What Would John Dewey Say About Science Teaching Today?

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... (5) scientific method is the only authentic means at our command for getting at the significance of our everyday experiences of the world in which we live.

John Dewey
Experience and Education

The year 1982 marked the 30th anniversary of the death of John Dewey. In a career spanning more than seven decades, Dewey was recognized throughout the world as America’s most influential philosopher and educational theorist. Moreover, as a man of action, he continuously sought to test his theories in the realm of human experience. For Dewey, education was a scientific approach to understanding the world. His words and practices have meaning for science educators today.

Dewey was deeply concerned about teaching practices that prevailed in America in the late 19th and early 20th centuries. He was disturbed by what he felt was elitism, irrelevance, and triviality of curricula in most schools, and denounced science educators who emphasized rote memorization and mechanical routine at the expense of inquiry and creativity. Science, said Dewey, was the most potent force in the modern world. He wanted it treated as such in the schools.

Project Synthesis, the recent study of the status of pre-collegiate science education in the United States, shows that many of Dewey’s criticisms hold true today. A summary of the study (Harms and Yager 1981) reports that:

John Dewey, about 1890. (All photos courtesy of Photographic Files, The University of Chicago Archives.)
1. The activities which inaugurate and sustain the teaching of scientific inquiry are conspicuously absent in most schools.

2. (Teaching) goals related to personal use of science in everyday life, to scientific literacy for societal decision-making, and to career-planning and decision-making are largely ignored.

3. ... (S)cience education has accepted very little responsibility for education in the STS (science, technology, and society) domain.

These excerpts summarize much of what is wrong with science education today. They explain why so many students are “turned off” by science courses in their schools, and suggest why the average American thinks that science is something done only in a laboratory, or that a theory is little more than casual conjecture.

To better understand John Dewey, we must go back to his New England origins. The year of his birth, 1859, was as portentous as any of the century. Darwin’s Origin of Species was published. Also that year, Karl Marx’s Critique of Political Economy, later to be incorporated into Das Kapital, had begun to sow the seeds of revolutionary movements that are felt today. On October 20, four days after John Brown’s notorious raid on Harper’s Ferry, John Dewey was born in the staunchly Yankee town of Burlington, Vermont.

Dewey’s parents, of sound New England stock, sought to instill in John and his two brothers traditional attitudes of industry, self-reliance, thrift, and independence of thought. Young Dewey enrolled in Burlington’s public school system, advancing rapidly enough to graduate at age 15. Although the Burlington schools had recently been reorganized and upgraded, classroom procedures were traditional, dull, and uninspiring. A complaint by a superintendent that there was “too much of learning and teaching parrot-wise” read much like Dewey’s indictments of schools of later years (Dykhuisen 1973).

Dewey grew up in a nation recovering from the wounds of the Civil War. The scientific, social, and cultural changes that arose in Europe were reaching across the Atlantic to tug at the fabric of American tradition and character. These forces, coupled with a powerful drive toward industrialization, wrought changes in all facets of American life. Some of the more enlightened colleges and universities were beginning to establish philosophies and curricula more in keeping with the times. Among these was the University of Vermont, where Dewey matriculated in 1875 when he was not quite 16.

Although little flexibility was permitted in the classical curriculum he chose at the university, Dewey managed to slip in a few courses in the natural sciences. Among these were geology and zoology taught by a professor who had the audacity and foresight to structure his teaching on evolutionary theory. The textbook for Dewey’s physiology was written by Thomas H. Huxley, Darwin’s early champion. In a speech 60 years later, Dewey recalled the impact this book made upon him.

After graduating from the University of Vermont in 1879, Dewey spent two years teaching Latin, algebra, and natural history at a high school in Oil City, Pennsylvania. His youth—he was barely 20—did not prevent him from gaining the respect of his students, who were charmed by his honesty, sincerity, and friendly demeanor.

A career in philosophy was his goal, however, and in 1882 he was accepted for graduate study at Johns Hopkins University in Baltimore. He received his Ph.D. in Psychology in June 1884. In September of that year, Dewey accepted his first professional appointment, an instructorship in philosophy and psychology at the University of Michigan. He soon gained the respect of his colleagues, and in 1889 he became head of the university’s department of philosophy.

During his years in Ann Arbor, Dewey’s thinking began to take a new turn. He was strongly affected by the teachings of William James, who held that the mind was not something apart from Nature, but in fact evolved in response to Nature. Also, he developed a growing interest in primary and secondary education. As a member of a committee investigating high schools throughout the state of Michigan, he became convinced that the instructional methods used in most schools were out of step with what psychology taught about the processes of learning in young children. Thus began Dewey’s search for an educational theory that would reconcile the demands of modern society with the needs of developing minds. This search was to occupy a major part of his long career.

Dewey and Science

During the latter part of the 19th century, scientific research in America was characterized by direct and obvious connections between discovery and practicability. The enormous strides made in communications, transportation, and the use of electricity were largely due to scientists who saw beyond the confines of their laboratories. Dewey was convinced that a scientific approach could improve education, and was anxious to use it in developing educational techniques.

The opportunity to do so was not long in coming. In 1894, Dewey was enticed to the newly founded University of Chicago to become chairman of the Department of Philosophy, Psychology, and Pedagogy. Two years later, he established an experimental elementary school, the Laboratory School of the University of Chicago. His dream of having a laboratory for testing his theories had come true.

At the Laboratory School, Dewey sought to use children’s natural activity and curiosity in ways that
would enable them to deal with problems in an intelligent way. The role of the teacher was to provide stimuli and cues to lead a child from his own fund of crude experience to the proper information and skills needed for addressing the problems of life.

Foremost in Dewey’s conception of education was belief in the use of inquiry, which he regarded as the instrument of science. “It should be axiomatic,” he said, “that the development of scientific attitudes of thought, observation, and inquiry be the chief business of study and learning” (Ratner 1939). He believed that students should be stimulated to inquire not once, but again and again, not only in science but in all areas of human living.

Dewey saw education as a means of integrating all young people into a democratic society where industrialization and urbanization were the rule. Loath to limit his advocacy of democracy to the classroom, he worked actively for Jane Addams’ famous Hull House establishment. Later, he founded and was the first president of the American Association of University Professors, and served on the National Committee of the American Civil Liberties Union. Liberal until the end, he spent the last few months before his death rallying his friends against the forces of McCarthyism.

Throughout his career, Dewey recognized the powerful effect science could have on the nation’s social and cultural institutions. “Science,” he wrote, “through its applications is manufacturing conditions of our institutions at such a speed that we are too bewildered to know what sort of civilization is in the process of making” (Ratner 1939). To readers of Alvin Toffler’s Future Shock and Robert Heilbroner’s An Inquiry into the Human Prospect, these words have a disturbingly familiar ring.

For Dewey, education was the soundest instrument of social, political, and moral progress. He was convinced that traditional education—static, rooted in the past, and dependent upon passive inculcation—could not do the job. What he wanted was a dynamic, evolving form of teaching based on man, his humanness, and his environment.

Today’s Science Teaching

In the 15 years following the launching of the first Russian Sputnik in 1957, the United States government spent an estimated $5 billion to improve science education in the nation’s elementary and secondary schools. The engineers of the new programs hoped that the momentum begun during those golden years would continue even though the funding might not. They hoped that science teachers would use the techniques of inquiry and investigation that were hallmarks of most government-funded science curricula. There was optimism that the enthusiasm of the 1960s would carry over to inspire new teachers joining the profession.

No one could have foreseen the social turmoil of the late 1960s and early 1970s that turned so much of the nation’s youth against established traditions and values. Goals of the 1950s—more and better scientists and engineers—were out of step with a nation long-ing to end the agonies of the Vietnam War. Environmental degradation, energy profligacy, and the specter of nuclear war caused many Americans to abandon faith in the inherent merit of scientific progress. They feared that the nation was being taken over by a military-technological complex over which they had no control.

In his 1912 presidential campaign, Woodrow Wilson gave this advice:

. . . (W)hat I fear is a government of experts. What are we if we are to be scientifically taken over by a small number of gentlemen who are the only men who understand the job? Because if we do not understand the job, then we are not a free people. (Kieffer 1980)

John Dewey knew that to be free, a society must not allow social and moral judgments to be arrogated by a few “experts.” All citizens have an obligation to be involved. Dewey was confident that education based on inquiry would prepare students for active participation in the democratic process.

Where does inquiry stand in science teaching today? The results of recent surveys show that fewer than half of all biology teachers claim to use inquiry-based techniques in their classrooms (Hurd et al., 1980). Only 10% of laboratory assignments associated with the three most commonly used textbooks were judged to be inquiry-based. More than 50% of biology teachers do not consider the development of inquiry skills a primary objective of laboratory work.

Another survey showed that only 30% of the nation’s elementary schools use materials emphasizing the use of inquiry (Helgeson, Blosser, and Howe 1977). In all areas of science, only 10% of classroom time is

Geology (or Earth science) class in Dewey’s Laboratory School, about 1902.
spent in inquiry-based teaching (Stake and Easley 1978).

Can it be that teachers do not themselves appreciate the critical role that inquiry plays in science education? Many admit that their own training allowed little time for open-ended experimentation and discussion. With the best of intentions, they may be conveying the view that science is merely an accumulation of facts rather than a dymanic, flexible approach to learning about the natural world.

Scientific illiteracy is one of the most serious problems confronting American society. If Americans do not understand what science is about, are they qualified to make critical judgments about scientific issues that affect their lives? Are they able to understand the significance of biomedical engineering, the consequences of careless management of hazardous wastes, or the long-term effects of nuclear energy?

In his classic work Experience and Education (1938), John Dewey advised educators to see their work "in terms of what it accomplishes, or fails to accomplish, for a future whose objects are linked to the present." More than any other discipline, science is intertwined with the social, political, and economic fabric of the nation. Today’s science student may one day discover a cure for a previously untreatable disease, or a new energy source, or new ways to feed the world's hungry. For the sake of our students—and society—we must constantly teach science with a view to the future.

Conclusion

John Dewey left us with many ideas applicable to science teaching today: 1) inquiry, the instrument of the scientific method, is both a means and an end of teaching; 2) education involves the progressive organization of knowledge by means of experience; and 3) education is for citizenship.

Today’s science teaching is often inadequate and inappropriate. Instruction is usually by means of listening, reading, and memorizing; inquiry is seldom used. Most science courses neglect the effects of science and technology on society, and little attention is given to developing an awareness of scientific careers.

The unifying themes of Dewey’s educational philosophy—experience, growth, and social relevance—are as appropriate today as they were eight decades ago. Science educators who heed Dewey’s words will help produce a generation of talented, informed citizens eager to participate in a democratic society.

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References


Chemistry class in Dewey’s Laboratory School, about 1902.