Let's Get All of Our Students in the Mathematics Fast Track

Dr. Anne Papakonstantinou
Director
Rice University School Mathematics Project

Imagine that you are an observer in an Advanced Placement Calculus class in a typical urban senior high school, ethnically balanced of course....

Who are the students in the class?

Now imagine that you are an observer in a remedial mathematics class at the same school.

Who are the students in this class?

- Why is there such a disparity in the student populations in the two classes?

- Why are mathematics classes some of the most segregated places in American society?

FACTS

- In the year 2000, 40% of the students in public schools were African American or Hispanic compared to 13% at the end of World War II.

- In the Houston Independent School District in 2004, 57% of students are Hispanic, 31% are African American, 9% are Anglo, and 3% are Asian and American Indian.

The study of mathematics in the United States has been dominated by white males.

FACTS

- U.S. Hispanics or African Americans earn only 4% of the bachelors' degrees in mathematics and fewer than 2% of the Ph. D. degrees.

- White males receive 3 out of 4 Ph. D. degrees awarded to U.S. citizens.

The National Science Board Reported:

- From 1990 to 2000, the percentage of foreign-born workers in the U. S. in science and engineering with Ph. D. degrees leaped from 24% to 38%.

- Since September 11, 2001, the number of temporary visas for jobs in science and technology dropped by 55% from 166,000 to 74,000.

The U. S. is not educating enough of its own students to satisfy the technology-hungry workforce.

There is low interest in scientific careers among the fastest growing demographic sector of the U. S. population – Hispanic-Americans.

FACTS

- American whites produce an average of 6.3 bachelor's degrees in science and engineering per 100 people between the ages of 18 and 24.
- Hispanics produce only 2.4.
- African Americans produce only 2.7.
- Asian and Pacific Islander Americans produce 14.7 degrees per 100 people in the same age group.

Mathematics moves society forward.

We must get more of our students, especially our underrepresented minorities, into the mathematics pipeline.

We must sustain our students, especially our underrepresented minorities, as they move through the mathematics pipeline.

The mathematics pipeline has a huge dropout rate.

- From 9th grade through the Ph. D., the half-life of students is 1 year.

- Beginning with approximately 3.2 million students entering high school, we lose 50% each year until only a few hundred attain the Ph. D.

Losses from the mathematics pipeline come disproportionately from females, African Americans, Hispanics, and native Americans but at different stages.

Our fastest growing population - the underrepresented minorities - currently produce fewer than 2% of our scientists, mathematicians, or engineers.

"No first-world nation can maintain the health of its economy or society when such a large part of its population remains outside of all scientific and technological activity."

Professor Richard Tapia
Rice University

The World is Changing

- In everyday life, we are bombarded with "mathematical" information.
- In the workplace, we are regularly challenged to learn new skills.
- Our lives are being reshaped by changing technologies.

The Equity Principle

Excellence in mathematics education requires equity – high expectations and strong support for all students.

Principles and Standards for School Mathematics (NCTM, 2000) p. 11

COURSE TAKING IS THE SINGLE MOST POWERFUL FACTOR UNDER A SCHOOL'S CONTROL THAT AFFECTS STUDENT ACADEMIC ACHIEVEMENT.

The goal for all students should be to take mathematics courses each year through the 12^{th} grade.

The goal for all educators should be to ensure that every mathematics course is of the highest quality.

Too many minority students do not receive academic counseling encouraging them to take advanced courses.

Minority populations have traditional values that stress gender-differentiated roles for boys and girls.

Mathematics teachers and counselors MUST communicate the importance of studying mathematics to prepare for future careers, to increase possible earnings, and to function in society.

Suggestions for Mathematics Teachers

- Interact with all students not just with white males.
- Eliminate bias in the way that you interact with students.
- Discuss mathematics anxiety with your students and share your personal beliefs about it.
- Encourage women and minorities to seek interests that involve mathematics.
- Do not accept failure from minorities or females.

Mathematics in the Fast Track

- Algebra I in 8th grade
- Geometry in 9th grade
- Algebra II in 10th grade
- Pre-Calculus in 11th grade
- A. P. Calculus in 12th grade (AB or BC)
- A. P. Statistics concurrently with

  Pre - A. P. Pre-Calculus or with A. P. Calculus, if desired

Ways To Get Students in the Mathematics Fast Track

- Curriculum compacting
- Grade telescoping
- Summer school

Ways To Get Students in the Mathematics Fast Track

- Concurrent enrollment in non-sequential mathematics courses
- Advanced Placement courses
- Credit by examination

The mathematics we teach must meet social and economic demands of the world, but we must take steps to ensure that everyone participates.

This presentation appears on the
Rice University School Mathematics Project
web site:
http://rusmp.rice.edu