THE PEDAGOGIC VALUE OF THE HISTORY OF PHYSICS.*

FLORIAN CAJORI, Colorado College.

"The education of the child must accord both in mode and arrangement with the education of mankind as considered historically; or, in other words, the genesis of knowledge in the individual must follow the same course as the genesis of knowledge in the race." Such has been the teaching of theorists like Comte and Spencer; such has been the conviction of teachers like Pestalozzi and Froebel. This doctrine is far from self-evident, but *if* it applies to physics, then certainly the history of the science should receive greater attention.

Professor Ostwald of the University of Leipzig, the editor of the *Classics of the Exact Sciences*, emphasizes the importance of the history of science as follows: "While . . . the knowledge of science as it now exists is being imparted successfully, eminent and far-sighted men have repeatedly been forced to point out a deficiency which too often attaches to the present scientific education of our younger talent. It is the absence of the historical sense and the want of familiarity with the great researches upon which the edifice of science rests."

Thus great writers on the philosophy of education as well as eminent scientific investigators have, in a general way, pointed out the value of a knowledge of the progress of science. The practical teacher will ask himself the practical question, exactly in what way will a knowledge of the history of physics aid in elementary teaching?

In the first place, *a knowledge of the struggles which original investigators have undergone leads the teacher to a deeper appreciation of the difficulties which pupils encounter.* The difference between mass and weight is a stumbling block to beginners, and the instructor's patience is often taxed to the utmost. The great originators of mechanics—Galileo, Descartes, Leibnitz, Huygens—had no clear notion of mass. Weight and mass were taken interchangeably; the two terms meant one and the same thing. That there is a distinction between the two began to dawn upon the minds when it was discovered that the same body may receive different accelerations by gravity on different parts of the earth's surface. When Jean Richer in 1671 went from Paris to Cayenne in French Guiana to make astronomical observations, he found that his pendulum clock, which in Paris kept correct time, fell daily two and one half minutes behind mean solar time. It was shortened, but after his return to Paris it had to be let out again. The distinction between mass and weight was clearly perceived by Newton in his extension of the laws of dynamics to heavenly bodies.[1] On the same spot of the earth mass and weight are proportional to each other. This is not a self-evident fact; Newton proved it in course of a splendid series of tests on the pendulum. He says in his *Principia* (Book II, Prop. XXIV, Cor. 7): "By experiments made with the greatest accuracy I have always found the quantity of matter in bodies to be proportional to their weight."

That the difficulties which students encounter are often real difficulties such as the builders of the science succeeded in overcoming only after prolonged thought and discussion can be exemplified in many ways. Take the laws of motion, the true nature of

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[1] MACH, *Science of Mechanics*, transl. by T. J. McCormack, 1893, pp. 161, 251.