Whose Mathematics? Our Mathematics! A Comment on Mariana Leal Ferreira's Book, *Mapping Time, Space, and the Body*

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In her paper in these proceeding and her new book, "Mapping Time, Space, and the Body", Mariana Leal Ferreira enchants the reader with the creative role that mathematical thinking plays in the lives of Indigenous peoples in Brazil. The Indigenous applications of mathematics make a good starting point for school mathematics. However, the false idea that school mathematics is "white" mathematics remains largely unchallenged. In this commentary, I provide some sources for the multicultural roots of school mathematics.

Mariana Ferreira's paper described some unique, original, and diverse mathematical ideas of Indigenous peoples of Brazil. Her book, "*Mapping Time, Space and the Body: Indigenous Knowledge and Mathematical Thinking in Brazil,*" develops these ideas in greater depth. It was thrilling to feel the pride expressed by Indigenous teachers as they pushed back against racist statements that "Indians could not do mathematics." But it made me sad to read that school mathematics was called the "whites' mathematics." How did we come to believe such a false version of the history of mathematics?

In the colonial period, vast stores of wealth were stolen from the peoples of the Americas, Africa, and Asia. Among the most precious possessions stolen was the people's history. In fact, the whole history of culture and civilization was rewritten to justify colonialism, slavery and modern imperialism (Bernal, 1987, pp. 1-2). The rewritten history claimed that white men in Europe were the founders of mathematics, science, art, culture, law, and philosophy. This version of history served the imperialists who claimed that whites were superior and people of color inferior.

It may sound crude but this false version of history is still taught today. In the case of Africa, the motivation for rewriting history was

explained by the great African American scholar, W. E. B. DuBois, back in the 1940s. The Europe-centered "rationalization" that DuBois exposed turns the true history of mathematics on its head.

> The rise and support of capitalism called for rationalization based upon degrading the Negroid peoples. It is especially significant that the science of Egyptology arose and flourished at the very time that the cotton kingdom reached its greatest power on the foundation of American Negro slavery (DuBois, 1974, p. 99).

I believe the study of ethnomathematics shows that all peoples have created mathematics. Would it not be reasonable, then, to look for the origins of mathematical thinking in Africa, the birthplace of the modern human species?

Recently, a few archaeologists have looked in Africa for early evidence of what is called "modern behavior." Modern behavior includes abstract thinking and symbolic representation, essential features of mathematical thinking. The standard history taught today places the origin of modern behavior in Europe (Southern France and Spain) 30,000 to 40,000 BP (before the present era). But archaeologists, digging in Africa, have found much earlier evidence of modern behavior. The artifacts they found included design work and a saw-toothed harpoon that date back to the Middle Stone Age (MSA), 200,000 BP to 40,000 BP. These artifacts root the origin of modern behavior in Africa, before *Homo sapiens* spread to Europe (Lumpkin, 2008).

Even the numerals used in world commerce are not "white" or European. Modern numerals were developed in India with additions by Islamic mathematicians in Asia and Africa. In the US, K-12 school mathematics rests on a foundation created by African and Asian mathematicians, not "whites". Some examples are listed at the end of these comments. Also listed are some theorems developed by Asian and African mathematicians long before they were known in Europe. These theorems have been renamed and are now known by the names of European men. That practice adds to the false idea that mathematics is a "white" subject, rather than the heritage of all humanity.

Amerindian Contribution

What contribution did the peoples of America make to the development of mathematics? I believe that the Indigenous peoples of the Americas made a huge contribution. For example, the Olmec and Maya civilizations of Central America developed a positional numerical system including a zero position holder. That may have been the earliest zero symbol ever used in a positional-value system of numerals. In South America, the Aymara and Inca civilizations also developed the science of astronomy, requiring extensive calculations.

Their knowledge of mathematics and science made it possible for these civilizations to create the great stores of wealth stolen by the European invaders. This stolen wealth provided major funding for the European Industrial Revolution. In turn, the Industrial Revolution led to a great expansion of European science, mathematics, and other branches of knowledge. As Karl Marx put it in *Capital,* on the sources (accumulation) of European capital:

> The discovery of gold and silver in America, the extirpation, enslavement, and entombment in mines of the Indigenous population of that continent, the beginnings of the conquest and plunder of India, and the conversion of Africa into a preserve for the commercial hunting of black-skinned people are all things which characterize the dawn of the era of capitalist production. These idyllic proceedings are the chief moments of primitive accumulation (Marx, 1967, p. 751).

And further, on the birth of European capitalism:

> …capital comes dripping from head to foot, from every pore, with blood and dirt (Marx, 1967, p. 760).

The potential impact on mathematics education of a corrected, truthful version of the origins of school mathematics is enormous. My personal experience in high school and community college teaching has reinforced this conviction. Combined with knowledge of ethnomathematics, it can lead to a truly multicultural mathematics curriculum. Relating instruction to the many cultures that produce mathematics can improve the learning of mathematics and increase

educational equity. In this quest, Ferreira's new book, *Mapping Time Space, and the Body*, makes a valuable contribution.

Some African and Asian Roots of Mathematics

Base 10 numerals	Egypt, 3200 BCE
Cipherization of numerals	Egypt (Boyer, 1944)
Positional value numerals	Mesopotamia, China, India
Right-triangle theorem	Babylonia, 1900 BCE
Proofs of right-triangle theorem	China, India, before Pythagoras
Chinese triangle	300 years before Pascal's birth
Formulas for areas and volumes	Babylonia, Egypt c. 1900 BCE
Debate, litigation, deduction	Ancient Egypt, 1850 BCE
Decimal fractions	Syria, 952 CE
Algebra	Mesopotamia, Egypt, India
Cubic equations, trigonometry and non-Euclidean geometry	Central Asia, c. 1000 CE to 1400 CE
Combinatorics	Islamic–Hebrew, North Africa, Spain (Katz, 1993, p. 277)
Infinite series, early calculus	Medieval India (Joseph, 1991, pp. 289-94)
Zero concept	India (Joseph,1991, pp. 241–43), Ancient Egypt (Spalinger, 1985)
Infinity concept	Ancient Egypt[1]

Some Re-Named Theorems

Babylonians knew that the angle inscribed in a semicircle is a right angle. It is now called "Thales' Theorem".

The Chinese triangle is called "Pascal's triangle".

The right triangle theorem was known in Babylonia 1100 years before Pythagoras, and "proved" in China and India 300 to 600 years before Pythagoras.

The Chinese solution of systems of linear equations is called "Kramer's rule".

The second-degree indeterminate equation of Brahmagupta, c. 625, is called "Pell's equation" after John Pell (1610-85).

Nasir-al-Din's quadrilateral is called the "Saccheri quadrilateral" (Boyer, 1968, p. 111).

The root extraction method developed in 3rd century China is called "Horner's method" (Li & Du, 1987, p. 111).

Decimal fractions are credited to Stevin although al-Uqlidisi used them c. 950 (Berggren, 1980, pp. 37-39).

Madhava's series from Kerala, India (c.1400) are known today as the "Gregory series" for arctangent, the "Leibniz series" for pi, and the "Newton power series" for sine and cosine (Joseph, 1991, pp. 289–294).

Notes

1. Ritner, R. K. (Personal email 6/10/13. Quoted with permission). "You are correct that the word "heh" originally meant "million." However, its usage in actual counting fell into disuse before the New Kingdom (Gardiner, Egyptian Grammar, 3rd ed., p. 191) and was replaced by multiples of "hefen" (10,000). As a result, the word "heh" became a term attached to objects signifying "a great number without end" (Woerterbuch der Aegyptischen Sprache, vol. III, p. 158: "unendlich grosse Zahl/ unendlich langen Zeit." This is often inexactly translated as "many" or "millions and millions."

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