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TEXT: Increasingly, applicants for the best employment opportunities will need a good grasp of science, mathematics, and computer technology. However, minorities, women, and other disadvantaged groups have not excelled to the same degree as others in these areas. Why this is so, and what can be done to increase their achievement, are important educational concerns now. Successful attempts to teach science and mathematics effectively have been made recently, and a range of educational policies, programs, and methods have been identified and are now in use.

There are a variety of reasons why some students have achievement difficulties,

including the following:

Cognitive Differences: Individual students process information and approach problem solving in different ways, although research has shown that, in general, individuals who are members of certain groups of students (i.e., minorities and women) process information similarly, but in a way that is different from that defined by educators as the norm. Because it is only this "normal" way of learning that has informed curriculum development, large numbers of students have failed to master science and mathematics coursework.

Family Stress: Students whose family life is in turmoil often suffer from lack of parental involvement. Further, the ability of these children to learn is hampered by lowered self-esteem, the result of their internalization of this stress. Prime sources of family stress for children at academic risk are poverty and unemployment, and other problems they engender.

Racial and Cultural Bias: Because some teachers believe that certain students cannot excel at science and mathematics, they encourage them to take less challenging, nonacademic courses. Teachers may also believe that, given a history of low minority and female student achievement in technological studies, and possible employment discrimination, it is better to prepare these students for the jobs that will probably be available to them than for jobs usually held only by white males. Parents also can discourage achievement as a result of beliefs they've come to accept after a lifetime spent in a society which is often prejudiced.

Students whose first language is not English, or is a nonstandard dialect, may have difficulty in understanding not only standard English, but also the cultural context of the learning material. Bilingual curriculum is frequently limited to the most basic subjects, so students are not exposed to higher level mathematics and science learning. Other cultural norms, such as the way children are supposed to interact with adults at home, may be at variance with accepted student-teacher interaction; these differences may also hamper students' academic success.

Disability: Though technological literacy is particularly important for improving the lives of the handicapped, frequently disabled people are "tracked" out of technical courses because of a misconception that they cannot function safely in a laboratory or could never work in a science setting.

Tracking: Students who exhibit any kind of learning difficulty, no matter what the reason, may be counseled to take less challenging classes instead of encouraged to work harder to master the more difficult ones. If tracking begins in the early grades, students never receive the educational building blocks they need for more advanced learning later.

Many principles of programs that successfully teach mathematics and science are also aspects of the more general effective schooling principles, while others respond specifically to the needs of minorities and women. A few of the principles are these:

High Quality and Long-Term Programs: Programs should emphasize: enrichment, rather than remediation; the personal importance of learning science and mathematics; and hands-on experience. They should begin early and continue throughout the schooling of the targeted groups, drawing on the cooperative efforts of universities, businesses, and the community. They should be evaluated frequently, and altered accordingly; and should have a diversified funding base to ensure uninterrupted operation.

High Quality and Diverse Staff: It is essential to have a strong principal and director, and competent teachers who all believe in students' ability to learn and are committed to removing educational inequities related to sex, race, ethnic background, and disability. Staff members should be recruited from target populations so they can serve as role models, and they should introduce students to other role models of both sexes with backgrounds similar to theirs.

Recontextualization: Learning tasks should be created that allow students to master them through use of their innate ways of understanding information. Information to be taught, and problems to be solved, should be embedded in familiar contexts, and should reflect students' cultural and ethnic diversity, so they can make immediate and practical use of what they learn. Relating mathematics and science learning to future careers also enhances student attention, and thus, comprehension and retention.

Cultural and Language Sensitivity: Teachers should respect the style of students with a nonstandard way of communicating, and with a culturally different way of interacting in group situations; and they should be sure that students comprehend their teacher's speech. Bilingual advanced science and mathematics classes should be available.

Anxiety-Reducing Strategies: A competitive classroom atmosphere can provoke student anxiety. An alternative learning environment--where cooperation, rather than being first with the correct answer, is rewarded--eliminates the stress of competition and the value conflict of some females and minorities who value cooperative social interaction. Instilling in students the belief that they can succeed also helps reduce anxiety.

Improved Programming: Smaller classes, where students can interact more closely with teachers, enhance learning. Increased time on task is also beneficial; developing learning activities that take less time to master, and recontextualization, which often results in more rapid learning, allow more time for mastery of additional material.

Cooperative Student Groupings: A hands-on, inquiry-oriented science curriculum, with students divided into small mixed ability cooperative groupings, has been shown to be

more effective than traditional teaching methods. Students learn to solve problems independently, and help each other develop skills. It has also been shown that cross-sex and mixed ability pairings result in more effective learning than do random pairings.

Extracurricular Learning: Science and mathematics achievement can be enhanced through after-school programs run by institutions that provide educational enrichment. Parents can encourage students to take advantage of these, and of the public library, by accompanying them. Finally, the use of increasing numbers of phone-in services which answer students' academic questions can be supported.

FOR MORE INFORMATION

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