How Can We Teach Abstractions to Nonintellectual Students?

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They shouldn't be in school in the first place, some of them. They're just here to play basketball. They don't want to learn what we're trying to teach. That was my first superintendent talking. I didn't like what he said. I thought we could teach all of them what we were trying to teach. He didn't, and he had been trying it 30 years longer than I had.

And what is it we were trying to teach? Abstractions—exactly the kinds of abstractions called for by Secretary Bell's Commission on Excellence. If you don't remember, here are the opening sentences describing the "New Basics," included by the Commission to clarify what we mean by the essentials of a strong curriculum.

**English:** comprehend, interpret, evaluate, and use what they read.

**Mathematics:** understand geometric and algebraic concepts.

**Science:** grasp the concepts, laws, and processes of the physical and biological sciences.

**Social Studies:** enable students to fix their places and possibilities within the larger social and cultural structure.

**Computer Science:** understand the computer as an information, computation, and communications device.

How can we teach abstractions to nonintellectual students—those basketball players who some say should not be in school at all and who others say should be enrolled in vocational programs, avoiding abstractions?

Once Again, A Lesson From History

I should like to paraphrase from the most remarkable document I have read in the past five years, The Role and Function of Vocational Education: Some Current Perspectives. I What I read surprised me; maybe it will surprise you. The following items are taken from the section called "Historical Metamorphosis," which is the story of how vocational education went wrong.

- The historical metamorphosis in the nature and structure of vocational education began with its change from subject content to process content. Originally introduced as an alternative teaching technique, vocational education evolved into a subject area in its own right.

- Vocational education was introduced to improve the learning of abstract material through practical experiences. The teaching methods used tangible materials to let students see and touch basic concepts.

- The book's historical perspective goes back more than 300 years. It says Comenius in the 1600s introduced a practical method of teaching to give meaning to words by associating them with objects that were familiar to the learner.

- Pestalozzi in the 1800s used physical objects to improve perceptions in the belief that sensory impressions were the basis of all knowledge. He rejected the teaching of mere words and facts, which had characterized all elementary education until the close of the 1700s. He turned away from verbalizations about things and relied instead on the study of real objects.

- C.H. Ham, a supporter of manual training in the United States in the late 1800s, pointed out that "the error in prevailing methods of education is striving to reach the concrete by way of the abstract, whereas we should pursue a diametrically opposite course."

- Calvin Woodward, the foremost advocate of manual training in the United States in the late 1800s, was a professor of mathematics and mechanics as well as dean of the Polytechnical School at Washington University in St. Louis, a university that still takes pride in its teaching of abstractions. Professor Woodward found that his engineering students had difficulty visualizing abstractions. When he asked them to build physical models to help them understand the abstractions, he found they had almost no manual skills. So he established a workshop in which his students could develop "some dexterity in the use of tools which, though slight, will be of great value to them in the subsequent work of their profession."

When Professor Woodward wrote "The Fruits of Manual Training," a journal article published in 1884, he said.

The word "manual" must, for the present, be the best word to distinguish that peculiar system of liberal education which recognizes the manual as well as the intellectual. I advocate manual training for all children as an element of general education. I care little
Vocational education was supposed to teach abstractions rather than job skills, but its original purpose has been lost.

Translating the federal bureaucracy's 1892 wording, we see that the purpose of vocational education was to teach students how to make pipes hold water so that their theories would hold water—not so that they could become plumbers. Well, some would, but some others would become astrophysicists.

You can see how badly vocational education has jumped off that track in the last 100 years, despite the efforts of even the great John Dewey to keep it on track when he opened his experimental high school at the University of Chicago in 1915. Dewey said back then:

Both practically and physically, the key to the present educational situation lies in the gradual reconstruction of school materials and methods to utilize various forms of occupations, typifying social callings, and to bring out the intellectual and moral content of these occupations in high school.

The "intellectual and moral content" are, of course, the very abstractions Secretary Bell's Commission is calling for. Dewey just said it more abstractly.

But Can We Use the Lessons of the Past?

Is vocational education the way to teach abstractions to nonintellectual students? Could those students sign up for cosmetology and come out with principles of aesthetics? Or study refrigeration technology, but learn molecular motion? Could those basketball players take auto mechanics and discover that what they call "jump shots" are actually parabolas?

My answer is this: not in the 1980s. Maybe in the 1880s, although I suspect that even then the leading thinkers, like Calvin Woodward, were expounding ideas that ordinary classroom teachers could not carry out. I don't think many of today's vocational teachers were hired to teach abstractions, and I don't think the majority could do it, even if an entirely new vocational curriculum were designed for them.

This conclusion is disappointing because it leaves the question unanswered. Comenius and all the others were probably right: the only way to teach abstractions to nonintellectual students is through concrete materials. But we run off the track somewhere along about junior high school. You can get a first-grade teacher to understand that the purpose of using Cuisenaire rods is to teach children mathematical relationships, not to teach them how to manufacture Rubik's cubes on an assembly line. You can even get a junior high industrial arts teacher to understand that the purpose of wood shop is to teach respect for self, respect for others, respect for tools, and "industrial discipline" rather than how to make bookends. But after that, welding teachers produce welders rather than people who understand theories of stress. Maybe the students themselves pull vocational education off Calvin Woodward's track. Maybe the Chamber of Commerce does it.

In any case, vocational education is a heavy freight train rolling across the meadow, crushing the abstract flowers under its practical wheels.