AN EDUCATOR FOR ALL SEASONS

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Most of this column will be guest-authored by the individual responsible for these quotations.

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No book or map is a substitute for personal experience; they cannot take the place of the actual journey. The mathematical formula for a falling body does not take the place of throwing stones or shaking apples from a tree.

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Science teaching has suffered because science has been so frequently presented just as so much ready-made knowledge, so much subject-matter of fact and law, rather than as the effective method of inquiry into any subject-matter.

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Where the school work consists in simply learning lessons, mutual assistance, instead of being the most natural form of cooperation and association, becomes a clandestine effort to relieve one's neighbor of his proper duties. Where active work is going on, all this is changed. Helping others, instead of being a form of charity which impoverishes the recipient, is simply an aid in setting free the powers and furthering the impulse of the one helped. A spirit of free communication, of interchange of ideas, suggestions, results, both successes and failures of previous experiences, becomes the dominating note of the recitation.

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Almost everyone has had occasion to look back upon his school days and wonder what has become of the knowledge he was supposed to have amassed during his years of schooling, and why it is that the technical skills he acquired have to be learned over again in changed form in order to stand him in good stead. One trouble is that the subject matter in question was learned in isolation; it was put, as it were, in a water-tight compartment. When the question is asked, then, what has become of it, where has it gone to, the right answer is that it is still there in the special compartment in which it was originally stored away. If exactly the same conditions recurred as those under which it was acquired, it would also recur and be available. It is contrary to the laws of experience that learning of this kind, no matter how thoroughly engrained at the time, should give genuine preparation [for careers and lives].

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In other words, to be effective, instruction should involve experiential, inquiry-based, collaborative learning and multidisciplinary subject integration. To anyone who has not been hibernating for the past decade, these are familiar calls that could have come from any recent issue of the *Journal of Engineering Education* or *Annual ASEE Conference Proceedings*. They didn't, though. They were stated by John Dewey in 1915, 1910, 1899, and 1938, respectively.

In fact, you can hardly think of a research-based educa-

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tional innovation or position in the past decade that Dewey didn't anticipate and provide a solid theoretical rationale for a century ago, be it problem-based or project-based learning, constructivism (the need to correct misconceptions in existing knowledge before new knowledge can be acquired), the importance of presenting technical information visually, the need to take student differences into account when designing instruction (addressing different learning styles), or even the negative effects on true learning of standardized tests of the "No Child Left Behind" variety. Education in Dewey's time was clearly facing many of the same challenges it faces now; those of us in the teaching business would do well to consider what he had to say about addressing them. Two collections of his writings still in print,[1] from which all the quotations in this column were taken, provide a convenient way to do it.

I was particularly struck by a series of lessons Dewey described in his 1899 monograph *The School and Society*, which might be ideal to present to, say, freshman engineering students today. Picture this:

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The students begin by imagining present conditions taken away until they are in contact with nature at first hand. That takes them back to the hunting people, to a people living in caves or trees and getting a precarious subsistence by hunting and fishing. Then they go on in imagination through the hunting to the semi-agricultural stage, and through the nomadic to the settled agricultural stage. The point I wish to make is that there is abundant opportunity thus given for actual study, for inquiry which results in gaining information. For example, the students had some idea of primitive weapons, of the stone arrowhead, etc. That provided occasion for the testing of materials as regards their friability, their shape, texture, etc., resulting in a lesson in mineralogy, as they examined the different stones to find which was best suited to the purpose. The discussion of the iron age supplied a demand for the construction of a smelting oven made out of clay, and of considerable size. As the students did not get their drafts right at first, the mouth of the furnace not being in proper relation to the vent, as to size and position, instruction in the principles of combustion, the nature of drafts and fuel, was required. Yet the instruction was not given ready-made; it was first needed, and then arrived at experimentally. Then the students took some material, such as copper, and went through a series of experiments, fusing it, working it into objects; and the same experiments were made with lead and other metals. This work has been also a continuous course in geography, since the students have had to imagine and work out the various physical conditions necessary to the different forms of social life implied. What would be the physical conditions appropriate to pastoral life? to the beginning of agriculture? to fishing? What would be the natural method of exchange between these peoples? Having worked out such points in conversation, they have afterward presented them in maps and sand molding. Thus they have gained ideas of the various forms of the configuration of the earth, and at the same time they have seen them in their relation to human activity, so that they are not simply external facts, but are fused and welded with social conceptions regarding the life and progress of humanity. The result, to my mind, justifies completely the conviction that students, in a year of such work (of five hours a week altogether), get indefinitely more acquaintance with facts of science, geography, and anthropology than they get where information is the professed end and object, where they are simply set to learning facts in fixed lessons. As to discipline, they get more training of attention, more power of interpretation, of drawing inferences, of acute observation and continuous reflection, than if they were put to working out arbitrary problems simply for the sake of discipline.

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The active, collaborative, problem-based approach embodied in these lessons would probably lead to greater engineering skill development and more true learning about the history and nature of engineering than the students would normally get in two or three years of traditional classes. The interesting thing is that the students who received this instruction were all seven years old. (I changed Dewey's "children" to "students" in my transcription.) If second graders could manage to negotiate all that engineering project work (for that is what it was), surely our freshmen engineering students ought to be able to handle it.

There's much more. Check it out.

References

1. (a) *Dewey on Education: Selections*, New York, Teachers College Press, 1959; (b) *John Dewey on Education: Selected Writings*, Chicago, University of Chicago Press, 1974 ❐

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