

Testing education

Standardized testing has traditionally been concerned with ranking individuals for purposes of comparing their knowledge of a subject. The College Entrance Examination Boards are primary examples. Test results are given in terms of percentile ranking of individual performance on the test. Such testing is not designed to measure the testee's extent of knowledge of the material, but rather his standing among peers.

In 1963 John Gardner, then president of the Carnegie Foundation, and Francis Keppel, U.S. Commissioner of Education, decided to explore the possibility of assessing the state of knowledge of the population in more absolute terms. The effort, they felt, would yield data on the effectiveness of the educational system by determining just how much people knew in such areas as science, art and social studies. The importance of such an assessment has recently been echoed by President Nixon in his call for measuring "how well the educational process is working."

The efforts of Gardner and Keppel, supported by the Carnegie and Ford Foundations, as well as with funds supplied more recently by the Office of Education, have resulted in the establishment of the National Assessment of Educational Progress Project. The project has three goals: to provide an index of what young people actually know, to measure changes in knowledge and skills over a period of time and to improve the quality of education in the United States.

Last week the results of the knowledge census were released for three categories: science, citizenship and writing. The nationally representative sample that was surveyed included 100,000 subjects aged 9, 13, 17 and 26 to 35. Typically, the results disclosed such information as that 98 percent of the 13-year-olds knew that a human baby came from its mother's body, but that only 29 percent of the 19-year-olds and 55 percent of the adults knew when ovulation occurs.

"The fundamental purpose of this initial survey was to provide a baseline so that in the assessment three years from now we can make meaningful measurements of gains in knowledge," says James Hazlett, administrative director of the National Assessment. "We also hope that the results provide some useful information to those people involved in developing curriculum changes."

Data were released for only 40 percent of the items. The remaining items will be re-tested for comparisons in the next cycle of testing. Unfortunately some of the data released is so sparse as

to make the validity of interpretations unreliable.

While 141 items were released on the "knowledge of the facts of science," for instance, only 14 items were available for "understanding the investigative nature of science" and 10 items for "attitudes toward science and scientists."

Such scant information is hardly a sound basis for evaluating educational progress of a nation or developing school curriculum. "The result is that released information for Objective III [the nature of science] is rather scant, and for Objective IV [attitudes toward science] is so meager as to be almost worthless," says Dr. Richard Merrill, president-elect of the National Science Teachers Association.

The objectives on which the tests are based are perhaps more interesting than the individual item results. In order to develop the test it was first necessary to draw up standards on what the American public should know or believe about science and citizenship. A panel of scholars, educators and laymen was responsible for drawing up the objectives. What has in effect been developed is a knowledge and attitude census that measures the objectives of a potential national curriculum.

AUTO EMISSIONS

Two-way attack

Nixon Administration statements have indicated a high awareness of the need for curbing automobile emissions, by weight the most common air pollutants in the United States.

Last week there were signs of action. The National Air Pollution Control Administration announced new and more efficient procedures for monitoring emissions. And an announcement by chairman Russell E. Train of the President's Council on Environmental Quality fulfilled the President's promise of last August that the Government would embark on a search for nonpolluting substitutes for the internal combustion engine.

Train's announcement came after a study by an ad hoc committee chosen by the Office of Science and Technology. According to Dr. Ernest S. Starkman of the University of California at Berkeley, a member of the committee and chairman of a new auto pollution advisory committee, the outlook is good that \$45 million to be spent by the National Air Pollution Control Administration over the next four years will turn up a viable alternative to internal combustion engines.

Train says that the three best possibilities are gas turbines, steam engines and a heat-engine-and-electric hybrid. But Dr. Starkman emphasized that no stone will be left unturned, that all pos-

For example, on the citizenship test Objective I is "Show Concern for the Welfare and Dignity of Others." One of the criterion attitudes for 13-year-olds is, "They respect those who differ from them in religion, national origin, race, social status, sex, clothing, physical or mental abilities, or interests." A series of test items, or exercises, were then developed to measure to what extent 13-year-olds do in fact meet this objective. Under this objective 83 percent of the 13-year-olds reported that they would be willing to let someone of another race live next door to them.

While the explicit purpose of the project is to assess knowledge and attitudes, there is also a communication and persuasion factor involved in asking specific questions, particularly those regarding attitudes (SN: 7/11, p. 31). A subtle but firm implication of asking citizenship questions on race and foreign relations indicates to 13-year-olds that there is a proper way to respond and believe.

This may be an unavoidable problem. "Anytime you are asking questions someone must think that it is important," says Dr. Frank Womer, staff director for the National Assessment in Ann Arbor, Mich. □

sibilities will be considered. NAPCA's principle chore will be the separation of the wheat from the chaff in the evaluation of competing contentions; research on the three major possibilities so far has been so limited that to say one or the other looks best is still very much a matter of opinion.

Dr. Robert U. Ayres of International Research and Technology Corp., a Washington, D.C., consulting firm, insists, for instance, that the steam engine is far and away the best possibility (SN: 9/20/69, p. 247): "The problem is to put together all of the existing information," he says. But he admits there are more specific problems. At present, water meets most of the criteria for a fluid to vaporize to propel either a turbine or a piston steam engine. But it does not meet them all, and a fluorocarbon with a high molecular weight that would also serve as a lubricant might be the answer. The trouble is that all presently available fluorocarbons break down into toxic substances at the temperatures demanded.

Heat transfer—between metals, liquids and gases—is another problem with steam engines, but Dr. Ayres believes progress in the basic subject of heat transfer over the past four years, when applied to steam engines, will solve the problems. Also still needed for steam engines are precise controls that

will meet modern demands for smoothness of operation—a problem that did not exist in the days of the Stanley Steamer. One clear-cut advantage of the steam engine is complete combustion of fuel, which eliminates harmful emissions, leaving carbon dioxide and water.

The hybrid car would use a small heat engine—perhaps internal combustion—to power a generator which would operate an electric motor. The engine would operate at a near uniform speed, the one which produces the least amount of harmful emissions. The car could operate on batteries—which could be charged by home current—in the city. For highway driving, the heat engine would be linked into the propulsion system to provide a supplement for the electric motor. The result would be a major reduction in emissions. Dr. Ayres believes the car has possibilities, but he points out that it would substitute four basic units—engine, generator, motor and batteries—for today's single internal combustion engine, and thus would be costly.

Dr. Starkman, who favors the gas turbine so far, believes problems connected with it (SN: 12/21/68, p. 617)—mainly those of cost—can be solved. Gas turbine engines, although they eliminate carbon monoxide and hydrocarbon emissions, do emit nitrogen oxides.

While the complicated process of selecting an alternative goes on, NAPCA will begin tightening up emission standards for internal-combustion engines, which Detroit so far seems determined to save.

The main thrust will be toward more efficient testing by 1972, so as to get actual emissions down near levels envisioned in earlier published standards. Carbon monoxide from test cars will be directly measured rather than estimated, for example. And flame ionization techniques that measure total hydrocarbons will be substituted for old methods which measured only certain hydrocarbon molecules.

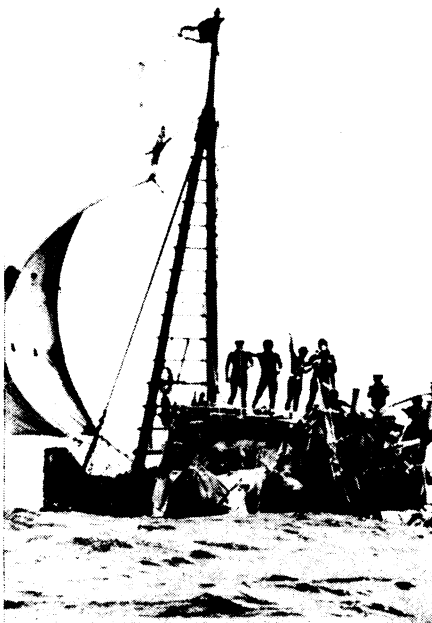
But even the very highest emission standards for internal combustion engines, even if they could be rigidly enforced, would be only a stopgap. By the mid-1980's, if there is no substitute for the internal combustion engine, the sheer proliferation of automobiles would cause auto-caused air pollution to begin rising again, according to Train.

Thus the solution lies in alternative means of propulsion. Or, as Dr. Starkman suggests, it lies in substituting mass transportation for the automobile, at least in urban areas—an alternative that has been given little emphasis by the Nixon Administration.

Mass transit will work only if people are willing to use it: "a matter of changing us instead of changing machines," says Dr. Starkman. □

RA II

Second time success



ESS

Ra II: Egyptians could have done it.

In a museum in Oslo, Norway, rests Kon-Tiki, the balsa raft in which the Norwegian explorer-ethnologist Thor Heyerdahl drifted 4,000 miles from Callao, Peru, to Tahiti during a 101-day period in 1947.

Kon-Tiki will now be joined in the museum by a papyrus vessel, the Ra II, which sailed across another ocean, the Atlantic, also to demonstrate that the seas could once have been a bridge, not a barrier, to the distant movement of earlier peoples.

Greeted by a cheering crowd and a calypso band, Heyerdahl's Ra II arrived in Bridgetown, Barbados, on July 12 after 57 days at sea. Heyerdahl and his seven-man international crew (SN: 5/16, p. 480) had set sail from Safi, Morocco, on May 17 in the boat, built according to ancient Egyptian designs, in an attempt to demonstrate that Egyptians could have reached the New World centuries before Columbus.

If such a theory was shown to be possible, scientists could consider the proposition that the bearded white men who legend says were the highly civilized precursors of the Incas of Peru, the Mound Builders of North America or the Mayas of Mexico, were the Egyptians.

Among the cables Heyerdahl received upon his arrival was one from a doctor in Martinique who was sending him a coin he found under three feet of sand while digging a trench near his home on the site of the island's ancient harbor. Remembering the Ra I voyage, he had sent the coin to the Institute of

Numismatics in Paris, which identified it as a genuine Ptolemaic coin of the Second or Third Egyptian Dynasty. The doctor said that due to the success of the Ra II expedition he would present Heyerdahl with the coin. Heyerdahl had also just seen an article about an earthen jar of coins from the same Mediterranean period found in the Azores.

"I believe we have only scratched the surface of what can be discovered about the common origins of some of our ancient cultures," Heyerdahl says.

Last year's voyage in Ra I was aborted when the craft broke up in heavy seas some 600 miles from Barbados and sharks in the water made repairs on the papyrus craft impossible (SN: 7/26/69, p. 79).

SST EFFECTS

Sweeping up studies

The Department of Transportation's supersonic transport program, now in its seventh year and scheduled to be complete through prototype testing in 1973, has been under attack from environmentalists since its inception.

The Government and the aircraft industry have been sensitive to the criticism, but their counter arguments have been weak. The sst's program Director William M. Magruder appeared to be going to the root of the issue when he announced this week that DOT will direct spending of about \$27 million over the next three years in studies of environmental problems in connection with the sst. The announcement was deceptively like the unveiling of a new effort; actually little new money is being spent.

The research—much of it not really new—will be done under DOT's direction by the Environmental Science Services Administration, the National Aeronautics and Space Administration, the Air Force and DOT's own Federal Aviation Administration. To be emphasized are effects of atmospheric pollutants and water vapor from the plane, noise problems and radiation hazards.

But, says DOT, about \$22 million of the total is already in the budgets of the involved agencies, and newly scheduled spending will be only about \$5 million. DOT says some of the research is already under way in non-sst programs.

To date, about \$700 million has been spent on the sst prototype program, with the final amount expected to hit between \$1.5 billion and \$3.5 billion, depending on where in the prototype-to-production chain the Government steps back. The House of Representatives in May approved \$290 million for the current fiscal year (SN: 6/6, p. 552), the largest amount for any single year of the program. The Senate has not yet acted on the request. □