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# Mathematics and Cultural Diversity in the Curriculum

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*Author's Note: The following remarks were made to a university-wide audience at the second workshop in a series of workshops on cultural diversity at the university and in the curriculum. The comments were made in May 1993, but they are as relevant today as they were four years ago.*

I would like to take a few minutes to talk about how I see mathematics fitting into the general discussion of multicultural and international diversity. When I attended this workshop last year I was unsure of the role of mathematics in these efforts. So were many other people. But in the year since then I have come to a very clear understanding of its role.

Mathematics has been and is part of every human culture. From the empirical geometries of the Egyptians and Babylonians to the formal geometry of Greece and the dynamic geometries of the Navaho and Inuit Indians; from the stylized algebra of the Chinese to the manipulative algebra of the Arabs and the calculus of the Europeans, every culture has a mathematical heritage. Every culture does mathematics.

Mathematics is a culturally based, human endeavor, but it has an importance that transcends its mere existence. In some sense mathematics forms a commonality across all cultures. Indeed, modern "western" mathematics is a truly international effort. It has a communication scheme transcending language barriers.

I currently am looking at the proceedings of a conference held in Germany to honor a German mathematician. There were 69 participants from 17 countries. The book, published in Germany with an introduction in German, is entirely in English. Viable and dynamic practitioners are found in every part of the world: China and Japan, the former SU, the Western Industrial Nations, Vietnam, Iran, Israel, Egypt, Brazil and Pakistan, to name a few locations.

Why should this be so? To quote Lynn Steen from *On the Shoulders of Giants*:

What humans do with the language of Mathematics is to describe patterns. Mathematics is an exploratory science that seeks to understand every kind of pattern—patterns that occur in nature, patterns invented by the human mind, and even patterns created by other patterns.

Even more than being a language or being a science, mathematics is a way of thinking. People are thinking mathematically whenever they do the following list of activities, taken from the document *Everybody Counts* by the National Research Council.

**Modeling:** Representing worldly phenomena by mental constructs, often visual or symbolic, that capture important and useful features.

**Optimization:** Finding the best solution (least expensive or most efficient) by asking "what if" and exploring all possibilities.

**Symbolism:** Extending natural language to symbolic representation of abstract concepts in an economical form that makes possible both communication and computation.

**Inference:** Reasoning from data, from premises, from graphs, from incomplete and inconsistent sources.

**Logical Analysis:** Seeking implications of premises and searching for first principles to explain observed phenomena.

**Abstraction:** Singling out for special study of certain properties common to many different phenomena.

So where does this get us? To quote the character of Mr. Escalante in the movie *Stand and Deliver*: "Mathematics is the great equalizer."

The best indicator of salary ten years after high school graduation is the amount of mathematics studied. The ten best jobs in the United States—rated on salary, sta-

bility, stress, and future—all need a mathematics background.

To paraphrase Dr. Marable, who spoke here on Martin Luther King Day:

In the 1990s a new segregation characterizes American society: unequal access to education in mathematics, technologies, and sciences results in people being excluded from full status as functioning, contributing members of society. This segregation is seen particularly among individuals outside the mainstream of American society—individuals from ethnic minorities, from rural areas, and among women.

I would like to argue here that the issue is even greater than having individuals fit in the American society at large. I see mathematics as a great equalizer—a form of empowerment—even within the ethnic and racial cultures of the nation. In writing a paper for my Mathematical Ideas course, a student came to this same realization. He wrote:

...I was born in the inner-city called Gary, IN, the product of a broken marriage and a father that I never knew. I've seen all of the males on my father's side go to jail, run away, or get killed... In August I will become the first person in the history of my family (on either side) to graduate from college. I will also become the first male on my father's side to do something legit (non-illegal), and no thanks to math... By the time of my senior year in high school I was the top history student in my school. I soon went on to star in that category on our school's academic superbowl team. Subsequently, I was accepted into Valparaiso University, with no thanks to math.

In high school I took algebra one, algebra two, and geometry... For one thing the fact that I'm black basically excludes me from the "normal" American culture in the first place, so I don't need math to exclude me from a culture that I don't exist in. Secondly, math is not needed to be a part of the black community. And lastly, I don't need math to fulfill my obligation as an American citizen, because in my opinion

blacks are not American citizens.

Yet later in the paper he wrote:

...When I first began writing this paper I was in a terrible funk, when concerning mathematics. But as I started writing my paper it became increasingly difficult to think of new points against math, and this is when I realized how immense my task was. In an attempt to gain further insight I asked one of my friends, Mr. Elliott Fourté, his opinion on this paper. Elliott told me that he couldn't give me any ideas on this paper for he thought that mathematics and life success were synonymous. He also told me that though I didn't feel that I've had a lot of math, that three years of math is a lot of math when looked at from a global and national standpoint.

After thinking about his I've realized that I've failed to give math enough credit... I've also come to realize that the statement "blacks don't need math" could be a cop out, and part of the reason that we as blacks are in our current situation could be attributed to a lack of science and math skills. Blacks in America's economic situation is very similar to that of third world countries, and the technology that comes from math and science seems to be the thing that separate the industrialized nations from the non-industrial.

What then is the role of mathematics in a world of diversity? This role is obvious: it is to provide individuals with the tools needed to be empowered in their own culture, and to provide them with a common language that can, and does, transcend cultural barriers.

How can mathematicians fulfill that demanded of them by their discipline? By the time an individual is old enough to attend college, he or she has acquired these tools, or it is frequently too late to provide them with the tools they need. It is therefore imperative that practicing mathematicians take a positive role in K-12 mathematics education by participating in professional development and curriculum projects, as well as by working with young students themselves.