

# Science: Recruiting Nontraditional Players

Overcoming educational obstacles facing women, minorities and the disabled

By JANET RALOFF

Last year, Leonard, a black eighth-grader, was assigned to an arithmetic course. At a "parents' night" about three weeks into the school year, his mother listened to his math teacher discuss her syllabus. Something sounded very wrong: Leonard had studied all this the previous year.

A talk with the principal revealed that the school had placed Leonard (not his real name) in non-college-track arithmetic instead of college-prep algebra — despite his mother's observation that he was a "whiz in pre-algebra," despite his having successfully completed many summer enrichment programs in math and science, and despite the school's never having tested his mathematics achievement. Responding to complaints from Leonard's mother — a physicist and university professor — the school tested his math skills and immediately re-assigned him to algebra.

This past summer, Leonard attended a science-enrichment program several hundred miles from home that focused on biology skills. But when he entered high school in September, he again found himself in a non-college-track science course. "Whereas most ninth-graders are assigned biology, I had to fight to get him in," his mother told SCIENCE NEWS.

She is quick to acknowledge that at 5'10" and 190 pounds, her quiet 14-year-old looks like the quintessential non-academic jock. What irritates her is that school officials seemed to judge him on his looks, not his abilities. "They just assumed he was dumb," she says.

Such presumptions are among the many barriers — beginning in grade school — that can derail women, minorities and the physically disabled from educational tracks leading to degrees in science, math or engineering. Since the 1960s, many colleges and universities have created enrichment and intervention programs aimed at helping students breach those barriers from kindergarten onward. But these programs have sustained a mixed track record at best, according to a report released Oct. 28 by the American Association for the Advancement of Science (AAAS).

Titled "Investing in Human Potential: Science and Engineering at the Crossroads," the report identifies factors char-

acterizing programs that have succeeded in bringing underrepresented groups back on track for careers in science, math and engineering. It also offers tips for parents and students on how to circumvent — or, if necessary, hurdle — traditional barriers to careers in math, science or engineering.

Since the 1960s, human-resource analysts have recognized that increasing the numbers of disabled, minority and female students prepared to assume careers in technical disciplines would require a major overhaul in the way colleges and universities train students. How well is higher education meeting the challenge?

"There's a lot of rhetoric about increasing the participation of underrepresented groups," notes Shirley M. Malcom, director of the AAAS' education and human-resources program and an author of the new report. However, enrichment and intervention programs to recruit these students into research disciplines are "fairly isolated," she says.

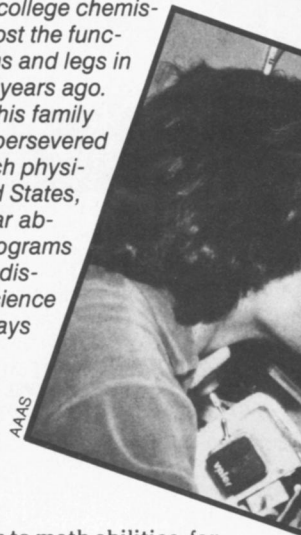
Malcom and her coauthors surveyed the presidents and chancellors of 276 colleges and universities, directors of nearly 400 campus recruitment/retention programs for minorities, women and the disabled, and representatives of nearly 100 campus-run organizations serving disabled students.

Although the survey turned up several schools with successful programs, says Malcom, "at no place did we find anything that you could call structural reform" — that is, a system in which the structure of courses, the teaching techniques, the campus ambiance and the efforts to recruit and retain students coexist with departments and programs committed to helping all students achieve an education in science, math or engineering.

In 12 case studies, the AAAS report focuses on schools with some of the more coordinated recruitment and retention programs. Each institution highlighted has targeted its efforts at counteracting barriers at both precollege and college levels.

These include problems with self es-

David Young was a college chemistry major when he lost the functional use of his arms and legs in an auto accident 11 years ago. With the support of his family and professors, he persevered to become a research physiologist. In the United States, one observes "a near absence of specific programs to recruit and retain disabled students in science and engineering," says Virginia Stern, a co-author of the AAAS report.



teem. When it comes to math abilities, for instance, parents tend to have less confidence in daughters than in sons, starting as early as first grade, according to a study cited in the new report. Another study showed that in junior high and high school, "even high-achieving African-American students tend to be placed in low-ability groups or tracks while low-achieving white, middle-class students tend to be placed in higher tracks or ability groups."

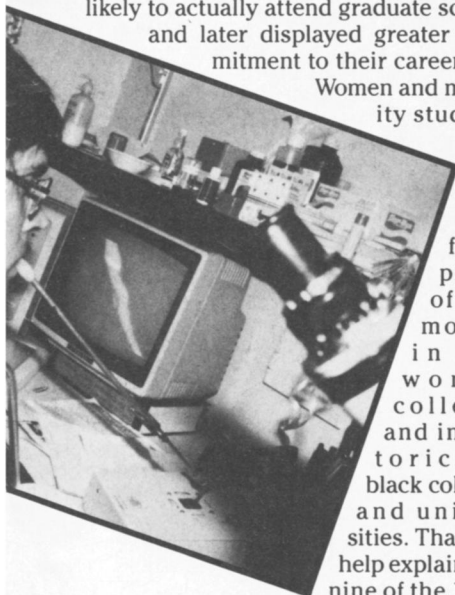
As a result, many female and minority students never develop confidence in their math or science abilities, and steer clear of high school classes that would challenge those abilities. The AAAS report points to promising attempts to counter that problem by several colleges and universities traditionally attended by minority students or women. Spelman College in Atlanta and the University of Puerto Rico in Rio Piedras, for instance, offer four- to six-hour science and math academies on Saturdays for minority students ranging from kindergarten to high school. The University of Alabama at Birmingham and the University of Puerto Rico offer summer research apprenticeships to minority high school students. And North Carolina A&T State University in Greensboro hosts a five-week, college-prep program on calculus for minority high-school juniors and seniors.

A dearth of role models can also send subtle cues that members of traditionally underrepresented groups can't hack technical subjects. Even women who enter college with technical majors "often receive the message that their presence in science, mathematics and engineering

courses will be tolerated but not welcomed," the AAAS report states.

At least four studies cited in the report found that women who majored in fields traditionally considered "masculine" — such as math and engineering — were more likely than women in "feminine" fields to report having had a female role model in their chosen field. In two other studies of female undergrads, those with female role models were more likely to enter college with the expectation they would attend graduate school, and later displayed greater commitment to their careers.

Women and minority students



have found plenty of role models in all women colleges and in historically black colleges and universities. That may help explain why nine of the 10 in-

stitutions producing the most black graduates who went on to earn doctorates are historically black colleges, the AAAS report notes. The authors also cite a similar finding by the Women's College Coalition in Washington, D.C., that almost half the graduates of women's colleges work in careers traditionally dominated by men.

Indeed, says AAAS coauthor Marsha Lakes Matyas, most research universities and other large schools that have distinguished themselves for cultivating women or minority students in science, math and engineering have "tended to try and create the kind of [nurturing] climate that we saw at smaller institutions."

Project Kaleidoscope reported similar observations in a June report on strengthening undergraduate science and math, titled "What Works." One focus of Kaleidoscope, funded by the National Science Foundation and run by the Independent Colleges Office in Washington, D.C., was an in-depth analysis of how predominantly black institutions and women's colleges have sustained such an impressive track record.

"And the more we looked at them, the more we realized they simply embodied the best principles of a liberal arts tradition," says Carol Fuller of the Independent Colleges Office. In the past, she says, educators "had somehow an unconscious notion that the historically black colleges and universities and the women's colleges had been [meeting some special

needs particular to] blacks and women." But what these schools do that's so special, she contends, "is just provide a good undergraduate education" in a "cultivating" environment. Such an education "would benefit everybody," she says.

In some of these schools, "no matter how much math students enter college with, they can still be a math major. They can come in with no math and graduate a science major," Fuller notes. And the reason, she says, is their philosophy, something embodied in what she was told at Spelman, a traditionally black women's college: "If the student fails, it's because the institution and the faculty failed the student."

In many ways, students with physical handicaps face the highest hurdles to participation in science, the AAAS study finds. But those who persevere in science-related careers may find more employment opportunities and job security than their counterparts in other fields. Although disabled scientists and engineers in the United States face a staggeringly high rate of unemployment — about 30 percent — this is still only about one-third the overall jobless rate among the nation's physically handicapped adults.

Most U.S. colleges and universities willingly accommodate students with almost any type of physical handicap, the AAAS authors report, but most such assistance falls far short of what students with severe disabilities need in order to thrive in a science setting.

Under the federal Rehabilitation Act of 1973, any handicapped student "who meets the academic and technical standard requisite to admission" must receive access to programs at colleges or universities that receive federal funds. The American Council on Education has interpreted this to mean that these institutions must "make reasonable adjustments and change discriminatory policies so that qualified students with disabilities can fulfill academic requirements. Students are not to be excluded from programs because of physical barriers or the absence of auxiliary aids."

Largely in response to the law, many colleges and universities have developed disabled services offices (DSOs). Of the 274 presidents and chancellors polled by AAAS, 74 percent said their schools had DSOs. However, research universities and doctorate-granting institutions proved much more likely than professional schools and liberal arts colleges to maintain these programs.

Even where DSOs exist, many suffer from severely constrained resources. The AAAS team found that 43 percent function on annual budgets of less than \$100,000 and that 13 percent make do with less than \$25,000. More than one-third of the DSOs surveyed employ no full-time

staffers.

With such meager resources, DSOs tend to respond to specific requests for help instead of taking the initiative to reach out to disabled students. "In most cases," the report states, "it becomes the student's responsibility to approach the faculty member, explain the nature of his or her disability and suggest the adaptations needed for the course. This assumes, however, that the student already knows the course and the laboratory content, which is rarely the case."

Because so few handicapped students today major in science-related subjects, few of the DSOs surveyed had actual experience in adapting laboratory settings or technical texts. To gauge their abilities to handle such requests in the future, the AAAS posed three, somewhat detailed scenarios. One involved a profoundly deaf freshman majoring in engineering. Another involved a blind student planning to take calculus. In the third hypothetical scenario, a junior signed up for analytical chemistry soon after an accident left him quadriplegic and wheelchair-bound.

Although most DSOs appeared familiar with the needs of blind students, many nonetheless had trouble fulfilling the requirements of the blind math student. One wasn't sure whether a cassette version of the math text could be acquired within the designated three-month lead time. Roughly 70 percent of the responding DSOs could provide readers for the student's weekly sets of math problems, and 60 percent could give the student access to a computer with a voice output. But only about 30 percent could provide access to a computer that prints out in Braille.

While almost 90 percent of the responding DSOs could provide the quadriplegic student with a lab assistant, only 30 percent could promise accessible labs and/or special equipment. Only 16 percent could offer a note-taker, and only 10 percent offered to help accommodate the student during tests (for instance, by providing helpers to turn pages or by giving the student extra time to complete the test, in light of his writing difficulties).

For the deaf student, nearly 75 percent of the DSOs offered to locate oral interpreters and more than half offered to find note-takers, but only 9 percent could provide access to specially adapted computers.

To help counter these problems, the AAAS authors recommend that colleges take the initiative in seeing that a lack of equipment, interpreters or other services "will not act as a functional gatekeeper" to careers in science-related fields. Moreover, they suggest that science and engineering departments set up outreach programs to begin recruiting disabled students to technical fields *before* these youths are dissuaded from taking math and science prerequisites in high school.

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**T**he AAAS report "illuminates the gap between lip service and real service to the students underparticipating in science and engineering on college and university campuses," says Daryl E. Chubin, of the congressional Office of Technology Assessment. "Hereafter, no institution can claim either a lack of awareness of recruitment and retention problems, or of insight into the array of models and methods to address these problems."

Chubin says he suspects government intervention will be needed to drive the "structural change" sought by Malcom and her coauthors. The AAAS report recommends government intervention. In particular, it suggests adding how well an institution trains its handicapped, minority and women students to the list of factors considered by federal agencies in awarding research grants. "We're not talking about replacing this as a notion of [a proposal's] scientific merit," Malcom says. Instead, she suggests using it to choose between otherwise equally meritorious proposals.

"Such structural reform is firmly within our grasp," Chubin adds. "Thanks to AAAS, we have the instruction manual for change literally in hand." □



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## Anthropology

*Bruce Bower reports from Chicago at the annual meeting of the American Anthropological Association*

### High-level utensils

Analysis of household objects uncovered in continuing excavations of a village in El Salvador entombed by the searing ash of a volcanic eruption around 1,400 years ago reveals a curious and surprising pattern, reports project director Payson D. Sheets of the University of Colorado at Boulder. Residents of the thatched-roof communal structures placed the majority of utensils in daily use — including ceramic vessels, pots, mortars and obsidian blades — in elevated storage areas rather than on or near the ground within easy reach.

Vessels and pots often turned up on top of ceiling rafters and columns, as well as in niches placed near the top of walls, Sheets says. Inhabitants of the windowless structures suspended some vessels from the ceiling with rope made from the fiber of a type of cactus they cultivated, he notes. Roofs also served as storage areas for obsidian blades and unexplained thin stone slabs, with some blades placed in accessible spaces above doorways. Reasons for the emphasis on elevated stashing of commonly used objects — also observed in a storage building on the site — remain unclear, Sheets remarks.

About 20 feet of volcanic ash buried the community, known as Ceren, yielding one of the best-preserved prehistoric villages in Latin America, according to Sheets. Architectural styles at Ceren display links to the Maya culture, he points out. For instance, excavators in 1990 uncovered an earthen-domed building with a central kiln surrounded by a rectangular adobe bench that may have served as a community sauna, much like those still in use by Maya groups.

Last year's field season also documented the first human remains at Ceren — three teeth discovered in an ash-filled depression about halfway between the village and a nearby river. More human remains may turn up along the river, Sheets

suggests, since Ceren's inhabitants probably fled toward the water as hot ash rained down on their homes.

### Kalahari conservatives

A review of archaeological evidence at southern African sites inhabited by hunter-gatherers known as the !Kung reveals a striking consistency over the past 40,000 years in their way of life, even after the !Kung came in contact with herding and agricultural societies, reports John E. Yellen of the National Science Foundation in Washington, D.C.

"The !Kung underwent change, but they show a surprising degree of cultural conservatism," Yellen contends.

Scientific debate currently rages over the extent to which contact with outsiders transformed hunter-gatherer societies in various parts of the world (SN: 4/29/89, p.264).

Yellen has excavated !Kung archaeological sites with colleague Alison S. Brooks of George Washington University in Washington, D.C. They find that the range of stone and bone tools excavated from three Kalahari sites remains largely unchanged over the past 40,000 years. This suggests that contact with Iron Age peoples nearly 2,000 years ago did not greatly alter the !Kung way of life, Yellen concludes.

Animal bones uncovered at four !Kung campsites show that although they ate fewer wild species beginning in the 1960s, Kalahari residents consumed the same number of species and the same proportions of small and large game as before, Yellen adds.

"Cultural conservatism" appears a successful strategy for adapting to an environment in which rainfall and food availability shift unpredictably from year to year, as in the Kalahari, he argues.