

On Further Examination: The SAT Score Decline

Today's 18-year-olds are less prepared for the verbal and mathematical rigors of college than were their counterparts 15 years ago. The causes are woven deeply and tightly into a fabric of changing social attitudes and educational expectations. These were the findings of a two-year study of the 14-year decline in scores on the Scholastic Aptitude Test (SAT), taken each year by some million college-bound high-school students.

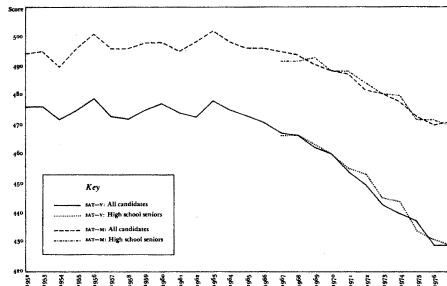
The SAT, a widely used college entrance exam, is designed to indicate how well individual students will perform in their first year of college. Scores, which range from 200 to 800, can be used to compare a student's capabilities not only with current peers, but also with those who took the test in previous years.

The College Entrance Examination Board, which administers SATs, gathered a panel to analyze the long and steady decline in test scores. That panel found, with what it feels to be a relatively firm statistical basis, that roughly two-thirds to three-quarters of the decline that began in 1963, resulted from changes in the composition of the test-taking population—primarily the influx of blacks, women and students from low income families. Then in 1970 the pattern changed again. Compositional changes began leveling off as an increasingly notable "across-the-board score decline" emerged, affecting all demographically defined groups, including those in the traditionally higher scoring segments. Thus, the panel termed the falling scores a two-phase decline.

Twenty-five years ago, only half of all American students completed high school. By 1964, this fraction climbed to two-thirds, and by 1970 to three-quarters. The proportion of graduates attending college in 1952 was about one-quarter, one-third by 1964 and almost 50 percent by 1970.

Changing national priorities on who should be educated contributed significantly to the SAT decline. Starting in the mid-1960s, more and more students with comparatively lower high-school grades were encouraged to attend college.

In a national effort to provide quality education to all segments of the population, low-income students, blacks and women were recruited by colleges. Statistics show that with exceptions, most low-income students (from families earning \$6,000 or less in 1977 dollars) averaged 100 points lower than average on both the verbal and math portions of the test. Blacks averaged approximately 100 points lower than average on verbal,



Relative stability preceded the 14-year SAT decline. Now scores may be climbing.

115 points lower on math. And women, who have traditionally scored equal to men on the verbal tests, averaged 40 to 55 points lower on math.

Contributing causes appear to be culturally linked. The panel suggests that sexual stereotyping of women's career opportunities and expectations is reflected in the lower math scores women receive. And the panel strongly states that economically disadvantaged and minority students suffer educationally, "despite statutory guarantees of equal opportunity."

As for the post-1970, and sharpest period of decline, statistics indicate that only one-quarter of the fall in scores is attributable to continuing compositional change. The remainder results from what the College Board panel describes as pervasive forces.

What kind? "Evidence is circumstantial," the panel says, but the "net conclusion is that there is almost certainly some causal relationship between the shift in the high schools from courses in the traditional disciplines to newer electives and the decline in SAT-verbal scores."

"Our firmest conclusion is that the critical factors in the relationship between curricular change and the SAT scores are that less thoughtful and critical reading is now being demanded and done, and that careful writing has apparently gone out of style . . . We can't prove that learning how to write is related to a decline in scores on a test that requires no writing. Yet in our judgment, this may be a significant factor. We strongly suspect that *expressing* [sic] something clearly and correctly—especially in writing—is thinking's sternest discipline."

Perhaps more insidious are the findings on high-school texts. One study commissioned by the panel found that by measures adopted on readability, difficulty and challenge, "current 11th-grade texts are generally at what is considered a 9th-to-10th-grade level" while "questions on the verbal part of the SAT are—by these same measures—on an 11th-to-12th grade and in some cases at a 13th-to-14th-grade level of readability."

Books contain more pictures, larger print, wider margins, and shorter words, sentences and paragraphs than earlier texts, the study shows. Exposition gives way to narrative.

The study also reports statistically on the extent to which student testing is being reduced to "objective answers," meaning the students have less reason to learn to write. And textbook publishers ask authors to "make it simple." The College Board panel criticizes these developments saying that "if textbooks are written down in response to persuasion that students don't have what they used to, this is itself a cause of the SAT-score decline."

What may be more interesting is that while scores for both verbal and math tests have dropped seriously, they have fallen more for verbal. The panel doesn't know why but speculates that one reason might be that there has not been the proliferation of electives in high-school mathematics that characterize English courses. But they say the cause may go farther—into the home. "We have conjectured that mathematics is essentially school-based learning while verbal skills are more influenced by experience in the home," the panel says.

The panel points to a decline in the number of two-parent households, a feeling of inadequacy parents express over being unable to help children with new subjects, more working mothers and a higher percentage of college-bound students seeking outside jobs as home-life changes that may affect test scores.

Television is described as a major distraction. By the time students are 16, most have watched 10,000 to 15,000 hours of it, more hours than they have spent in school. Television cuts into motivation for doing homework and can even raise false expectations of what educators should and can do. One panel member, a teacher, says "Sometimes I feel I'm competing with television stars who can sing and dance while they add and subtract and do the alphabet. I can't."

Other social attitudes about education may also affect test scores. Absenteeism is condoned, grades mean less than they used to, homework is cut in half and open-admission colleges make high grades no longer necessary as an entrance requirement.

What's the solution? The answers are not in the report, although certain clues to them are. It won't be a simple return to the "Three R's," for example. Elective offerings are not necessarily bad, nor are simpler texts that make certain sub-

A dream of wings—via feet

Superman's strength and X-ray vision are as nothing, to his earthborn observers, compared with his ability to fly under his own power. Even among people who pursue no such conscious goal, flight is a recurrent theme in dreams, whether as physical escape or as a metaphor for a more psychological yearning. On Aug. 23, Bryan Allen climbed aboard a fragile, winged craft named the Gossamer Condor, strapped his feet to a pair of bicycle-like pedals connected through a linkage to a 13-foot propeller, and flew.

He was not the first. One early flight took place in 1929, when Hans Werner Krause flew an "ornithopter" designed by Alexander Lippisch, for 300 yards, using his feet to flap the craft's delicate wings. Allen estimates, in fact, that 30 to 40 aircraft have successfully flown—not just glided—using human muscles as their only source of power.

A major difference, however, was that Allen's flight met the conditions necessary to win the "Kremer prize," an award equivalent to 50,000 pounds sterling, contributed by British industrialist Henry Kremer to inspire just such efforts. Kremer first offered a 5,000 pound prize in 1959, open only to British attempts. In 1967 he doubled the amount and opened the competition to all nationalities, still with no successful takers. The amount was raised to 50,000 pounds in 1973.

Yet, except for the participants, the money may be beside the point. What the competition did do was provide a strict set of rules against which the entrants would be judged. It was not the first of its kind (the Italian government offered a sum in the 1960s equivalent to Kremer's original prize), but it did mean that the winner would be truly flying, not just providing an occasional supportive nudge to a glider.

The Gossamer Condor effort was organized by Pasadena engineer Paul D. MacCready, who designed the craft together with Peter Lissiman. The design was translated into hardware by Vern Oldershaw, using a mylar wing surface over bent metal ribs along tubular aluminum spar, with piano wire for bracing and cardboard for the wing's leading edge. The 10-foot-long fuselage was suspended beneath the 96-foot-wide wing, which also carried a strut leading forward to a smaller wing, or canard. The entire construction weighs about 70 pounds; Allen, according to Allen, weighs about 135.

The conditions of the attempt, as set up by the Royal Aeronautical Society of England, required the flight to cover



Bryan Allen pedals the Gossamer Condor above Shafter, Calif.

a figure eight around two pylons half a mile apart. The craft had to take off under its own power (no slingshots, for example), from nearly level ground (a slope no greater than 1 part in 200), and to cross the start/finish point at least 10 feet above the ground.

The Condor taxied along a runway at Shafter Airport in Shafter, Calif., on small wheels, driven by the push from the aft-mounted propeller, until it developed enough lift to rise from the ground. The craft's maximum speed is about 12 to 13 miles per hour, Allen says, and stall speed is about 7. During the prize run, he was pedaling at from 80 to 90 revolutions per minute, with slight gearing (1.2:1) producing a propeller speed of 96 to 108 rpm. The flight lasted 7 minutes and 28 seconds, of which 6 minutes 22 seconds comprised the official run. The craft has accumulated a total of about 6.5 hours of time aloft since it began flying in March, says Allen, including about 10 attempts at the prize and a maximum duration of some eight minutes for a single flight.

Allen believes that human-powered aircraft are unlikely ever to become "practical"—even minimum performance, he feels, is too close to maximum human capabilities. Such a craft might, however, work wonders with the addition of a small, 1.5-to-2-horsepower engine. "Imagine," he says, "flying across the country on six gallons of gas. At 30 miles per hour." □

jects easier to digest by the new population of students entering the educational system. More diversity, not less, is what is needed, the panel says. Texts and classes should offer stimulation and challenge to all levels of students, not just the lowest common denominator.

Harold Howe II, vice chairman of the College Board panel and vice president of education and research for the Ford Foundation told SCIENCE NEWS that "lack of confidence of society in itself is depressing the attitudes of children. We're asking people [in reading this report] to pause and think about what affect these attitudes are having on our children."

Sandra Clark, a panel member and head of the English department at a Bellevue, Wash., high school, says we have to rethink what it is students are learning in school and what it is society thinks they ought to learn. Perhaps lower achievement expectations are the price we have to pay for educating increasing numbers of students. Benjamin S.

Bloom, another panel member and Distinguished Service Professor of Education at the University of Chicago, disagrees. He points to the Japanese, who educate an even larger percentage of

their population than the United States does, as proof that the masses can be educated without watering down the quality of student achievement expectations. □

Nitrogen fixation: A piece of the action

The future will demand more food, and food production demands that nitrogen be converted from its atmospheric form to biologically useful ammonia. But providing nitrogen fertilizer by the industrial processes available today will lead to ever-increasing fertilizer prices and continuing massive consumption of nonrenewable fossil fuels, William E. Newton of the Charles F. Kettering Research Laboratory told the meeting of the American Chemical Society this week in Chicago. "Such a situation will be devastating for all nations," Newton warns.

Newton and other researchers studying nitrogen fixation expect to find the

key to the fertilizer dilemma by learning from the system that most efficiently converts nitrogen to ammonia without high temperature and pressure. That system is the enzyme nitrogenase, which is found in certain bacteria, some of which live on the roots of soybean plants and other legumes. Isolated in the laboratory, the enzyme demands only about half as much energy as does the industrial process. But to imitate the bacterial enzyme, chemists need to know the details of its operation.

Researchers have long known that an essential cog in biological nitrogen fixation is a "cofactor" that contains the metal molybdenum. However, that com-