

## Math Called Key to Indian Self-Determination

Greater access to mathematics education is critical for American Indians if they are to achieve true self-determination, according to the report of a Conference on Mathematics for Native Americans, held July 1977 in Albuquerque.

Forty teachers, administrators, and program developers involved in Indian education emphasized a central theme during the meeting: the need for numeracy, or basic mathematics competence, for application in daily life, general education, and tribal development, and for increasing the number of Native Americans in science and health professions.

Participants at the conference, funded by AAAS through its Project on Native Americans in Science and the Educational Foundation of America (EFA), emphasized that accelerating tribal developments in such areas as health care and energy resource management underline the need for Indian people trained in relevant fields. Basic competencies, especially in math, according to the AAAS/EFA conferees, hold the key for efficient self-management by the tribes.

An earlier study by AAAS, in a survey of barriers obstructing entry of American Indians into careers in the natural sciences, clued staff members to the need for special attention to mathematics. Conferees at the Albuquerque meeting strengthened the impressions that the earlier research project had left. Inadequate counseling and inappropriate or bad teaching, added to a complete lack of encouragement for learning mathematics, had produced a pattern of mathematics avoidance in American Indian students.

Characteristic loss of or lack of interest in math and math-related work was due, the conferees felt, to widespread, perhaps racist, assumptions about the abilities and goals of Indian students. Many firsthand examples offered to AAAS staff and meeting participants confirmed this attitude: "I got counseled out of algebra into general math," one Kiowa premedical junior told an investigator, "because the counselor said I'd never go to college anyway. So I had to make it all up my freshman year." Discouragements like this eventually add up to a pattern of avoidance ("I would have had more math but I was afraid of flunk-

ing"), even when the student had no experience of failure in math-related areas. Thus, many career routes can be closed off before exploration of needed skills takes place.

For most of the Albuquerque conferees, changing the attitudes of Indian students and their teachers and counselors is a major part of resolving the problem. In fact, they felt that a new nationwide stress on mathematics competence would immediately produce major improvements in Indian education.

Changes also need to be made in curricula and teaching methods for the benefit of Indian and non-Indian students alike, said the conference attendees. All agreed that conventional mathematics curricula need to be modified to place more stress on the application of math in daily life and work. In addition, the curriculum ought to be purged of unnecessary and confusing learning elements (for example, fractions) in favor of more pragmatic and necessary elements (for example, metrics and the use of handheld calculators).

Most of the conference participants felt that innovation was not necessarily the key to change and that good one-to-one teaching would be a forward step; all agreed that combinations of programmed, individualized, computer-assisted, and tutorial help worked best with any student who needed remedial or new skills in math. The conferees' sense was that Indian students had responded well to all of these methods, and that encouragement plus exposure to practical applications of mathematics, whether for a job-specific skill such as construction site measurement or pharmaceutical dosage calculation, were necessary to change student attitudes about math.

Another theme of the Albuquerque conference was the need for attention to cultural factors in Indian education. Cultural differences, the conference attendees maintained, dictate that some conventionally accepted and innovative methods of teaching mathematics might have to be discarded in Indian programs. For example, an Indian student's silence in the classroom must not necessarily be assumed to indicate fear of lack of knowledge or of possible embarrassment; the traditional Indian approach of *receiv-*

*ing* knowledge by listening and observing must be taken into account. This suggests inappropriateness of the traditional "discovery" method of learning.

Many of those at the AAAS/EFA meeting had themselves developed culturally based mathematics curriculum materials that relate to Indian systems of knowledge and learning, demonstrate the relevance of mathematics to Indian culture, and develop knowledge of different cognitive systems.

Other conferees saw a need for math education for the many older students enrolled in tribal colleges. Many of these students already are tribal administrators and ranchers or are involved in business relationships such as land leasing to energy companies or to non-Indian farmers. For such people a different approach has to be taken from that required for a typical student entering a math-related course of study.

For many Indian students, the need for mathematics competence is exacerbated by the very nature of reservation life, which tends to be rural and isolated. Learning often means traveling hundreds of miles, often to a curriculum completely disassociated from their special needs. Learning, the meeting participants pointed out, must be compressed into realistic and manageable units. The tribe must continue to function while its members study at lunchtime or at night.

Despairing of imminent changes in teacher education or in federal Indian education policy, conference attendees felt that their efforts to focus on mathematics would best be spent in forming a national network of educators working in Indian educational settings. Formation of a network of teachers, administrators, and program developers to share materials and methods, to organize in-service training, and to develop new materials and strategies was, they thought, essential.

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