

PHYSICISTS TEACH MINORITY STUDENTS

Stanford's summer program for high-school students of Mexican descent shows them what modern science is up to and encourages some to go to college

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A MEXICAN-AMERICAN high-school student in southern California is a member of a minority group with no academic tradition. He is likely to drop out of school through lack of personal and parental interest, and even if he does finish high school he will probably not go to college. Some physics and mechanical-engineering faculty members at Stanford University are doing what they can to persuade these students to continue their

education. At a four-week program, held each summer at Stanford, Mexican-American students attend lectures, do some laboratory work, and socialize with staff members; thus they get a taste of college life and a feeling for modern science that is not available to them elsewhere. The budget is low, the results are mixed, yet the idea is spreading to other campuses in the US.

The beginning

This program sprouted roots six years ago, during a coffee-room discussion among the faculty, staff and graduate students of the physics department

concerning the problem of high-school dropouts. Subsequent research revealed that the problem was particularly severe among youths of Mexican ancestry. In California's Santa Clara County, which includes Stanford and San Jose, persons with Spanish surnames numbered 17% of the population in 1960; yet these Mexican-Americans account for less than 4% of the student bodies in even the local colleges and universities. Typically the Mexican-Americans live in close-knit Spanish-speaking communities. Because the parents have little formal education they are unable to assist their children in language or academic

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LOW TEMPERATURE PHYSICS. William Hamilton demonstrates the condensation of water vapor as he pours liquid nitrogen over a small amount of water. Fog over the ocean, he explains, is caused by condensation.

REFLECTING TELESCOPE is demonstrated by a graduate student. Some of the students build these telescopes as a laboratory project.



problems or to encourage them to pursue their studies. More frequently the children are expected to join the family in earning a living when they are old enough to work.

When Stanford's physics department discovered that none of the efforts directed toward motivating "culturally deprived" minority students were aimed at the Mexican-Americans, they decided to set out on a volunteer venture of their own. Under the direction of Alan Grundman, who was the department administrator at the time, the physics department set up a four-week summer program for 20 Mexican-American students from all over the county. Lino Lopez, then director of the Mexican-American Community Service Agency, provided valuable advice and direct contact with the Mexican-American community.

The targets of the program are high-school sophomores who show some intellectual promise but who are failing to achieve this potential in their present high-school work. It is hoped that the students will become motivated by the program to go on to college; with this aim, they should try to improve their high-school grades and otherwise strengthen themselves in order to gain admission to college.

Rather than trying to instill a body of knowledge into these students, the physics department hoped, through lectures, seminars and laboratories, to give the students a taste of college life. The "gee-whiz" approach typi-

cal of some of the labs and lectures, while unrealistic, was justified by the fact that these students were still two years below college age and could not be expected to sit through a fully developed mathematical explanation of physics phenomena.

From the beginning the program was kept loose, so that faculty and graduate students could participate as much or as little as their summer research activities would allow. One professor might be able to give only one lecture, while another might spend a week or more supervising students in the afternoon lab. Mason Yearian has donated appreciable amounts of his time to the organization and administration of the program.

Lectures, tutorials, labs

A typical day includes a lecture, a tutorial session in small groups, a laboratory period, and a "class" period. The tutorial sessions are designed to strengthen particular areas of academic weakness, such as mathematics, reading, biology or Spanish. In the class periods the whole group meets to learn about study skills, college preparation and various ethnic subjects.

The lecture series has relied on volunteer lecturers, and there has always been an enthusiastic response among both faculty and students. As illustrated by the 1969 lecture schedule in Table 1, the range of topics varies widely with the interests and imaginations of the volunteers. Several favor-

ite lectures have become nearly permanent features. For example, Arthur Schawlow always presents a clear and lively discussion of the laser, illustrated by holograms and devices such as a laser typewriter eraser. The students have also enjoyed Don Aitken's lecture concerning the geology of the San Francisco Bay Area, and how the geology affects the weather there. In his talk about low-temperature physics, William Hamilton induces the students to think for the first time about what cold is and what happens near absolute zero. Although some effort was made originally to ensure some continuity from lecture to lecture, those efforts were abandoned as nearly impossible with a separate lecturer on each day.

Student reaction to the lectures varies from boredom to great interest, and it is usually difficult to predict just what will turn the students on. Most lecturers find it quite a challenge to gear their talks to the level of a high-school student. So much of the vocabulary that is second nature to a physics graduate student is foreign to a 16-year-old.

The laboratories were supervised by each one of the five major research divisions within the department of physics—high-energy, microwave, low-temperature, nuclear-structure and theoretical physics. When the department of mechanical engineering (under the impetus of William Moffatt) joined the program in 1968, it became possible to add two more laboratory

groups. Consequently the program was enlarged from 20 to 30 participants.

Skills and pride

The laboratory projects are selected to teach a skill and to provide the student with something he can take home or "show off" at the end of the program. Last year's projects were:

- building a telescope
- learning to use a camera and to develop film
- designing and constructing a "hovercraft" using a reconditioned lawnmower motor
- building electric photocell switches
- programming a computer to translate between Spanish and English.

Students were randomly selected for most of the labs, and the girls took to the mechanical work as well as the men.

Other lab projects have been tried. For several years some students built a binary counter. Because this counter had limited appeal to the students, it was dropped in favor of the photocell switches. One year a group conducted a series of field trips to acquaint the students with their community and environment. However, this project was very difficult to organize and to sustain. Computer projects have been tried with varying success. They work best when the students are selected for their ability in math and interest in computers. In addition, the group this year programmed a problem that was not mathematical in nature. Yet most students prefer projects with more tangible rewards.

At the end of the summer, when the students present their lab projects to their classmates, the pride is evident. One group staged a dramatic scene to illustrate how their electric switches might be used for burglar alarms. Members of another group were sorely disappointed when their hovercraft, which had worked only the day before, failed to take off for the demonstration before the entire group.

Social and residential

Not all the activities are academic. Socializing between the Mexican-Americans and members of the physics and mechanical-engineering departments over lunch has led to picnics and camping trips. Excursions to Stanford's Computation Center and Medical Center, and to neighboring campuses, further break the routine. Guest speakers are occasionally invited to address the group.

In 1966 the physics department experimented with a residence program, housing all participants on the campus. Many headaches resulted from this experiment. The students could behave like adults from 9 am to 4 pm but not for a full 24 hours. Back in the dorm they became high-school students again, staging pillow fights and water battles, and creating many discipline problems for their harrassed counselors. The physics department was simply not prepared to handle these nonacademic situations, and they happily returned to the commuter program the following summer.

Funds are now available to continue some activities throughout the year. Perhaps the tutoring is the most important of these activities.

The student not only receives the help he needs but also the assurance that interest in him continues beyond the brief few weeks of the summer program. The two directors plan further programs of cultural enrichment and periodic counseling.

Finance

Although the first year of the program was financed entirely through voluntary contributions, it could never have been sustained on that basis. The second year Stanford received funds from the Rosenberg Foundation as well as from the school districts that had students in the program. With this additional financial support the department hired an English teacher to conduct classes and supervise the program, and four tutors who were themselves Mexican-American.

In the third year of the program the financing was taken over by the East Side Union School District in San Jose under Elementary and Secondary Education Act, Title I, money. This arrangement resulted in a welcome centralization of the program. It was now necessary to select the students from one school district rather than from all over the county. The physics department decided to try selecting all participants from one school, Overfelt High School, which was a target school for improvement within the district. It was far easier to conduct a winter program and follow-up studies when all the students were located in one school. Furthermore it was hoped that the large number of participants from one school would succeed in influencing a much larger group of fellow students. Two staff members of Overfelt who were extremely interested in the program were hired to direct both the summer and winter phases of the program.

The first of these directors, Martin Tucker, was a counselor at Overfelt with an intimate knowledge of and excellent rapport with most of the Mexican-American students. The second director, Rudy Ortega, was a Mexican-American who teaches mathematics at Overfelt. Both men still work with the program.

The tutors who work with the program are Mexican-American college students who serve as positive examples to the younger students. One tutor, Richard Ruiz, was a graduate of the first summer program and is now a student at Harvard University. Much of the value of the tutors results

Table 1. Lecture Topics

Topic	Lecturer
Weather and geology of the Bay Area	Donald Aitken
Lasers	Arthur Schawlow
Atmosphere and pollution	Gary Latshaw
Space exploration	Pete Zimmerman
Computers	Bob McCown, Paul Berdahl
Low-temperature physics	William Hamilton
Atoms	Jim Timbie
Soap bubbles	Blas Cabrera
Radio science	Jan Siren
Thunder and lightning	Pete Selzer
Physics of music	Bruce Bush
Scientific beginnings	Andy Abarbanel
Space mechanics	Ilan Levi
Astronomy	Paul Zucker



SOLDERING is taught to these girls before they begin to build their electric photocell switches. Later the switches could be coupled with an alarm.

from their individual personalities, and most are very constructive factors in the program. The budget for the program is summarized in Table 2. Of the total \$6000, the East Side Union School District provides \$5000 while the remaining \$1000 was allocated by the Stanford University Graduate Student Association. A major expense in the budget of the first two years had been a "scholarship" paid to the students to compensate for the money they lost by not working in the fields during the summer. At first this scholarship had been important in selling the program to the parents. However, even without these payments students were readily recruited for the program. They were given academic credit for participation.

Colorado and Arizona

By 1968 word of the Stanford program had spread to the University of Colorado, where Willard Chappell of the department of physics became interested in establishing a similar program. They sent a graduate student, Jerry Sullivan, to participate in the program and to study it for adoption at Boulder. Last summer the Colorado program got under way. Although their plan is similar to Stanford's, the changes made show what variety is possible.

Instead of the tutorials, the Colorado physics department attempted a se-

ries of discussion groups on science, history, film and communications. These groups were designed to stimulate the student toward individual thought and questioning. At first the students were not accustomed to the informal atmosphere where they were not told what to do or how to act, but soon they were able to supply the content of the discussion themselves.

As a second innovation the University of Colorado made available the counseling services of their School of Education.

The Mexican-American Program may be extended to yet another school. The Department of Political Science at the University of Arizona contacted the University of Colorado about the possibility of establishing a similar program. It will be interesting to see how the program works in a nonscience department.

Follow-up studies

Although the Stanford physics department wishes it could report that all of its "graduates" went on to college, the statistics are too incomplete to do so. Isolated examples of success certainly stand out. Ruiz is a senior at Harvard. One student is at the University of California at Berkeley, one is at the University of the Pacific and one is at Stanford. Eight program graduates are enrolled at the University of Santa Clara. Of the 50% who responded to questionnaires, all except

Table 2. 1969 Budget

Director's salary (year)	\$1000
Teacher's salary (year)	1000
4 tutors, \$400 each (4 weeks)	1600
Transportation	1000
Laboratory expenses	500
Graduation dinner	250
Misc. admin. expenses	100
Activities (picnics, etc.)	100
	5500
Balance for winter activities	500
	\$6000

two are still in high school or have graduated from high school. The boys who graduated from high school are in college or in military service, and half of the girls are in college. In general the students did not improve their grades after the program, but many were enrolled in more difficult courses.

Success, depending on how one defines it, is often measured in individual ways rather than by cold statistics. One girl never lacked academic motivation but did lack social confidence. By the end of the program she was speaking to other students with much greater ease and had even learned to fix her hair in a more becoming manner. A high-school dropout who had come to the program as a visitor subsequently decided to re-enroll in high school. Other students reported that they were more interested in learning than before, were somewhat disappointed now with high-school classes and were eager to get to college.

Another important effect of the program is that on the student's family. Nearly all the parents attend the graduation dinner and exhibit a sense of pride in their children on that occasion. Many are convinced for the first time that a college education is worthwhile and that their son or daughter is capable of doing college work.

All these examples may be only small tokens of success. The students affected are only a small fraction of the Mexican-American population. But the department of physics is pleased to be moving in the right direction.

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