ETHNOMATHEMATICS LOOKS BACK AND LOOKS FORWARD

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Ethnomathematics as a recognized area of study is approaching its twenty-fifth anniversary. Ubi D'Ambrosio's presentation on "The Social-Cultural Basis of Mathematics Education" at the Fifth International Congress of Mathematical Education in Adelaide, Australia, in 1984, is often considered the launching of the field of ethnomathematics. The International Study Group on Ethnomathematics was started the following year. An anniversary, like the start of a new year, encourages review of the past and discussion of directions for the future. Hence, this is an appropriate time to look at the history and prospects of ethnomathematics.

Ideas of ethnomathematics long preceded the establishment of the field. Throughout the history of mathematics, the culture and the needs of people have contributed ideas to mathematics and, in turn, the development of mathematics in different places often reflected the cultures of its sources. Almost any instance from the history of mathematics could demonstrate this cultural connection, but a few examples should suffice. The ancient Egyptians' geometry grew from both their daily life of agriculture and the cultural influence of their religion. Historians have suggested that the study of pure mathematics in early Greece was partially a result of their custom of public debates and use of deductive arguments, as well as their prosperity which allowed study of mathematics that had little practical economic applications. Classical Chinese mathematics tended toward arithmetic and algebraic areas, matching the growth of bureaucratic applications of mathematics. Much later, Muslim mathematics came into Europe through a variety of trade, military, and cultural interactions around the Mediterranean Sea. The art of the Renaissance led to important developments in projective geometry and

Baroque music reflected the mechanical mathematical models being developed to describe the physical world. A new wave of pure mathematics in the 19th Century has been partly attributed to the growth of universities and the professionalization of mathematics (Grabiner, 1974). At the same time, revolutions in mathematics leading to non-Euclidean geometries and abstract algebras were contemporaneous with Beethoven's revolution in music and anti-monarchist political revolutions in Europe. Perhaps the abstraction of mathematics at the turn of the 20th century matched abstraction and impressionism in art and atonal music. These are only a few generalizations, but more specific examples can be found throughout history where mathematics grew from cultural and economic situations and in turn, mathematics contributed to cultural and economic development. Historians of mathematics looked into examples such as these and cultural interactions with mathematics, though they tended to focus primarily on Western culture. Morris Kline, a mathematician, contributed two notable books to this discussion in the middle of the twentieth century, *Mathematics in Western Culture* (Kline, 1953), and, more content-oriented, *Mathematics: A Cultural Approach* (Kline, 1962). Ifrah (1994), looking at number concepts and representations, also found many examples, both Western and non-Western.

Modern study of mathematics in non-Western cultures can be said to have begun as anthropologists of the late 19th and early 20th century occasionally noted mathematical aspects of the cultures they were studying, though they often looked at them disparagingly, trying to demonstrate the growth of civilization toward the European model (Dantzig, 1930). Raum (1938), writing on education in Africa, began to break from that viewpoint. A study in 1967 (Gay & Cole, 1967) was much more even-handed, comparing mathematics learning skills of children in Liberia and children in Connecticut, USA. The authors noted that the differences in the way of life of these two groups of children were reflected in their different kinds of

mathematical skills. Gerdes (1993) gives more detail on early studies in mathematics and culture.

New interest in so-called "third world" mathematics came in those countries themselves as former colonies gained their independence and began to emphasize their own history and achievements in the arts, literature,….and even mathematics. This was especially noted as developers of new school curricula tried to use local examples to replace colonial applications of mathematics. For example, in West Africa, the Joint Schools Project picked up some ideas from new British mathematics curricula, but specifically used names, geographic locations, market situations, and cultural examples familiar to West African children. The Entebbe Project (officially, the African Mathematics Project), even while following the "modern math" curricular theme that was sweeping the United States in the 1960s, purposely included relevant cultural examples in examples and word problems.

A similar story happened in the United States as the civil rights movement overflowed into school curricula and concerns were raised about Eurocentric curricula and the resulting interest in countering past neglect by including the achievements of African Americans (and later, other minority groups). This was first seen in literature, history, and the arts, but soon even science and mathematics joined the "multicultural" movement, again by seeking a broader range of cultures for examples and by including historical references to African-American scientists and mathematicians.

The 1970s saw new writing on mathematics of non-Western cultures, probably best exemplified by the work of Claudia Zaslavsky. Zaslavsky was a high school mathematics teacher in New York. In the late 1960s, her son was teaching in Tanzania and she went to visit him. Like all good teachers, she was always on the lookout for materials to use in her teaching,

and various examples of mathematics in the local culture caught her attention. Not only did she put much of this material into her own lesson plans, but she also continued to make trips to Africa and did research in the United States, eventually producing *Africa Counts: Number and Pattern in African Culture* (1973), which became one of the first books to take a broad view of mathematical examples in African culture. (She followed this with several other books, e.g. Zaslavsky (1996) on using examples from other cultures in mathematics classes.)

As more mathematics educators began to pay attention to issues of mathematics in culture and society, Ubiratan D'Ambrosio of Brazil emerged as a spokesman. D'Ambrosio had been considering social, cultural, and political issues in mathematics and the history of mathematics for many years. He recognized that this approach could be valuable for a broader education and stronger social conscience of mathematicians and mathematics educators, especially as mathematics was increasingly interacting with societal issues. As stated in the introduction, his plenary address at ICME-5 in 1984 is often considered the real start of the field of ethnomathematics and that presentation remains an important document for defining the field. A sign that his suggestions had been heard came at the following Congress, ICME-6 in Budapest, in 1988, when an entire day of the conference was set aside for discussion of "Mathematics, Education, and Society," including sessions on social-cultural issues in mathematics, which, by this time, was labeled "ethnomathematics".

Meanwhile, the International Study Group on Ethnomathematics (ISGEm) was launched the at the 1985 meeting of the National Council of Teachers of Mathematics (NCTM) in San Antonio, Texas. Since 1985, at every annual meeting of NCTM there has been a meeting of ISGEm (or, later, the North American chapter, called the North American Study Group on Ethnomathematics (NASGEm)). Other chapters and less formal groups were formed elsewhere

around the world, notably in southern Africa and Brazil. Each group holds meetings and conferences to exchange news, research, and ideas. In 1998, the first International Conference of Ethnomathematics was held in Granada, Spain, home to a classic ethnomathematics-related site, the Alhambra. A pattern of quadrennial conferences began and subsequent meetings were held in Ouro Preto, Brazil (2002), and Auckland, New Zealand (2006). The next will be in Towson, Maryland, USA, in 2010.

From early in the development of ethnomathematics, it seems there four major areas of research: (a) theoretical and philosophical; (b) data gathering from the field, finding mathematical examples in various cultural groups (often, but not always non-Western); (c) applications of ethnomathematics in classroom settings; and (4) using ethnomathematics in working in non-Western settings, in and out of the classroom.

D'Ambrosio (1992) has led the theoretical and philosophical discussions, though others have made further contributions, trying to sketch out exactly where ethnomathematics ideas come from and how they fit into broader philosophical schemes. Recently, this area has also been represented in writings and actions on the role of mathematics in politics, social justice, and equity. For example, ethnomathematicians contributed to an NCTM (1997) yearbook on equity issues in mathematics classroom, and Gutstein and Peterson (2005) offer many examples of these issues. Also, ethnomathematicians have been involved in the RadicalMath group, which sponsored the recent conference, "Creating Balance in an Unjust World: Conference on Math Education and Social Justice."

Data gathering might be considered the "anthropological" branch of ethnomathematics, the source of examples of mathematics in other cultures that forms a large part of the content base of much other work. This includes examples of counting and measuring systems;

mathematics in crafts, architecture, design, and the arts; and mathematical thinking in many aspects of daily life and the structures of society. Zaslavsky's work on African mathematics opened this part of the field, and Ascher (1991) and Ascher (2002) gave many examples from around the world. Gerdes (1997, 1998, 1999, and other works) has been prolific in tying examples from Mozambique, Angola, and Congo to Pythagoras' Theorem and other mathematical ideas—and to philosophical ideas also. Bishop (1988) offered a useful structure for organizing such study. He named six activities that all societies do, all with mathematical implications: counting, measuring, locating, explaining, designing, and playing. Several studies have used that structure as an outline of their search for examples. Eglash (1999) went beyond basic anthropological data collection to fit the examples into a sophisticated mathematical context.

Since many ethnomathematicians came to the field as mathematics teachers, much of the interest is finding ways to incorporate ethnomathematical examples into classroom mathematics curriculum. Increasingly school textbooks have included sidebars or even direct text content of mathematics in other cultures. The last two decades have seen a growing number of presentations at mathematics education conferences and articles in teacher journals and yearbooks (such as NCTM, 1995, and NCTM 1997) with suggestions for using ethnomathematical examples. Again, it might be said that Zaslavsky was an early proponent of this area of work, especially in her later books, such as Zaslavsky (1996).

Some mathematicians, ethnomathematicians, and especially mathematics educators work directly in a cultural setting (often non-Western) where an ethnomathematical point of view contributes directly to their work. They relate to their society by bringing local examples from outside the stream of "standard" mathematics into curriculum and other applications. Often this

work provides validity to local mathematical thinking and makes the classroom closer to society. Two examples from Brazil demonstrate this idea: a study of urban Brazilian children who do sophisticated arithmetic as they sell items on the street (Carraher, 1988); and the use of the measurement techniques of unschooled farmers of Brazil's Landless People's Movement to compare with school measurement formulae (Knijnik, 1997). Some mathematics educators noted that mathematics—and especially its cultural connections—could be valuable tools for education in oppressed societies. Powell and Frankenstein (1997) provided examples from several countries, such as Fasheh (1980) from Palestine, who wrote that mathematics could teach independent thinking—which could be a radical, even subversive idea in certain closed societies.

The past twenty-three years have seen the field of ethnomathematics reach into many areas, but work really has only just begun. At the formation of the International Study Group on Ethnomathematics, the leaders chose the words "Study Group" for the name, since, they said, we certainly do not have all the answers and understandings of this new field. Rather, we need to study it. We do not claim to be all-knowing experts, but students hoping to continue to learn more. Now, nearing the quarter-century mark, the challenge is to decide the direction for the field to move in the next quarter century. It is assumed that the work areas outlined above will all continue, but questions remain. How does ethnomathematics theory fit into a broader view of the history and philosophy of mathematics? How does ethnomathematics relate to other studies of culture, sociology, and even political thought? How much of an impact does ethnomathematics make in school curricula and how does that affect student affective and cognitive learning. These questions cannot be answered in a single paper or even an entire conference, but the process must begin.

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