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LETTERS

Japan's SAT?

Although I have no reason to doubt that the mathematical ability of U.S. students is significantly lower than that of Japanese students, the article "An awesome look at Japan's math SAT" by Barry Cipra (News & Comment, 1 Jan., p. 22) may be somewhat misleading.

First, the University Entrance Center Examination (UECE) is hardly "Japan's equivalent of the American SAT [Scholastic Aptitude Test]." The SAT is supposedly a measure of one's "scholastic aptitude," not of one's already acquired knowledge, the theory being that colleges can use SAT scores to select those applicants most likely to succeed in college. (Whether the SAT is useful for this purpose is another matter.)

The UECE, on the other hand, like all university entrance exams in Japan, is intended to eliminate applicants; anyone who passes the entrance exam is, in effect, guaranteed success in college by virtue of having passed. It is therefore to be expected that questions in math or in any other subject will be of extreme difficulty, the more prestigious universities asking the more difficult questions.

Thus to assess the extent to which the UECE reflects the actual mathematical ability of Japanese high school students in general, one needs to know not only what percentage of the relevant population takes the exams (14% for Japan and 31% for the United States, says Cipra) but also what percentage of the examinees get what percentage of the answers right and what sort of score counts as a pass.

It is also necessary, if we are to compare U.S. high schools with Japanese high schools, to know how much of what is covered by the entrance exams is actually taught in the high school.

One major difference between U.S. and Japanese college-bound high school students is that a large proportion of the latter spend a large amount of their extracurricular time in cram schools (*juku*, *yobikoo*) specifically in order to get the kind of knowledge needed to pass entrance exams. (Similarly, the most prestigious private high schools—which is to say the high schools with the best record in getting graduates into prestigious universities—squeeze the 3-year syllabus into 2 years and devote the senior year exclusively to teaching test-taking.) To the extent that Japanese high school children get into universities because of knowledge gained in *juku*'s, it seems somewhat inappropriate to credit the Japanese high school with doing a superior job of education.

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Judging from the quite difficult applications of the theories of polynomials and of solid geometry given as sample problems in Cipra's article, the Japanese UECE could be most properly compared to the U.S. Math Achievement Test, which is intended to assess mastery of the high school curriculum. It has two forms (levels I and II) in order to accommodate students whose mathematical training has been more extensive than that of others. Scores on the Math Achievement Test are not generally considered to be as important a determinant of college acceptance in the United States as SAT scores are because the SAT is valued as a measure of the likelihood of college success that is largely independent of curriculum (*1*).

I do not doubt that young men and women graduating from secondary school in Japan are by American standards extraordinarily well trained in mathematics, nor do I doubt that many of them would achieve high scores if they did take a test like the SAT. However, I think that the comparison of prominent tests in the two countries is wrongly informed.

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1. *Taking the SAT 1992–1993* (College Board, Princeton, NJ, 1992), p. 3.

To get full credit for the Japanese math test problem, it seems, one would have to do the problem the tester's way, not by some other, equally valid method. I suspect this says something about the Japanese attitude toward teaching math. An American teacher might be delighted by a student discovering his or her own way to solve a problem, even if it were a clumsy way. I'm not sure the Japanese teacher would share that delight.

American kids may learn less, but many still have the confidence to try things their own way, rather than "by the numbers." This is a clear American math advantage.

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Implicit in the findings of the studies of Japanese and U.S. high school students is the conclusion that U.S. students need to improve their study habits and scholastic achievements. While improvement would be welcome, it need not be extended to the graduate system. One of the greatest strengths of the American educational system is its post-secondary years. If students are asked to stretch their effort to the extreme during high school, their later efforts might decrease. Many Chinese, Korean, and Japanese students are so exhausted by the time they enter college that they want a period of respite. Their American counterparts, on the other hand, are just beginning to tighten their belts and dig in. I believe the vigor and intensity of U.S. researchers are partly due to the fact that they were not crippled during the high school years.

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Nuclear Structure Research

Michelle Hoffman's Research News article "The cell's nucleus shapes up" (26 Feb., p. 1257) was an interesting and readable overview of some developments in mammalian nuclear structure over the past 20 years, and we commend *Science* for its attention to this subject. On a few points, however, the article appears to attribute to my laboratory contributions from other investigators whose work is clearly referenced in our reports (*1*, *2*) in the same issue. First, the fact that the splicing assembly factor SC-35 concentrates in regions enriched in small nuclear ribonucleoproteins was previously demonstrated by X-D. Fu and T. Maniatis (*3*). Hence, the observations we reported concerning the relative distributions of SC-35 and polyadenylate RNA or small nuclear ribonucleoproteins within individual domains were an extension of this primary observation.

Second, the statement referring to the report by Carter *et al.* (*2*) as having shown for the "first" time that messenger RNA transcripts were associated with these regions is misleading. S. Huang and D. Spector (*4*) had previously shown that unspliced c-*fos* transcripts accumulate very close to these regions soon after induction of this gene, and we had previously reported evidence that polymerase II transcripts in general, as detected by poly-adenylate RNA, are most highly concentrated in these regions (*5*).

Finally, we do not agree that our work is the "first" three-dimensional model, as the Research News article states, because several investigators have provided evidence and suggested models for the topological organization of genes and RNA metabolism within the mammalian nucleus, several of whom are referenced in our two *Science* reports (*1*, *2*).

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2. K. C. Carter *et al.*, *ibid.*, p. 1330.
3. X.-D. Fu and T. Maniatis, *Nature* **343**, 437 (1990).
4. S. Huang and D. L. Spector, *Genes Dev.* **5**, 2228 (1991).
5. K. C. Carter, K. L. Taneja, J. B. Lawrence, *J. Cell Biol.* **115**, 1191 (1991).

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Determining Paleoclimates

The article "Is the geological past a key to the (near) future?" by Elizabeth Culotta in the Special Section on the Evolution of Atmospheres (12 Feb., p. 906) focuses on fossil pollen and marine plankton as sources of paleontological data on paleoclimate and raises questions about whether proxy data are adequate for the task of testing simulations of general circulation models (GCMs). The composition of fossil macrofloras, the shapes and sizes of fossil leaves, and the anatomy of fossil wood have all been used extensively as indicators of continental climate during the Tertiary and Late Cretaceous (*1*). Vertebrate fossils, of both ectotherms (*2*) and endotherms (*3*), provide other independent sources of paleontological data on paleoclimate. In the last 15 years, interpretations of these fossil data have become increasingly quantitative, and the precision and reliability of the estimates have improved greatly (*4*).

It has already been demonstrated that GCM simulations of paleoclimate tend to produce results for continental interiors that are far more seasonal than the multiple lines of fossil evidence indicate (*5*). At least for the Cenozoic, the paleontologists' temperature estimates have standard errors of only a few degrees centigrade for mean annual temperature and cold month mean. This is substantially better than the GCM simulations do even in reproducing *present* conditions for continental interiors. No doubt GCM simulations will improve considerably over the next few years as they get a boost from advances in computer technology, but the current situation is that if you want to know the climate for any time