School Daze: A Critical Review of the 'African-American Baseline Essays' for Science and Mathematics

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These essays are riddled with pseudoscience and pseudohistory. They should not be used for the training of teachers or the teaching of students.

In the early 1980s the Portland Public School District in Portland, Oregon, was faced with the task of preparing a court-ordered desegregation plan. A consultant to the school district, Asa Hilliard of Georgia State University, suggested the concept of the "African-American Baseline Essays" as part of Portland's plan.

The baseline essays were conceived as short stories presenting the history, culture, and contributions of Africans and African-Americans to art, language, mathematics, science, social studies, and music. These essays were to serve as reference and source materials for teachers in much the same way as textbooks. The "African-American Baseline Essays" have been adopted by the Portland and Detroit public school systems; they have been seriously considered for adoption by public school systems in Atlanta, Chicago, and Washington,


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D.C. (Ortiz de Montellano 1991).

Although the authors of the "African-American Baseline Essays" were supposedly selected because of their knowledge of their specific disciplines and because of their expertise in African and African-American history, the scholarly credentials of the authors of the science and mathematics essays are highly suspect. The author of the science essay is Hunter Havelin Adams III, who is described in the foreword to the essays as a "research scientist at Argonne National Laboratory." Adams was not, in fact, a research scientist but a hygiene technician who had only a high school diploma (Ortiz de Montellano 1991).

The mathematics essay was written by Beatrice Lumpkin, associate professor of mathematics at Malcolm X College (a community college in Chicago). Lumpkin's scholarly writings appear to be confined to brief notes in *Historia Mathematica* and articles in *Journal of African Civilizations.* None of these works contains any original work in either mathematics or history. Lumpkin is also the author of a historical novel and a children's book about ancient Egypt.

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In the Beginning

Beatrice Lumpkin begins her mathematics essay with a discussion of prehistoric African systems of numeration. The discussion centers on the Ishango bone, an artifact excavated in Zaire that has been dated to 6500 B.C. (Marshack 1972). The Ishango bone is engraved with a series of parallel scratches having varying lengths and grouped according to some system. A variety of explanations of the marks have been advanced: They may represent a multiplication table, a game tally, or a calendar.

The reader of the mathematics essay is clearly intended to infer that systems of numeration originated in Africa. However, the Ishango bone is a rather recent example of a type of inscribed artifact produced by Paleolithic cultures stretching from the Iberian Peninsula to the Russian steppes. Most of these artifacts have been found in Europe. These facts are easily gleaned from Alexander Marshack's *The Roots of Civilization* (1972), a source Lumpkin cites in the mathematics baseline essay and in other writings.

Way Down in Egypt Land

A key concept running through the "African-American Baseline Essays" is that Egypt was an African civilization. This means something beyond the obvious fact that Egypt is located in Africa. In the science essay, Adams repeats the claim of Senegalese physicist Cheikh Anta Diop that the ancient Egyptians were descended from central equatorial and northwestern African ethnic groups (Diop 1982). Physical anthropologists, however, do not accept Diop's conclusions. Brace et al. (1993) have presented the results of a comparison of 24 craniofacial measurements made on skeletal material from Egypt, Europe, North Africa, Nubia, Somali, India, Asia, and North America. The measurements chosen were ones that are known to be genetically controlled, but only trivially adaptive. These researchers concluded that the ancient Egyptians are much more closely related to the populations of neolithic Europe, modern Europe, North Africa, and India than to the populations of sub-Saharan Africa. These conclusions are consistent with the research of other physical anthropologists (see Brace et al. [1993] for a complete list). The inclusion of discussions of Egyptian science and mathematics in the "African-American Baseline Essays" therefore is based on a fundamental misunderstanding of the biological relationships among the various African subpopulations.

Even if it were true that the ancient Egyptians came from the same racial stock as sub-Saharan Africans, the discussions of Egyptian science and mathematics in the "African-American Baseline Essays" would still be worthless for the training of public school teachers. Lumpkin's mathematics essay is merely shoddy scholarship, while Adams's science essay unites pseudoscientific claims with fanciful attempts at substantiation.

The science essay contains a number of diagrams purporting to demonstrate the ancient Egyptians' extraordinary scientific and mathematical sophistication. For example, Adams reproduces as a full-page illustration a site plan of the Temple at Luxor with a human skeleton superimposed on it to demonstrate that the Egyptian architects designed the temple so that its subdivisions would conform to the proportions of the human body. A cursory glance at the diagram reveals that while the skeleton's ankles and knees do indeed match crosswalls on the plan, none of the other joints (hips, wrists, elbows, or shoulders) corresponds to any significant feature of the temple. That the builders intended a correspondence between the temple and the human skeleton is rendered highly unlikely by another fact: The portion of the temple that is supposed to represent the cranium, rib cage, pelvis, and upper legs was built by Amenophis III; the remainder of the temple was built by Ramses II, approximately two generations later (Baines and Malek 1980).

Adams's science essay contains a healthy dollop of Great Pyramid mysticism. According to Adams, the geometry of the Great Pyramid encodes as follows:

> the value of pi, the principle of the golden section, the number of days in the tropical year, the relative diameters of the earth at the equator and the poles, and ratiometric [*sic*] distances of the planets from the sun, the approximate mean length of the earth's orbit around the sun, the 26,000-year cycle of the equinoxes, and the acceleration of gravity.

One of the figures accompanying the science essay also informs the reader that the height of the Great Pyramid multiplied by 10^9 yields 91,651,673 miles, approximately the mean distance from the earth to the sun.

This last assertion carries no weight as evidence that the Egyptians possessed an unusual level of scientific knowledge. There is no reason to multiply the pyramid height by 10^9 (other than to get the desired answer). If by chance the height multiplied by some simple factor did not give an approximation of the mean distance from the earth to the sun, another multiplier certainly could have been found that would give the distance to the moon, to the nearest star, or to the Andromeda nebula. Writing the product to eight significant figures incorrectly implies that the height of the Great Pyramid is known with the same precision. Adams is evidently unfamiliar with the concept of significant figures (taught to high school physics and chemistry students).

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Adams repeats a standard claim of Great Pyramid mysticism that the structure encodes a number of mathematical formulae. For example, the perimeter of the base divided by twice the height supposedly gives the value of pi (which is 3.14159265). Indeed if one performs this computation using the dimensions of the Great Pyramid, one gets a good estimate of pi (3.150685).

Pyramidologists like Adams characteristically restrict their attention to the Great Pyramid and all but ignore other Egyptian pyramids. Forty-seven royal pyramids are known to have existed. The heights and base dimensions of 22 true pyramids belonging to this group can be determined with a reasonable degree of accuracy (Baines and Malek 1980). If these dimensions are used to calculate pi, one obtains values ranging from 2.58 to 4.42. Furthermore, the value of pi calculated from the dimensions of a pyramid depends on the slope of its sides. Extant Egyptian mathematical papyri reveal problems dealing with the slopes of pyramids and use four different values for the slopes (Gillings 1972).

In another section of the science essay Adams discusses what he calls "psychoenergetics," saying, "The ancient Egyptians were known the world over as the masters of 'magic' (psi): precognition, psychokinesis, remote viewing and other underdeveloped human capabilities." According to Adams, psi was an exact science that was used to preserve the world order and protect the pharaoh. However, if the Egyptians were such powerful magicians, why were they conquered by the Persians? Why were ten revolts against the Ptolemies unsuccessful?

Adams subsequently informs readers that ancient Egyptian doctors were also experts in the healing technique now known as Therapeutic Touch. Readers of SKEPTICAL INQUIRER will be familiar with the unsubstantiated claims of the advocates of this fringe medical therapy. Adams is deeply confused about the distinction between science and pseudoscience.

Adams also has a penchant for wild extrapolation from limited data. He discusses a small model of a bird found in a tomb at Saqqâra in 1898. When a replica of this model was made from balsa wood and a horizontal stabilizer (not present in the original) added, the replica was able to glide a short distance (Messiha et al. 1984). However, balsa wood is roughly 20 times less dense than the sycamore wood from which the original artifact was made; consequently, the aerodynamic performance of the balsa wood replica was significantly different from that of the original. From this incompetent exercise in experimental archaeology, Adams leaps to speculations about the ancient Egyptians' use of transport and recreational gliders. The articles that Adams cites here were not written by professional Egyptologists.

Beatrice Lumpkin's treatment of Egyptian mathematics is marginally better than Adams's discussion of Egyptian science. It still violates the canons of historical scholarship in a number of ways. Lumpkin frequently cites her own fictional writings as authorities to substantiate her assertions. She also frequently omits facts, especially when those facts do not support her conclusions.

For example, Lumpkin states that the Egyptian value of pi was better than the biblical or Mesopotamian value of pi equal to three. Nine estimates of the value of pi were calculated before A.D. 1000. Of these, the Egyptian value was the second most inaccurate (Beckmann 1971). The use of a value of pi equivalent to 3.125 has been found in a Babylonian cuneiform tablet. This tablet is discussed in George Sarton's *A History of Science* (1966), a source cited by Lumpkin elsewhere in her mathematics essay.

There are grounds for doubting that the Egyptians had an understanding of the concept of pi (Bunt et al. 1976). The Rhind mathematical papyrus shows how the Egyptians calculated the area of a circle from its diameter. To get the area, 1/9 of the diameter is first calculated; this fraction is subtracted from the value of the diameter; and the result is then squared. This is equivalent to using a value of pi equal to 256/81. This procedure for calculating the area of a circle appears to have been developed empirically (Gillings 1972).

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Beware of Greeks

When Adams and Lumpkin attempt to deal with later historical periods than ancient Egypt, their accuracy as historians should be better because Greek science and mathematics are better documented than Egyptian science and mathematics. Adams has difficulty getting even the most basic facts correct about Alexander the Great and Alexandria:

> In fact, the Greeks called Egypt the seat of scientific knowledge and sent many of its [*sic*] most brilliant scholars there to study such as Thales, Democritus, and Pythagoras. Perhaps it was this reason Alexander made Alexandria, Egypt, the capital of his empire after he conquered Egypt in 325 B.C.

Alexander did not make Alexandria the capital of his empire. Alexander actually never saw the Alexandria to which he gave his name; he ruled from Babylon and Susa until his death. These facts are readily verifiable in the writings of ancient historians, such as Plutarch and Arrian. And contrary to the claims of both Adams and Lumpkin, Alexandria was not an Egyptian city. It was founded as a Greek colony and was not legally part of Egypt. In antiquity it was commonly referred to as "Alexandria near Egypt" (Sarton 1966; Fraser 1972).

Adams's version of Egypt under the rule of the Ptolemies is similarly a farrago of misinformation:

> Frequently, it is assumed that, during the Hellenistic period of Greek rule, the African character of Egypt was negligible, however, to the contrary, the Greeks practiced a policy of assimilation, marrying Egyptian women and even adopting Egyptian religion.

All of this is demonstrably false. There was no such policy of assimilation. In fact, for many generations the Greeks in Egypt disapproved of marriages with native Egyptians. It was also many generations before native Egyptians held high government offices or military commands. The Greek and Macedonian presence in Egypt has been compared to that of the Boers in South Africa and whites in the antebellum U.S. South (Bevan 1968; Lewis 1986).

The intellectual elite of Alexandria during the first century after the death of Alexander—the most creative period of Hellenistic mathematics and science—was composed almost exclusively of Macedonians and Greeks from outside of Egypt. Manetho, the historian to whom we owe the division of Egyptian history into dynasties, is the only identifiable Egyptian intellectual during this period (Sarton 1966; Fraser 1972).

Beatrice Lumpkin fulminates against the supposed racism of the writers of mathematics textbooks:

> Euclid of Alexandria, one of the greatest mathematicians of this era, lived and died in Egypt. There is no suggestion that he ever left Africa. Yet he is pictured in textbooks as a fair European Greek, not as an Egyptian. We have no pictures of these mathematicians, but we could at least visualize them honestly in costumes, complexions, and features true to the peoples and their times.

It is highly improbable that Euclid was a native Egyptian. He wrote in Greek and his name is a common Greek one. This name was sufficiently common in antiquity that Euclid the mathematician was confused with the philosopher Euclid of Megara (Heath 1926). It is also likely that Euclid lived for a time in Athens. The mathematical commentator Proclus preserves a tradition that Euclid was a Platonist (Morrow 1970). At the time of Euclid the books of Plato had not yet begun to circulate widely, making it likely that Euclid lived at some time in Athens and attended Plato's Academy. T. L. Heath, the leading expert on Greek mathematics and Euclid in particular, believed that Euclid must have studied at some time in Athens because it was only in Plato's Academy that he could have learned the mathematics that later appeared in the *Elements* (Heath 1926).

Euclid's *Elements* is also firmly a part of Greek mathematical traditions. Three earlier Greek mathematicians are known to have written similar elements of geometry (Morrow 1970). Significantly, one of these works was the mathematics manual written by Theudius of Magnesia for use by Plato's Academy (Heath 1926). Lumpkin is glowing in her praise of the *Elements:* "The logical arrangement of this work is so masterful the *Elements* dominated the teaching of geometry for 2,000 years." The abstraction of the *Elements* is Platonic, while the method of exposition (definition, common notion, postulate, and theorem) is Aristotelian (Heath 1926; Bunt et al. 1976). The extant Egyptian mathematical papyri have only the remotest similarity in form and content to Euclid's *Elements.*

Historians of mathematics consider the Egyptian influence on Greek mathematics to be minimal. This influence was confined to the very elementary geometry of the time of Thales, to practical methods of calculation (the branch of mathematics the Greeks called "logistika") and to the proto-algebra of Diophantus. The Greeks borrowed much more heavily from the mathematics of Mesopotamia (Heath 1921; Eves 1971; Fraser 1972).

Who Is Al-Khwārizmī and Why Is He In 'African-American Baseline Essays'?

When she reaches the Middle Ages, the period of Islamic mathematical dominance, Beatrice Lumpkin enthuses: "In summarizing the contribution of the African Muslim mathematicians, *especially those of the Nile Valley,* an author is overwhelmed by an embarrassment of riches." [Emphasis added.] The "African-American Baseline Essays" section on mathematics discusses eight Islamic mathematicians: Al-Khwārizmī, Abū Kāmil, ibn Yūnus, ibn al-Haytham, Omar Khayyam, Nasir Eddin, Al-Kāshī, and Al Qasadi. Of these, only Abū Kāmil and ibn Yūnus can be considered in any sense African. Beyond his appellation as the "Egyptian calculator," virtually nothing is known of Abū Kāmil's life (Levey 1980). Ibn Yūnus lived and worked in Cairo in the tenth century (Goldstein 1965; King 1980). Of the remaining Islamic mathematicians, only ibn al-Haytham had an association with Africa. Ibn al-Haytham (known to Europeans as Alhazen) was educated in Baghdad; he came to Egypt to participate in an unsuccessful project to dam the Nile River (Vernet 1965; Sabra 1980; Hogendijk 1985).

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The origins of the remaining Islamic mathematicians mentioned in the mathematics essay are well known:

- Al-Khwārizmī—Urgench in former USSR (Berggren 1986).
- Omar Khayyam—Nishapur (now in Iran) (Berggren 1986).
- Nasir Eddin—Khorasan in Persia (Eves 1971).
- Al-Kāshī—Kashan (90 miles north of Isfahan) (Berggren 1986).
- Al-Qasadi—Granada (mathematics baseline essay).

Lumpkin and Adams get many of the facts about the lives and works of Islamic mathematicians and scientists wrong. Both Lumpkin and Adams mention the Dar al-Hikma (House of Wisdom) established by the Fatimid rulers of Egypt in Cairo. Both essay authors have ibn al-Haytham working in the Dar al-Hikma; however, the only institution in Cairo with which ibn al-Haytham is known to have been associated is the al-Azhar Mosque (Sabra 1980). Lumpkin also describes ibn Yūnus working in the Dar al-Hikma. This is highly unlikely: The Dar al-Hikma was founded in A.D. 1005; ibn Yūnus made his last astronomical observation in A.D. 1003; and died in A.D. 1009 (Sourdel 1965; King 1980). The article on the Dar al-Hikma in the *Encyclopedia of Islam* (Sourdel 1965) does not mention the name of a single Islamic scientist in connection with the Dar al-Hikma.

The Transmission of Islamic Mathematics and Science to Europe

The science and mathematics essays distort the history of the transmission of Islamic science and mathematics to Europe. According to both Adams and Lumpkin, Europeans learned about Egyptian, Hindu, and Arabic mathematics and science through the translations of Constantinus Africanus (born in Carthage in North Africa). As Beatrice Lumpkin describes it, Constantinus "brought a precious cargo of manuscripts to Salerno, where a school was founded to translate and study the Arabic works." Characteristically, Lumpkin neglects to tell readers what manuscripts he brought to Salerno. Adams is similarly uninformative. The works that Constantinus Africanus translated were the medical treatises of Galen, Hippocrates, the Persian doctor Haly Abbas, and the Jewish physician Isaac Israeli (Castiglioni 1941; Crombie 1959).

Adams explicitly charges European scientists with plagiarizing the discoveries of Islamic scientists. For example, he asserts that ibn al-Haytham discovered the refraction of light and that credit for this discovery has been falsely ascribed to Isaac Newton. Not unexpectedly, Adams cites no authority for this extraordinary statement. The mathematical law governing the relation between the angle of incidence and the angle of refraction is commonly known as Snell's Law (after the seventeenth-century Dutch physicist Willebrord Snell). Ibn al-Haytham came close to discovering this law, but ultimately failed to do so (Al-Daffa' 1977).

According to Adams, Newton also has been improperly credited with the discovery of the law of gravity, saying it actually was discovered by Al-Khāzin. Adams has confused Al-Khāzin, a Sabaean mathematician and astronomer of Persian origin (Dold-Samplonius 1980), with al-Khāzinī, the author of the *Book of the Balance of Wisdom.* In mathematician al-Khāzinī's theory of weights, the weight of a body varies according to its distance from the center of the world. Accordingly, objects at the center of the world weigh nothing. This is a far cry from Newton's inverse square law for the force of gravity acting between two masses. At this point, the reader will probably not be surprised to learn that al-Khāzinī was actually a Byzantine Greek (Hall 1980).

Adams also charges that the work of the astronomer al-Battānī was stolen by Copernicus. Copernicus did indeed use some of al-Battānī's astronomical observations (Hartner 1980; Duncan 1976); Copernicus clearly acknowledged this use. In Book One of *On the Revolutions of the Heavenly Spheres* Copernicus explicitly cites al-Battānī as the source of the erroneous estimate that the sun's diameter is only ten times that of Venus (Duncan 1976).

Finally, Adams asserts that the works of al-Bīrūnī were plundered by both Galileo and Francis Bacon. Unless these Western scientists were able to read Arabic (which is doubtful) they could scarcely have taken any of their ideas directly from his works. None of al-Bīrūnī's books were translated into European languages during the Middle Ages or the Renaissance. Many have never been so translated. Having been born south of the Aral Sea in Khwārizm, al-Bīrūnī was not African. There is irony in Hunter Havelin Adams III invoking the name of al-Bīrūnī. In the words of one biographer, "Bīrūnī had a remarkably open mind, but his tolerance was not extended to the dilettante, the fool, or the bigot" (Kennedy 1980).

Conclusion

The science and mathematics essays in the "African-American Baseline Essays" are riddled with pseudoscience and pseudohistory. As tools for the training of public school teachers they are not merely worthless, but are likely to prove pernicious. Their fallacious modes of reasoning may dull the critical faculties of readers. The "scholarly" research displayed in both essays is too shoddy to serve as a model for any teacher or student. The essays will contribute to the growing tribalization of American culture. A purported goal of the "African-American Baseline Essays" is to "eliminate personal and national ethnocentrism so that one understands that a specific culture is not intrinsically superior or inferior to another." This statement is nothing but cant. Throughout the science and mathematics essays the genuine achievements of Greek, Arab, Persian, and European scientists and mathematicians are ruthlessly pillaged, and credit for them assigned to black African cultures on the flimsiest of grounds.

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