ETHNOMATHEMATICS: A LIBERATION FROM THE YOKE OF EUROCENTRISM OR THE BIGGEST DISASTER THAT COULD BEFALL MATHEMATICS EDUCATION

Stuart Rowlands and Robert Carson

University of Plymouth and Montana State University

Based on a review of the literature from practitioners in the United States, the introduction to this session will argue the latter.

INTRODUCTION: WHAT IS ETHNOMATHEMATICS AND WHY THIS RESEARCH REPORT?

The handout by Greene, 'Good-Bye Pythagoras?', will serve as a good introduction to the confusion that is ethnomathematics, for it states:

> But even the most ardent professors of ethnomathematics say they are not trying to replace the great Greek and other European thinkers who have shaped modern mathematics. Instead, they say, they are blending European ideas with African, Asian, Native American, and other mathematical innovations, teaching both European and non-European practices (Greene, 2000, 3rd page).

This research report will show that, contrary to Greene, advocates of ethnomathematics *are* in fact trying to replace Greek and European contributions in the history of mathematics and with a pedagogy that is essentially a study of non-European practices that are not, by themselves, mathematical.

It must be stated at the outset that this report recognises the contributions made by many different and diverse cultures in the historical development of mathematics and that there is plenty of evidence of mathematical activity among peoples all over the planet. 'Mathematics is not only a Western cultural phenomenon, but one which appears in many diverse civilizations' (Katz, 1994, p. 29) and we would agree with Katz that ethnomathematics *would* make a valuable contribution to the curriculum *if* it demonstrated how mathematical ideas grew out of the needs of various peoples [1]. However, we will attempt to show that ethnomathematics does not make this contribution.

So far, ethnomathematics has had little influence in the UK, but it is gaining a very large influence amongst teachers and educationalists in the United States. The introduction to Greene's (2000) article gives an indication of this and the National Council of Teachers of Mathematics 1997 Yearbook (NCTM, 1997) is given over to 'multicultural and gender equity' which includes many references to ethnomathematics. The reason behind this research report is to highlight the confusion and contradictions in ethnomathematics that we may have to face in the near future.

So what is ethnomathematics exactly? Is it a mathematical study or an anthropology expressed mathematically? Is it an attempt to describe another culture with the language and concepts of one's own or is it an attempt to describe the world as the 'ethnomathematician' sees it? Is ethnomathematics culturally specific such that no definition or description can be made without losing that specificity? The difficulty in answering the question is that no one really knows, including its most ardent advocates! Despite the many articles, the question as to what *is* ethnomathematics is a controversial one and there exists differences in opinion between many of its advocates, for example, D'Ambrosio, Gerdes and Ascher (see Barton, 1996).

After highlighting its popularity in the United States and giving some indication as to what it is, Greene finally illustrates ethnomathematics with an example from Arthur B. Powell:

> A man in North Africa must cross a river with a jackal (a predator), a goat (potential prey), and fig leaves (a potential snack for the goat). He has a boat that can hold him and two other items at one time. Neither the jackal and the goat nor the goat and the fig leaves can be left alone together on either shore. How can the man get the jackal, the goat, and the fig leaves across the river? (Greene, 2000, 9th page).

The familiarity of the problem, for example,

> The following is an ancient (medieval) puzzle. A showman needs to carry across a river his wolf, his goat and a stack of cabbages. Left unsupervised the goat would eat the cabbages.....(MEI, 2000, p. 40).

is probably an attempt by Greene to reassure the sceptic that it isn't good-bye Pythagoras! Below we will show that ethnomathematics is the very attempt to say good-bye!

A REVIEW OF THE NCTM 1997 YEARBOOK

The book begins with Croom who examines the changes needed for equity in the curriculum: '[m]ultiple learning situations must be provided that build on students' prior knowledge and cultural backgrounds' (NCTM, 1997, p. 4). He also states that ethnic groups and females must be afforded the same opportunities to learn the 'higher-level mathematical concepts as their upper- and middle-class white male counterparts' (p. 5). However, how prior (sociocultural) knowledge to be reconciled with, say, 'white, male, upper-class' calculus or pre-calculus algebra is not explained. The hidden agenda seems to be 'equity' obtained by replacing 'Eurocentric male mathematics' with higher-level concepts in ethnomathematics and this is betrayed by many of the subsequent articles.

For example, Davidson and Cramer argue that for true equity in the mathematics classroom, *fundamental and all-encompassing changes in the curriculum* must be made – changes that incorporate mathematical ideas from all over the world into the everyday life of the classroom – as opposed to multicultural enrichment activities during, say, one month in the year. The focus is on ethnic traditional skills and the

mathematical investigation of cultural artefacts - which is fine as a cultural activity but it reduces mathematics to multicultural art and design and presupposes that students from ethnic minorities are previously aware of such knowledge. The authors state:

> Children who enter school with an understanding of the dominant culture do not need help from the school system in understanding that culture. Children who come from cultures with different rules need to be taught, in school, the rules of the middle- and upper-class white culture of power to have greater access to jobs, housing, education, power, and general success in our society (Delpit 1988). (NCTM, 1997, p. 136)

Children from the dominant culture do need help in understanding science/maths. However, if children from different cultures are to be afforded the same opportunities as children from the dominant culture then they too have to be encultured in the scientific disciplines of that culture. Unwittingly, Davidson and Cramer are arguing the case in terms of equity for the teaching of 'Eurocentric' math.

According to Masingila and King (NCTM, 1997), ethnomathematics is the examination of 'mathematical practices' of other cultures such as basket weaving, building houses, counting, geometry in art etc. However, many of these practices may not necessarily be mathematical [2] and for the class to 'abstract' the 'relevant' mathematics (which begs the question as to how this may be possible) may have nothing to do with the actual mathematics of the relevant culture. A trivial example of the mathematics required by a particular pharmacy clerk is given on page 116 and the arithmetic necessary for the student to analyse this example *may have to be learnt and understood prior to handling this example*.

According to Malloy, '[m]any mathematics educators believe that students' enculturation into the mathematics community is significantly related to their mathematical-strategy building and achievement (Suydam 1980)' (NCTM, 1997, p.23). It certainly seems the case that many mathematics educators believe this, but this belief carries the implication that cognitive ability in mathematics is somehow related to ethnic origin - that in some sense, mathematics is related to 'race' in the sense that different ethnic origins create different insights. Perhaps Malloy would agree with:

> Education shall afford positive recognition of what is common as well as of what is diverse in the religious and cultural way of life and the language of the inhabitants....Each population group has the right to develop syllabuses in accordance with the world view and within the cultural framework of the population group itself.....The Government reaffirms that, in terms of its policy that each population group should have its own schools, it is essential that each population group should also have its own education authority/department... (*White Paper on the Provisions of Education in South Africa* **1983**, taken from Vithal & Skovsmose, 1997, p. 136).

According to Campell & Rowan, '*mathematical power* for all cannot be fully realized if the classroom environment limits any child's access to challenging mathematics

instruction' (NCTM, 1997, p.61) which is a sentiment expressed throughout the book, and yet much of the book trivialises mathematics to problem solving limited to everyday contexts. *We therefore have a two-tier system proposed whereby mathematics as an academic discipline becomes only accessible to the most privileged in society and the rest learn multicultural arithmetic within problem solving as a life skill.*

Swetz's appears to cut the Gordian knot from his multicultural colleagues by referring to mathematics as a universal endeavour that should be taught through its history and that students 'who have in the past felt culturally, racially, or sexually disenfranchised from mathematics can find its history empowering; they can realize that mathematics belongs to all people' (NCTM, 1997, p.121). However, he downplays the Greek heritage to this universal endeavour which is somewhat curious, especially since secondary school mathematics is rarely, if ever, taught through its history. Why downplay the Greek heritage? This issue is discussed in the next section.

THE CONTRADICTIONS OF ETHNOMATHEMATICS: A REVIEW OF POWELL & FRANKENSTEIN'S 'ETHNOMATHEMATICS, CHALLENGING EUROCENTRISM IN MATHEMATICS EDUCATION'

In a brief historical overview of mathematics education that supposedly goes back to the distinction between 'scholarly' mathematics of the ideal education of the Greeks (that 'maintains the economic and social structure') and the 'practical' mathematics of the 'manual worker', D'Ambrosio states

> [W]e will call *ethnomathematics* the mathematics which is practised among identifiable cultural groups, such as national-tribal societies, labor groups children of a certain age bracket, professional classes, and so on. Its identity depends largely on focuses of interest, on motivation, and on certain codes and jargons which do not belong to the realm of academic mathematics [the mathematics of the 'elite']. We may go even further in this concept of ethnomathematics to include much of the mathematics which is currently practised by engineers, mainly calculus, which does not respond to the concept of rigor and formalism developed in academic courses of calculus.....And builders and well-diggers and shack-raisers in the slums also use examples of ethnomathematics (Powell & Frankenstein, 1997, p.16).

For D'Ambrosio, ethnomathematics *does not belong to the realm of 'academic' mathematics*. Calculus, it seems, forms a part of ethnomathematics provided it does not respond to rigour and formalism – and this seems to be the ethnomathematician's 'beef' with the Greeks. Surely if the broad mass of people learned the 'academic mathematics' that was reserved for the 'elite', then the 'focus of interest' may shift from *not having to use* the mathematics appropriate for the slums.

For Ascher & Ascher, 'Ethnomathematics is the study of mathematical ideas of nonliterate peoples' (Powell & Frankenstein, 1997, p. 26). If one were to respond that the purpose of education, including mathematics education, should be to transform non-literate peoples into literate ones, then you might run the risk of being accused a

racist/Eurocentrist who holds the view that most of the peoples in the world are our intellectual inferiors and that higher technology goes with higher intelligence. However, while it is most certainly the case that the majority of peoples in the world live in poverty because of the domination of Western colonial powers, nonetheless a challenge to that domination begins with literacy: *ethnomathematics runs the risk of maintaining the status-quo through the glorification of the knowledge that already exists rather than transforming knowledge to the level that has been utilised in that domination.* Despite any good intention, ethnomathematics is the attempt to equalise everything down to the poverty of the 'builders and well-diggers and shack-raisers in the slums'.

Much reference has been made to the supposed 'Eurocentric and male-centric myth' expressed by Kline:

> [mathematics] finally secured a firm grip on life in the highly congenial soil of Greece and waxed strong for a brief period. In this period it produced one perfect flower, Euclidean geometry. The buds of other flowers opened slightly and with close inspection the outlines of trigonometry and algebra could be discerned; but these flowers withered with the decline of Greek civilization, and the plant remained dormant for one thousand years. Such was the state of mathematics when the plant was transported to Europe proper and once more embedded in fertile soil. By A.D. 1600 it had regained the vigour it had possessed at the very height of the Greek period and was prepared to break forth with unprecedented brilliance. If we may describe the mathematics known before 1600 as elementary mathematics, then we may state that elementary mathematics is infinitesimal compared to what has been created since (Kline 1972, p.27).

This is a complete quote, but unfortunately many advocates of ethnomathematics (e.g. Powell & Frankenstein, Joseph, Anderson, see Powell & Frankenstein, 1997) state this passage selectively in parts so as to leave the impression that Kline completely downplays the contributions made by the Arabs (Joseph goes further by stating that this statement 'ignores a substantial body of research evidence pointing to the development of mathematics in Mesopotamia, Egypt, China, pre-Columbian America, India, and the Arab world', Powell & Frankenstein, 1997, p. 65, and for Anderson, this statement is a justification of racism and imperial rule). However, taken as a whole, this passage puts into context the significance of the development of mathematics during the scientific revolution. One also has to bear in mind that Kline's book is specifically on 'Mathematics in Western Culture': *the title of the book*! In the interlude between the death of Hypatia at the hands of a mob of Christians to the Renaissance, Kline attributes the development of mathematics to the Hindus and Arabs whose ideas 'were not absorbed into the body of mathematical learning, however, until well into the seventeenth century' (p.116). Kline also refers to the principle of place value, attributed to the Babylonians, which 'is so important that it merits a bit of discussion' (p.32) and that 'Babylonia is, in fact, considered to be the source of some of Euclid's knowledge of algebra. Whereas the Babylonians developed a superior arithmetic and algebra, the Egyptians are generally considered

to have surpassed them in geometry' (p.33). *The point must be stressed that due to the scientific revolution of the 1600's, the leap in mathematical development was such that its previous history pales in significance!*

Joseph, in his rewriting of the history of mathematics, states 'In his book, *Black Athena* (1987), Martin Bernal has shown how the respect for ancient Egyptian science and civilization, shared by ancient Greece and pre-nineteenth-century Europe alike, was gradually eroded, leading eventually to a Eurocentric model with Greece as the source and Europe as the inheritor and guardian of the Greek heritage' Powell & Frankenstein, 1997, p. 63). It is doubtful whether the Egyptian contribution has been eroded, but if we consider ancient Egypt as *the* source of a development inherited by Europe, *then why are advocates of ethnomathematics eager to downplay this development* (of a body of abstract knowledge that is primarily deductive)?

NOTES

1. Usually, an emerging agricultural society finds the need to account for taxation and ownership, etc. What happens in the European development, following Greece, India, the Arabs, etc., is an increasing departure from concrete accounting, into a symbol-based system of thought that produces its own architectonic structure. That is the part of the mathematical conversation schools are supposed to be drawing students into (although now that everything has only instrumental value we are rapidly forgetting why that should be, or what benefits are expected to accrue).

2. Any practice may be described mathematically, but that does not mean to say that the practice is mathematical. For example, laying the dinner table may be described as a mapping of 1 plate, 1 knife etc with each tablemat, but laying the table is *not* a mathematical activity!

REFERENCES

Barton, B.: 1996, 'Making Sense of Ethnomathematics: Ethnomathematics is Making Sense', *Educational Studies in Mathematics*, **31**, 201-233.

Greene, E.: 2000, 'Good-Bye Pythagoras?', *The Chronicle of Higher Education*, Oct. 6, http://chronicle.com

Katz, V. J.: 1994, 'Ethnomathematics in the Classroom', *For the Learning of Mathematics*, **14**, 26-30.

Kline, M.: 1953, *Mathematics in Western Culture*, Penguin, Harmondsworth.

MEI.: 2000, *Decision and Discrete Mathematics 1*, 2nd edition, MEI Structured Mathematics, Hodder & Stoughton, London.

NCTM.: 1997, *Multicultural and Gender Equity in the Mathematics Classroom: the Gift of Diversity* (J. Trentacosta & M. J. Kenney, eds.), The National Council of Mathematics Teachers 1997 Yearbook.

Powell, A. B. & Frankenstein, M.: 1997, *Ethnomathematics: Challenging Eurocentrism in Mathematics Education*, SUNY, NY.

Vithal, R. & Skovsmose, O.: 1997, 'The end of Innocence: A Critique of ''Ethnomathematics''', *Educational Studies in Mathematics*, **34**, 131-157.