Japanese Jump

A recent study confirms Japanese superiority in math achievement, but does Japan surpass the United States in intellect as well?

By LINDA GARMON

Sony, Fuji, Nikon, Toyota, Toshiba. These brand names, which have become household words in the United States, are near-ubiquitous reminders of Japan's outstandingly high rate of technologic — and economic — growth since World War II. Is this marked technologic success based on a Japanese superiority in intellect or scientific achievement? Two recent studies investigating the possibility of an *intellectual* upper hand yield conflicting results. However, a third study confirms what previous research has suggested: that when it comes to actual *achievement* in mathematics, Japanese students are superior to U.S. students.

In all of those studies — one by Richard Lynn of the New University of Ulster in Coleraine, the other two by Harold W. Stevenson and cohorts of the University of Michigan at Ann Arbor — "intellect" and "achievement" are defined as scores on various tests. Achievement tests measure performance in specific areas such as history or elementary algebra, explains Ann Jaungeblot of the Educational Testing Service in Princeton, N.J. Intelligence tests — whose contents are more general — "look for the cognitive processes that function to assist people to learn and that do so across all areas," she says.

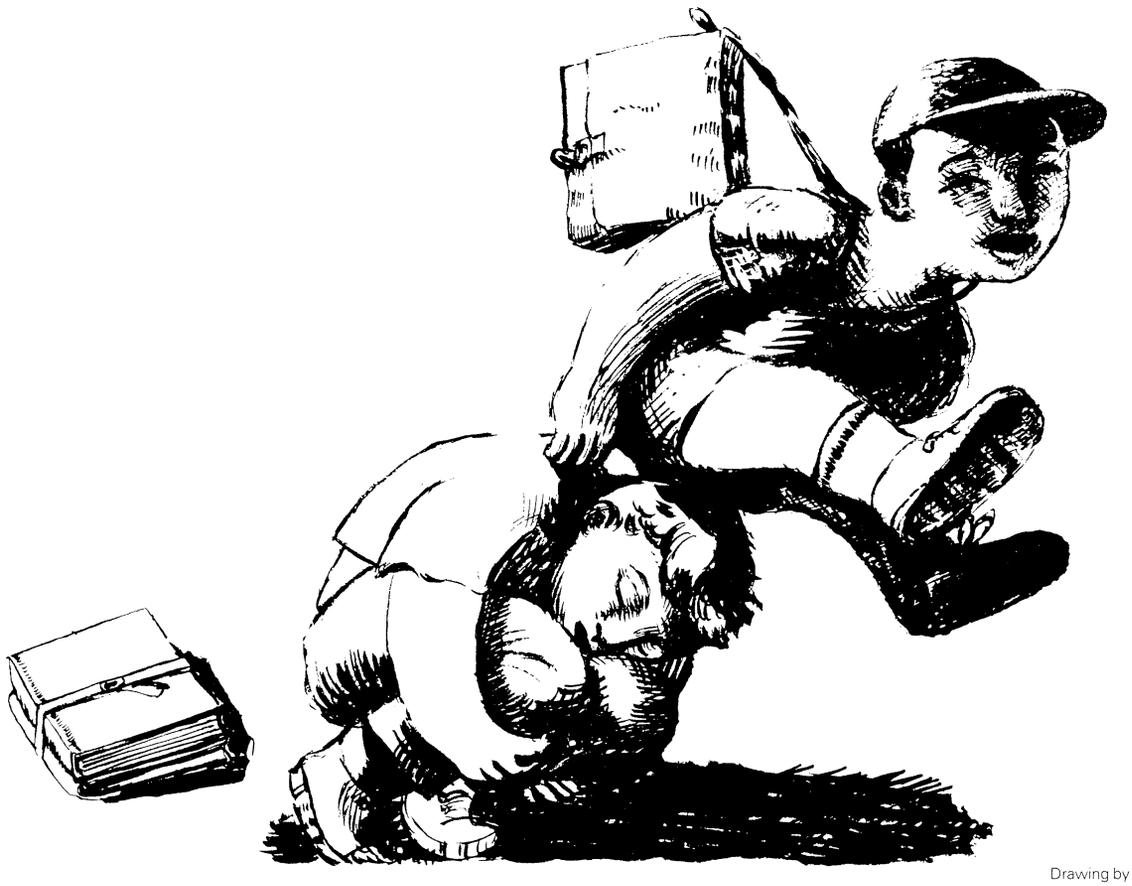
One of the best-known intelligence tests is the Wechsler Intelligence Scale, an IQ test. In research described in the May 20 NATURE, Lynn looked at Wechsler scores — which were previously obtained at different times from different age groups — to compare the intellect of Japanese with that of Americans. After analyzing Japanese IQ data for 27 different age groups that span almost seven decades, Lynn concluded that the mean Japanese IQ has grown increasingly superior to the mean American IQ. Specifically, relative to a mean American IQ of 100, Japanese groups born earlier in the century (from 1910 to 1945) have a mean IQ of 102 to 105; those born from 1946 to 1969 have a mean IQ of 108 to 115.

A key point is that Lynn is reporting mean Japanese IQs *based on U.S. norms.* Technically, the mean IQ of any particular cultural group is always 100, because after an IQ test is constructed, it is standardized for a specific population. Standardization involves giving the test to a representative sample of the population in order to determine the average number of items passed at various age levels. The results of this process are in turn used to adjust future raw test scores so that when a person passes the number of items previously shown to be "average," the resulting IQ score is 100. Lynn reported mean IQs greater than 100, because his cross-cultural analysis involved taking the average Wechsler Intelligence Scale raw scores of the 27 Japanese age groups — which would each correspond to Japanese-scaled scores of 100 — and converting those numbers to American-scaled scores. In so doing, Lynn found that over the course of a generation, the mean IQ in Japan *relative to U.S. norms* has risen by about 7 IQ points.

But Stevenson believes that such a statement is "meaningless," based on "bad science." He says: "I just don't think you can compare IQ scores from cultures as diverse as Japan's and the United States' when the test is made up in only one of those cultures." Using a Japanese translation of an IQ test constructed in the United States is no basis for cross-cultural comparison of intellect, he says. Translating a question into a different language, Stevenson explains, might create subtle psychological cues that render that question easier to answer. For example, consider the portion of standard IQ tests called "digit span," which requires subjects to repeat series of numbers. "Supposing I asked an American child to recite 'one, eight, seven,'" says Stevenson, "and I asked a Japanese child to recite [the corresponding] 'ichi, hachi, shichi.'" In this case, the Japanese series might be easier to remember simply because two of the words rhyme and all three sound similar.

Lynn counters that in criticizing his research, Stevenson "has given an example of what might happen by chance. Any particular question that favors the Japanese by chance won't have an overall effect," he says, "because the results are based on dozens of questions — some of which might favor the Americans."

Still, Stevenson maintains that the best way to approach cross-cultural comparisons is to work with researchers native to the other countries involved and to con-



Drawing by Andrew Young

struct a test whose questions have been judged fair and psychologically equivalent by the researchers of both cultures.

Stevenson says that he and his University of Michigan colleagues recently collaborated with psychologists and psychiatrists in Japan to construct such a test to measure "cognitive functioning." (This same collaboration also involved researchers from Taiwan in order to include that country in the cross-cultural comparison.) The intelligence test included measures of general knowledge, verbal memory, auditory memory, perceptual speed and the ability to draw an object after it is verbally described. It was administered to 240 first-grade and 240 fifth-grade children randomly selected from 40 classrooms in each country. The results — which the researchers plan to submit to either CHILD DEVELOPMENT or THE MONOGRAPHS OF THE SOCIETY FOR RESEARCH IN CHILD DEVELOPMENT for publication — show no significant "differences [in scores] representing national superiority in cognitive functioning," Stevenson says. "We don't find the differences that Lynn found," he says; "the raw scores, the number of points the kids scored [in all three countries] are very, very comparable."

In a manner similar to that used in constructing their cognitive functioning test, Stevenson and associates also compared the mathematical achievement of the same groups of elementary school children in Japan and the United States (and Taiwan). Earlier cross-national studies had indicated that Japanese consistently are the top performers in mathematics and science achievement, the researchers noted. But those studies involved mostly junior and senior high school students; Stevenson and colleagues decided to investigate whether the cross-national difference originates during the early years of schooling.

First, the researchers thoroughly examined the curricula in the different countries in order to base their test on topics "with which the child would be expected to be familiar because of their appearances in the children's textbooks." Then, they constructed a test of 70 questions — each of which was judged valid by native speakers in the countries participating in the comparison. Each child continued taking the test until four successive items were missed; the child's score was the total number of items passed. In addition to administering the test, the study involved observing the children in the classroom and interviewing their mothers.

The results — published in the June JOURNAL OF EDUCATIONAL PSYCHOLOGY — indicate that U.S. children lag significantly behind Japanese (and Taiwanese) children in their mathematical achievement. The average score obtained by U.S. male fifth-graders on the mathematics test was 45, compared with 53 for Japanese male fifth-graders. The average score obtained by U.S. male first-graders was 16.6, compared to 20.7 for their Japanese counterparts. (Scores for boys and girls did not differ significantly within each country.)

Moreover, among American first-graders, Stevenson notes, 16 percent could not even count the 17 dots in one of the test questions. To illustrate the American fifth-graders' difficulties, "10 percent could not divide 42 by 6; 9 percent could not divide 24 by 3; (and) 23 percent could not state the product of two numbers given one of the numbers as a division problem involving the other number," Stevenson and associates report.

The researchers attribute such poor mathematical performance among U.S. children to several factors, including the amount of time parents spend assisting their children with homework, teachers actually spend teaching and students spend "on task" (working). In each case, Stevenson and colleagues discovered, the Japanese devote more time. In addition, the Japanese devote more time specifically to mathematics instruction, the researchers report.

This greater attention to mathematics no doubt has played a role in that country's post-World War II technologic triumphs, Stevenson says. "America does fairly well in providing high-level technologic training for a *certain part of the population,*" he says. "But when we talk about the average person, America falls short." Says Stevenson, "We need improved teaching of math and sciences in high schools, junior high schools and elementary schools." And, he says, "We need to do a much better job of alerting parents as to what their contributions can be." □