important that we should know them; but even a large volume of facts when stored in the human mind is powerless to add one cubit to progress. It is like putting a pair of legs on the Encyclopedia Britannica and expecting it to do something. Knowledge is power, but reason is power in action.

Dr. James Gayley, of the United States Steel Corporation, told me recently that the professor at Lafayette College who taught him how to think made so deep an impression upon him that it has lasted throughout his life. Mr. Gayley is distinguished for what he has done as a metallurgical engineer. His life has been one of productive thinking; he has pursued science with the view of its improvement. That teacher, Mr. Gayley said, once gave him a solution containing iron, and instead of instructing him how to best precipitate the metal he told him to try three

or four ways of doing it and report which was best. This led directly to thought and reason and built up a master mind among engineers. We may still heed the voice of old Carlyle crying from the heathery hills of Dunscore; "Produce! Produce! Were it but the pitifullest infinitesimal fraction of a product, produce in God's name! 'Tis the utmost thou hast in thee; out with it then."

Where among all the professions do we get the results that come through productive thinking as from engineering? The engineer is the architect of the world's progress. Transportation in railways and ships, in motor cars and aeroplanes, is the productive thinking of mechanical engineers woven into our industrial life. The men who did these things were students of science, not that they might be mere storehouses of knowledge, but that they might produce. Civil, electrical, chemical and mining engineers are fields which afford infinite opportunities for research and progress. If you men of the future do not rise to your chance in these lines it is not because the fields are not still open for cultivation and growth, but rather through your own inefficiency or perhaps your top-heaviness.

"In vain our toil,

We ought to blame the culture, not the soil."

Even Huxley feared that men might be over-fed scientifically when he said: "An exclusively scientific training will bring about a mental twist as surely as an exclusively literary training. The value of the cargo does not compensate for a ship's being out of trim; and I should be very sorry to think that a scientific college would turn out none but lop-sided men."

All this bears upon culture in its broadest sense. Productive thinking is the most important form of culture. It makes for power, refinement, progress, knowledge, taste, civilization. The subject, you see, is a very broad one; the obligation upon you as students of science is equally broad. Take care that you be not "lop-sided men." A graduate of the Colorado School of Mines, like all graduates of the higher institutions of learning, misses his opportunities and discredits his college if he does not carry throughout all his walks of life the imprint of the educated man. Noblesse oblige is a degree and an obligation which is uniformly conferred upon all college men. To carry this obligation properly one should study culture in all its phases and in its broadest sense. Study it as an undergraduate and study it still harder and more fully through all your post-graduate life. To this end let us accept and profit by that definition of culture given us by Matthew Arnold: "Acquainting ourselves with the best that has been known and said in the world." A professor at Wellesley College defined culture to the students as that which is left after all else learned at college is forgotten.

Virtue and moral training belong to cultural work in the education of engineers. It is a mistake to suppose that schools and colleges are places for mental training only. Physical exercise through athletics is just as much a part of one's college life nowadays as the study of mathematics; the one helps the other. Emerson said, "Archery, cricket, gun and fishing rod, horse and boat, are all educators, liberalizers." To the engineer physical training is of value in order to fit him for outdoor work. Moral training is of even greater importance. Locke has placed virtue first in defining the objects of education. Wisdom he puts next, and then good breeding; last of all learning. It is more the province of the teacher than of the student to safeguard and train the character by precept and example, for, after all, "the foundation of culture, as of character, is at last the moral sentiment. This is the foundation of power."

It is a common saying that manners make the man. Good manners afford us easy weapons with which to win

*Address delivered at the 38th Annual Commencement, Colorado School of Mines, Golden, Colo., May 24, 1912.