Chapter Five

Effective Decision-Making in Pluralizing the Content

"School Teachers' Blues" (excerpts)
Refrain
School teacher blues (school teacher blues)
I got them school teacher blues (school teacher blues)
School teacher blues
Nothing to lose but ma pay...
And that ain't nothin'
You know my fingers have turned purple
My master is like I chewed it
My mind is gettin' warped
From inhalin' ditto fluid
Refrain
And the problem when in public
Don't know what parents might say
They don't pay me quite enough
To make me act that way
Refrain
They say Johnny can't read
But what does Johnny have to know
Look at the competition
It's the age of video
Refrain

Chapter Five • Effective Decision-Making in Pluralizing the Content

Ohh, noble education
Rising tide of mediocrity
I points my finger to the home
And I views hypocrisy
Refrain

The women's blues group, Saffire, sings the "School Teachers' Blues." They lament the energy required to teach pitted against those perennial questions about the worth of the effort. Middle and secondary content-area teachers faced with pluralizing their curricula sing their own version of the blues. They express any number of concerns as they move toward pluralizing their curricula, making it more inclusive and multicultural. Change—even the idea of change—is often met with resistance. This is true for individuals as well as institutions, including educational organizations. Conservative by nature, schools experience the tension of the push toward curricular reform and the pull to maintain the status quo.

Chapter Five addresses the question, "What do culturally responsive teachers teach?" Many curriculum decisions are out of their hands with school departments, school districts, and state mandates directing what is taught, but that is why teacher participation and input in curriculum development is so critical; teachers, individually and to a greater degree collectively, can and should find ways to influence the curriculum taught in their schools. Many curriculum decisions will be based on their assumptions about knowledge, student learning, and the needs of students.

Curriculum development is often the area where teachers who want to be change agents first see themselves assuming this role and experiencing institutional resistance. As a beginning middle or secondary teacher, you have been able to concentrate on developing relationships with your students and have been able to implement culturally relevant teaching practices. By mid-year you are ready to be a more active member on the departmental curriculum committee, and it is then that you realize that your ideas of a more inclusive curriculum are up against state mandates for curriculum content and pressures to improve students' scores on statewide tests. Now might be a good time to reread the Introduction at the beginning of this text and turn to the section on change agents in Chapter Ten.

Implementing a multicultural curriculum at the elementary level is usually received enthusiastically; the expectation is that teachers will talk about famous women, men and women of color, and respect and appreciation for all kinds of differences.¹ The most controversial aspect of multicultural education at the elementary level often revolves around whether to acknowledge families

with same-sex partners. Concerns at the middle and secondary level focus on "whose stories" should be told and whose privileges should be unmasked. Will culturally relevant curriculum fractionalize us into ethnic/cultural/gender camps? Empowering middle and secondary students is seen as potentially more threatening.

In this chapter, we look at the various "blues" teachers face when they think about implementing multicultural education and present some general guidelines for pluralizing curricula. Banks's curriculum framework provides a good overview to different multicultural curriculum approaches. We conclude the chapter with a discussion of multicultural curricula for specific subject areas, a general plan for getting started, and the benefits of a culturally relevant curriculum for middle and secondary students.

THE MULTICULTURAL SCHOOL TEACHERS' BLUES

The "Too Much Information—Not Enough Time" Blues

Learning "multicultural information" for a specific discipline takes considerable time and energy. This information is not readily available in textbooks, and teachers must engage in independent research to find and include appropriate materials in their courses. There is also the concern over which perspectives to include. One of the myths about a multicultural curriculum is that all perspectives must be included. Teachers rightly panic at the thought of trying to mount that enormous task within the confines of a yearlong or, worse yet, semesterlong course.

We can apply the argument of too much information to any discipline. A natural by-product of the information age is that we are continually bombarded with new information or new perspectives on existing information. As teachers, we are dealing with an overabundance of information no matter what curriculum goals we have, and teachers will need to work together formally and informally. Diaz (1992) suggests that teachers need to develop multicultural literacy and integrate this information into their teaching repertoire so that they can be "congruent with the heterogeneity present in this nation as well as in the world" (p. 194).

We take seriously teachers' concerns for finding more time. How do teachers find more time? Obviously, developing priorities and recognizing that you can't "do it all" are general guidelines. In addition, experience at teaching also helps teachers become more efficient—they are more familiar with instructional preparation, they learn how to streamline grading, and they develop relationships with students and better techniques for classroom management. We cannot stress enough that teachers need to work with others. They should start small and look for new ways to restructure practices while synthesizing

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2 This question reflects the concerns of the mainstream. It assumes that groups are unaware of their own histories and experiences and that the present Eurocentric curriculum is creating unity.
new information. Many districts have grants available to teachers to support their developing new curricula. Many states mandate professional development that requires teachers to take courses or attend conferences and workshops to retain certification. A small group of committed colleagues could take advantage of professional development opportunities to advance their goals. As a change agent, you might be interested in radical and immediate change, but systemic change—change that alters the traditional ways institutions or professions operate—needs both consensus around a vision and leadership.

The “What to and How to Cover” Blues

Critics claim that a multicultural curriculum is too political or too politically correct. Was Columbus a hero or a heel? Did Edison invent the light bulb or did he take credit for work done by a Black man? Teachers are concerned about the truth, but what is the truth and whose version will be studied? Particularistic visions (such as Afrocentricism or Eurocentrism) are adversarial to more culturally pluralistic ones (those of Sleeter and Grant and Banks). Do we risk reducing the curriculum to the latest revelations of revisionist history or the most recent group who grabs our attention in the headlines?

Multiculturalists recognize the political nature of education (see Chapter One). In fact, making explicit the links between knowledge and the power behind it are goals of multicultural education. According to Banks (1996a), “the positions of both the Western traditionalists and the multiculturalists reflect values, ideologies, political positions, and human interests. Each position also implies a kind of knowledge that should be taught in the school and university curriculum” (p. 5). Multiculturalism’s emphasis on developing students’ critical thinking skills means providing them with a broad range of information from which they can draw their own conclusions.

The “My Content is Not Multicultural” Blues

Some middle and secondary teachers view their disciplines as outside the scope of multicultural education. Even as math and science teachers embrace culturally relevant instructional and assessment approaches, they might believe that their subject matter is “culture neutral.” Efforts to include famous women mathematicians or scientists of color are seen as incidental to the real content; force fitting multicultural information into the class is an inauthentic stretch.

Fortunately, several useful texts have been published in recent years that provide a sound rationale and framework for developing an inclusionary approach in the content areas. We will describe this further in the section dealing with specific subject areas.

The “My Students Are Not Diverse” Blues

Some teachers believe that because they teach in racially or ethnically homogeneous communities that multicultural education has less relevance for them. They question the significance of multicultural content for their students.
Moreover, sometimes the community is vocal, challenging teachers about the importance of such content.

Such concerns reflect a limited definition of multicultural education. Although some communities are less racially diverse than others are, cultural differences are still present. To recognize multicultural education as the purview of only urban centers or more racially heterogeneous communities overlooks the cultural impact of gender, social class, ability, and sexual orientation on an individual's identity. It also denies the reality of the global community young adolescents will live in!

**The “This Won’t Help My Students on the SATs” Blues**

Parents, teachers and administrators are concerned that multicultural education, no matter how noble, good, or just, will take away from the “real” purpose of education. Won’t the “basics,” that is, mathematical problem solving and reasoning abilities and skills in writing/composing and verbal reasoning be ignored? Won’t this subsequently affect students’ performance on standardized tests like the SATs or the ACTs?

Recent changes in the structure of the content and format of many standardized tests including the SATs and ACTs underscore test makers’ recognition of the link between culture and assessment. Such tests increasingly reflect the diversity of students in schools and the goals of multicultural education. The content of test items has become more inclusive, and more items require critical thinking and interpretations of multiple points of view. For many questions, students are asked to produce responses, rather than merely recognize answers. Instead of being penalized by the adoption of multicultural themes and strategies, students in these classes would be better prepared!

**Guidelines for Pluralizing Curriculum Content**

Teachers who have battled the blues and want to make a commitment to pluralizing their content need to think about knowledge in new ways. Multiculturalists view knowledge as a social construction. We have already looked at several examples of how language is never neutral (see Chapter One) and seen how multiculturalists are called to dig below the surface structure of language to understand its hidden meanings, power, and privilege. Knowledge, even information that has all the trappings of “hard evidence,” is influenced by the kinds of questions a society asks and the methods people use to obtain answers. If we videotaped two people talking, the tape would not be a neutral recording of events. Why, for example, have we chosen to record this conversation and not someone else’s? How do the speakers change their conversation because of the taping and how does their understanding of why they are being taped affect them? The cameraperson chooses the angles, the close-ups, and the lighting, which can influence what we see. Moreover, our eyes take in only a small fraction of the sensory data available. In the end, the lens is never neutral. “The knowledge construction process relates to the extent to which
teachers help students to understand, investigate, and determine how the implicit cultural assumptions, frames of references, perspectives, and biases within a discipline influence the ways in which knowledge is constructed within it" (Banks, 1996a, p. 337). This applies to the sciences as well as to the humanities.

Teachers do not have to know everything their students are to learn, but they need to understand the concept of knowledge construction and present students with examples from different vantage points. Teachers sometimes need to research marginalized voices and perspectives to supplement traditional texts. These curriculum changes involve not only including additional sources of information, but also the framing of assignments and teaching students new ways of interacting with the material. Students must also learn how to see themselves as constructors of knowledge.

Teachers are constantly faced with decisions about how much to cover and at what depth. A curriculum that responds to Sleeter and Grant's Multicultural and Multicultural and Social Reconstructionist approaches takes time and requires depth. However, the issue of too much information is not solely a problem for multiculturalists. The "too much information—not enough time" blues face everyone. All teachers (and school districts) will make decisions about what is included and what is excluded. For multiculturalists the "center of the curriculum no longer focuses on mainstream Americans, but on an event, issue, or concept that is viewed from many different perspectives and points of view. This is done while at the same time helping students to understand our common U.S. heritage and traditions" (Banks, 1996a, p. 339). As we will see, this statement is not just about history, but also relates to modes of scientific inquiry, for example.

Future middle and secondary teachers can use several criteria to guide the development of a culturally responsive curriculum, regardless of their disciplines. The curriculum should do the following:

1. Acknowledge that multicultural education and a multicultural curriculum is crucial for all students. This statement represents an assumption held by those developing the curriculum. The curriculum will reflect the underlying definition of multicultural education of the curriculum specialists and will evolve out of their thinking and experiences with the benefits to all students being an inclusive curriculum. A curriculum that views multiculturalism as critical for everyone will not save learning about people of color until their "week, month, day" of celebration, nor will it be an add-on to the traditional curriculum.

2. Develop materials that help students understand and appreciate diversity. Appreciation is a difficult outcome to predict. You might remember adults

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3 Thanks to the work of many scholars coming out of ethnic studies departments (including ethnic/cultural studies, women's studies, and so forth) the amount of information available is steadily increasing.
trying to help you develop an appreciation for okra or salsa. They might or might not have succeeded, but one thing is certain: You needed to have some contact or exposure to have a chance. If we look at diversity as including the voices, culture, contributions, and perspectives of many groups, then as a start, you need to expose your students to this information. The nature of how students are exposed to information also makes a difference. Are there certain contexts in which you might have been more inclined to develop a taste for okra or salsa?

3. **Include multiple, nonstereotypical perspectives and voices through the use of primary sources.** Students need to be taught the difference between primary and secondary sources—they can also be included in the search for locating these sources—as well as how individual positionality (see Chapter Three) affects how information is presented and understood. In Chapter One, we pointed out that differences in meaning can result from slight changes in word choice.

4. **Teach students how to recognize power and privilege inequities in society.** To develop curriculum that recognizes power and privilege, teachers must be sure that they maintain a level of awareness. Nieto’s definition of multicultural education spoke of a process. Part of that process for multiculturalists is to keep those concepts in the forefront of their thinking. They continue to ask themselves “In what ways are power and privilege operating in my life?” Pedagogically, the best way to teach students this awareness is by modeling our own awareness and through the kinds of questions we continue to ask them—questions that allow students to draw conclusions around power and privilege.

5. **Adopt a critical thinking dimension that incorporates complexity and responds to multiple interpretations.** Discuss problem solving strategies and generate appropriate options for action. Determine the relevance of content to students in the class and connect to current local and global issues.

6. **Incorporate ways of involving parents/families and community leaders in the classroom.** Draw on the expertise and experiences of family members and community leaders. Provide students with opportunities to listen to adults and help them understand how individuals interpret their experiences and construct knowledge. Link what students are learning to what others in the community are doing. (See Chapter 8.)

**Curriculum Framework**

Educators approach pluralizing their curriculum in a variety of ways. Their first resource is usually a textbook. “However, the content about ethnic groups in textbooks is usually presented from mainstream perspectives, contains information and heroes that are selected using mainstream criteria, and rarely incorporates information about ethnic groups throughout the text in a consistent and totally integrated way” (Sleeter and Grant as cited in Banks & Banks,
1997, p. 232). Teachers can’t rely on publishers to create their curricula and must find additional ways to make their materials be more inclusive.⁴

Banks (1997) has categorized the strategies teachers use to address the lack of ethnic and multicultural content in elementary and secondary classrooms and has identified four levels into which curriculum materials and assignments can be classified. These levels correspond to different multicultural goals and objectives. Again, we see how critical a teacher’s definition is in determining how multicultural education is implemented in her classroom. You might also want to check how each level matches our yardstick (that is, criteria) for culturally relevant curricula and how the levels reflect Sleeter and Grant’s approaches to multicultural education. (Also see “Incorporating Cultural Pluralism into Instruction” in the readings for a list of assignments related to Banks’s curriculum levels.)

**Contributions (Level 1)**

At this level, heroes, holidays, and some cultural elements such as food and music are inserted into the curriculum. For example, a teacher might do a unit on “Great Mexican American Writers” or “Women Who Have Made a Difference” or ask students to do research on sports played around the world. These units act as corollaries to the mainstream curriculum whose goals and structure remain unchanged. A social studies teacher might assign a project on famous Native Americans. “The criteria used to select ethnic heroes for study and to judge them for success are derived from the mainstream society and not from the ethnic community” (Banks, 1997, p. 233). Who is a hero, and what is deemed heroic, therefore, is filtered through a mainstream lens and might not fully reflect perspectives from the ethnic community. Lessons focus on an occasional “citing/sighting of the exotic.” Themes are discussed or studied on a special day (Martin Luther King Jr.’s birthday) or during a designated month (Women’s History Month) with little or no reference to these individuals or groups elsewhere in the curriculum. In middle schools, “Celebrate Diversity” days are popular events, and middle school teachers often find Level 1 an easy starting point, but sometimes they stay at this level. Turn to page 149 and read the examples of the Contributions Approach listed. How many of these lessons have you experienced either as a student or a teacher?

**Additive (Level 2)**

This approach pluralizes the curriculum with the “addition of content, concepts, themes, and perspectives to the curriculum without changing its basic structure, purposes and characteristics” (Banks, 1997, p. 235). Through this approach, a book (for example, Toni Morrison’s *Beloved*) or a unit (Women and the Vietnam War) or even a course (The Psychology of Women) might be added to the curriculum. Although pluralized content is added, it is usually

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⁴ Teachers should start by evaluating the materials they have on hand. The criteria, particularly items 2–6, listed in the previous section, can be a useful yardstick.
done within the context of an existing curriculum that again reflects mainstream perspectives. Again, there is no rethinking or restructuring of the curriculum and adding more material to an already overloaded course can overwhelm the most committed of educators! The Additive approach is popular among secondary school teachers.

Despite its shortcomings, however, Banks sees this level as a possible precursor to transformative curricula (level 3). Moreover, Banks suggests that implementing levels one and two is better than ignoring ethnic and multicultural input, altogether. Both provide some visibility that is lacking in mainstream curriculum. He sees the Additive level as a necessary first step to moving to more relevant and inclusive levels. Others are not as generous in their assessment of these levels. There is concern that the accomplishments of people of color will be presented in a way that limits the depth of their significance and contribution. For example, was George Washington Carver the only Black scientist taught about in your school and were his contributions reduced to discovering peanut butter? This approach becomes a facile way to perpetuate the "illusion of inclusion." The addition of a few select historical figures or authors relegated to limited classroom exposure can do little to change a Eurocentric focus or value system. See page 150 for a list of examples that reflect the Additive approach to multicultural education. How many of these types of activities have been part of your education? What is your opinion of this approach?

**Transformation (Level 3)**

Unlike the Contributions and Additive approaches the structure, goals, and perspectives of curriculum are changed at the Transformation level and students are able to "view concepts, issues, themes, and problems from several ethnic perspectives and points of view" (Banks, 1997, p. 237)—points of view that include multiple voices that are traditionally left out of the curriculum. As previously discussed, many novice and experienced teachers find this curriculum revision a daunting task. "Does this mean I need to include the viewpoints of every ethnic group in our country?" This, however, is not the goal; the goal is to empower students to view concepts and issues from multiple perspectives and especially from the perspectives of those groups most actively involved and influenced by the events. The goal is to encourage students to think critically about the complexities of society by examining various perspectives.

Although applications of the Transformation level are perhaps more obvious in areas such as social studies, music, and art, there are also ways to recognize the importance of diverse points of view, social customs, vocabularies, and experiences in science and mathematics.5

Consider, for example, an inquiry-based lesson in which students have been asked to determine the Earth’s circumference as though they were

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5 The authors are indebted to Dr. Frank Giuliano for contributing, both conceptually and in writing, the science examples included in this section.
astronomers living 500 years ago. The National Science Education Standards (NRC, 1996) advocate that, in such a lesson, the teacher should help students discover how, "in Columbus' day," it was known that the distance between a town in Scandinavia and a town in Italy was about 3000 miles (calculated by measuring the North Star's angle from the horizon at both locations). It is easy for many teachers to engage students in such a Euro-centered lesson. A more inclusive approach, however, might engage students in a role-playing activity in which they are members of the great University of Alexandria. Eratosthenes, born around 274 B.C., was the first scientist to measure the Earth's circumference. This was done more than 2000 years ago, using the shadows cast by the Sun in two different cities in North Africa. This approach allows students not only to learn the content, but also to immerse themselves in the social context of how ancient scientists lived and worked.

More contemporary, and perhaps more compelling, examples of applying the Transformation level in science center around environmental issues. During the past few decades, our attitude toward the environment has moved closer to the Native American view and is moving slowly away from the view of the Europeans who took over the land. In addition, it is becoming increasingly obvious that environmental issues cannot be separated from social and cultural issues. The recent controversy surrounding the hunting and fishing rights of the Ojibwe tribe in Minnesota is one example of the connections among cultures, societal issues, and environmental concerns.

The relationships among environmental issues, cultural issues, and societal issues are exemplified by the contemporary issue of environmental racism. This refers to situations in which the costs and effects of some environmental degradation fall disproportionately on some groups of people. Those same groups are often those who have been marginalized or have faced discrimination because of their race or ethnicity. This issue raises questions regarding which neighborhoods are more likely to be on the receiving end of pollutants or which towns are more likely to be the site of chemical plants, paper mills, or other sources of unpleasant substances and odors. Arguments are made that those who are most likely to be on the receiving end of such pollution are members of groups in society likely to experience discrimination and racism. One could argue that lack of political, social, or economic influence by poorer neighborhoods and minorities effectively translates into those same neighborhoods and groups bearing more of the environmental costs.

One final example deals with integrating multicultural content into mathematics. In a recent gathering of faculty to discuss considering multicultural issues in course content, a colleague from the math department balked at the idea, falling back on the rationale that teaching mathematical concepts did not necessarily fit in with "multiple perspectives." When it was suggested that examples used to solve problems could be taken from relevant, real world examples, he conceded that yes, perhaps he could use examples from poverty statistics or employment data but that information was so depressing! What the professor's remarks seemed to miss is that even though the statistics are
alarming and depressing, especially for women and members of racial minority groups, the opportunity to think critically about issues of inequality and to raise awareness could be a part of his curricular agenda.

As illustrated in these examples, pluralism and multiculturalism are not ideas that one puts in education; rather, they are inherently part of, and necessary to, understanding math, science, and the scientific process. Math and science, like culture, are not objects to be manipulated or described, but are negotiated, temporal, and emergent (Good, 1995). Exploring culturally embedded assumptions regarding the nature of math and science by using their histories and philosophies will help students better understand the dynamic, complex nature of science. Additional examples of the Transformation approach are listed on page 151.

**Social Action (Level 4)**

The Social Action approach takes the Transformation level a step further. Students are educated for "social criticism and social change" (Banks, 1997, p. 239) and are given instruction in decision making. Students are encouraged to analyze and question authority rather than to accept it passively. To many, this is a radical redefinition of education—education designed to produce change and question reproduction of the status quo. This approach links education to democratic action that asks educators to change long-held ideas about the purpose of school. It puts into practice several of the criteria of culturally relevant curricula we have listed earlier.

Action, especially in the name of social justice, turns teachers into change agents, proactive in empowering students to address some of society's problems. Students become problem solvers, investigating social issues, promoting democratic ideals, while critically analyzing the consequences of their actions. For example, in an American government class dealing with censorship, students develop a survey of students' interests in reading materials. Among the books most listed by students as ones they'd like to read are three that have been banned by the Board of Education (such as *Mein Kampf* by Adolf Hitler; *Kaffir Boy* by Mark Mathabane; and *Huckleberry Finn* by Mark Twain). Students interview several factions of the school community including parents, administrations, students, and community leaders. Students research cases regarding censorship of literature, write letters to the school and local newspaper editors, and schedule open debates. The culminating activity might be a proposal to the School Board to lift the ban. Whether students are successful or not in getting the ban lifted, they have learned valuable information and have put into practice the civic skills extolled in our textbooks. Examples of the Social Action approach are listed on page 153. What social action is likely to result from completing these activities?

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6 Sleeter and Grant's Multicultural and Reconstructionist approach to multicultural education is relevant here as are Dewey's education for citizenship and Banks's multicultural education for democracy.
ISSUES IN PLURALIZING SPECIFIC CONTENT AREAS

Specific academic areas have their own unique struggles as they move towards curricula that are more inclusive. Some disciplines are concerned with who has the right to teach which content; others are engaged in discussions of historical accuracy, new political agendas, and what constitutes truth—scientific or otherwise. We look briefly at some of the issues being discussed among English, history, and math and science educators. Some of the issues are really debates over which curriculum approach to multiculturalism should be implemented.

A Culturally Relevant Literary Curriculum?

Many English teachers have diversified their readings to include authors of color, and textbook publishers have facilitated that process by marketing a number of texts that respond to the American “mosaic.” Given that teachers have at their disposal a wider selection of primary sources than in the past, can we feel confident that their students are receiving a culturally relevant curriculum? The answer is, “It depends.” Teachers using the Additive curriculum approach don’t change the basic framework of their course, and students, though gaining some new information, will probably not engage in any transformative construction of knowledge.

From current statistics on the ethnic background of teachers, we know that most English teachers are White, and, therefore, are the ones introducing authors of color to their students. In Seasons of the Witch, Gail Griffin (1995) writes honestly about her experience teaching African-American literature as a White teacher to primarily White students. The experience has been a “crucial site of self-discovery” (p. 162). She says,

A reading is never any better than the reader. Instead of asking Black literature to do my work for me, I’m learning to assume that it will function as a touchstone, revealing much about its White readers that I need to know to make the interventions and translations that can liberate the novel’s power, to clear away some of the web of distortions, omissions, and outright lies about African Americans in which many White students are stuck, and to dislodge the ignorance of themselves on which racism depends.

Griffin speaks of the privilege Whites often assume in their ability to teach African American literature when they have “precious little genuine understanding of the cultural context [. . . .] not to mention wholly unexamined assumptions (like mine) about their competence to understand and ‘right’ to teach anything they happen to enjoy reading. . . . I want to begin to think about, and to teach about, African American texts [authors of color] as lenses through which we whose vision is compromised by white privilege can come to see our own whiteness more clearly” (1995, pp. 137–138).

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7 We discuss culturally responsive reading and writing in Chapter Six.

8 Although our text separates pedagogy (teaching strategies) from curriculum, the separation is artificial. We recognize how interconnected instructional approaches and curriculum are.
Cheung (1994) cautions teachers not to present works by authors of color as representing an entire group. They should also make students aware of the link between politics and book publications. In addition, "it is important to show that race and gender do not merely affect the literary production of women and ethnic minorities but that they shape the work of canonized authors as well. (How anxiety about White ideology informs Melville's Moby Dick has been brilliantly illustrated by Toni Morrison)" [Cheung, 1994, p. 147]. Finally, students must be made aware of how oppressed people create culture and celebrate their heritage; too often students see marginalized groups as only victims (Griffin, 1995, p. 144; Wood, 1994, p. 229).

As our comments suggest, a culturally responsive literary curriculum is more than the introduction of non-White writers. In Chapter Six, we define reading as a process of constructing meaning and emphasize the role cultural background plays in comprehending. A culturally responsive curriculum seeks to empower students and encourages readers to assume some ownership over the text. It also diffuses the position of the White teacher as the authority in discussions. The challenge for English teachers is to help facilitate these processes for their students while not colluding in their appropriating the text in ways that "[annihilate] critical racial self-awareness" (Griffin, 1995, p. 155).

A Culturally Relevant Social Studies/History Curriculum

Popular debates about multicultural education usually focus on the curriculum for social studies and history classes. Anxiety centers on answers to the following three questions: Whose story should be told? Whose knowledge is more valid? What are the consequences of implementing an inclusive curriculum? We will respond briefly to each question.

Multiculturalists believe that students should be exposed to a variety of perspectives. Boyle-Baise's (1995) uses feminist standpoint theory to frame her presentation of multiple perspectives. "According to standpoint theory, there is no one stance that fully explains the 'truth' of social reality, rather there are varying standpoints or social positions from which reality is perceived . . . The search for truth requires consideration of many standpoints, including minority and majority points of view" (p. 162).

This concept is consistent with the Banks (1996a) typology of knowledge types: personal/cultural, popular, mainstream academic, transformative

9 Cheung refers to bell hooks's comments on the greater marketability for books depicting Black male oppression of Black females than White oppression of Blacks.

10 Dr. M. D. Purinton is credited for reminding us of this point.

11 A major shortcoming in our presentation is a discussion placing students of color as the students reading the texts. G. Ladson-Billings (1994. The Dreamkeepers: Successful Teachers of African American Children. San Francisco: Jossey-Bass) is an excellent source despite its focus on elementary grades.

12 Lies My Teacher Told Me by James W. Loewen (1995) is an excellent source of transformative academic knowledge for history teachers. It is published by The New Press.
academic, and school. Personal knowledge is based on an individual’s experiences in the home and immediate community; popular knowledge is primarily the information we obtain through mass media; mainstream academic knowledge derives from traditional Westerncentric sources of history and the social sciences. Transformative knowledge is defined as “the facts, concepts, paradigms, themes, and explanations that challenge mainstream academic knowledge and expand and substantially revise established canons, paradigms, theories, explanations, and research methods” (p. 9). School knowledge is what teachers find in their textbooks and curriculum guides—the implicit “facts, concepts, generalizations, and interpretations.”

Thus, the multiculturalist’s answer to “Whose story should be told?” is, “As many peoples as possible.”

The debate over whose knowledge is more valid has been heated. George Will (1990) extols the virtue of Western civilization. “‘Eurocentricity’ is right, in American curricula and consciousness, because it accords with the facts of our history, and we—and Europe—are fortunate for that. . . . Saying that may be indecent, but it has merit of being true and the truth should be the core of any curriculum” (p. 10). Ladson-Billings’s comments serve as a rejoinder:

When scholars who take a different position—one that looks at a longer continuum of Western tradition and asserts that both Africa and Asia have contributed to the European scholarship and thus are joint heirs to the western tradition (Asante, 1987; Bernal, 1987)—they are castigated and accused of sloppy scholarship. And while most conservative scholars will acknowledge the influence of Egypt on the West, there is a subtle pattern of distortion that lifts Egypt out of Africa and reconstructs the racial composition of Egyptian society. (1995, p. 331)

Multiculturalists believe that “All types of knowledge are needed.” Each kind of knowledge represented in Banks’s typology offers student insights into how knowledge is constructed, how it reflects the views, experiences, hopes and goals of a particular group. “Teaching students various types of knowledge can help them to better understand the perspectives of different racial, ethnic, and cultural groups as well as to develop their own versions and interpretations of issues and events” (Banks, 1996, p. 8).

Whether a social studies/history teacher decides to develop curricula at Banks’s Transformative or Social Action level will depend on her or his overall learning goals. Too often textbooks, if not teachers, are used to organizing information around historical periods highlighting famous heroes, laws, and battles. An inclusive curriculum is theme and issues based. Inquiry methods of teaching are used and students have opportunities to read primary sources and historical fiction. They collect oral history and record social history. Reflection and decision-making skills are incorporated into the learning. We can see how Banks (1996b) links social studies to his Social Action level. “The main goal of the social studies is to help students acquire the knowledge, skills, and values needed to make reflective personal and public decisions so they can make action, consistent with American values—such as equality, justice, and human dignity—that will improve and reform society” (p. 231).
Multicultural critics fear that this approach will undermine students’ individuality. Are we teaching students to see themselves as belonging only to an ethnic, cultural, or gender group and as victims, as well? How will national unity be preserved? Although legitimate, these questions narrow the goals of multicultural education and overlook other essential characteristics of a multicultural curriculum. Historians are quick to tell us that it is unfair to judge past events by the standards of today; however, providing students with multiple perspectives will allow for a more balanced and complex story. Students will be taught to reflect on ways in which Western ideals have not yet been met and how their participation can move us toward those ideals. Social studies and history is not just about victims, but about the “surviving and thriving” of people who have had to struggle.

By the year 2020, an estimated 46 percent of our school-age population will be students of color. “Students from diverse ethnic, cultural, and linguistic groups must have an opportunity to see themselves and their heritages represented in the curriculum if they are to ultimately see themselves as Americans. At the same time, White students will find themselves in work and living environments that are increasingly diverse. They will need perspectives and skills that prepare them to successfully encounter diversity” (Ladson-Billings, 1995, p. 332).

From a multiculturalist’s perspective, an inclusive curriculum is integral to our preserving national unity!

A Culturally Relevant Math and Science Curriculum

We group these two subject areas together because of the common attributes used to describe the disciplines—objective, definitive, value neutral, and scientific, and the belief by many that math and science aren’t multicultural material. However, as with our earlier example of videotaping two people talking, even math and science lenses are never neutral. Issues around implementing a multicultural curriculum in math and science classes center on redefining educational goals in this area, expanding our understanding of these fields (that is, what constitutes scientific knowing, what makes math so powerful), and who will be our future mathematicians and scientists.

Both The National Council of Teachers of Mathematics (NCTM) and the American Association for the Advancement of Science (AAAS) have made strong statements in support of multicultural education:

Students should have numerous and varied experiences related to the cultural, historical, and scientific evolution of mathematics so that they can appreciate the role of mathematics in the development of our contemporary society. (NCTM)

It is important . . . for students to become aware that women and minorities have made significant contributions in spite of the barriers put in their way by society; that the roots of science, mathematics, and technology go back to the early Egyptian, Greek, Arabic, and Chinese cultures; and that scientists bring to their work the values and prejudices of the cultures in which they live. (AAAS)

(Both cited in Multiculturalism in Mathematics, Science, and Technology, 1993, p. 4)
Nevertheless, math and science teachers are often skeptical about what to do after hanging up posters representing the contributions of women and people of color and completing a time-line around the room pinpointing the origins of significant mathematical and scientific concepts or discoveries. (We can see the additive curriculum approach at work here.)

A transformative approach to math and science “centers the student in the knowledge-acquisition process” (Tate, 1996, p. 194). Instruction is situated in or contextualized by students’ interests, cultural knowledge, and experiences. Tate (1996) relates the story of why so many students got the wrong answer to the problem: “It costs $1.50 each way to ride the bus between home and work. The weekly pass is $16.00. Which is the better deal, paying the daily fare or buying the weekly pass?” The test question assumed that the person working only had one job and worked 5 days a week, a reality that did not fit with students’ lives whose parents often had two jobs and worked weekends. Many of us may remember fussing over certain questions only to be told by our teacher “Just answer the question. Don’t read so much into it.” A culturally responsive curriculum allows for “reading into” the problem. A social reconstructionist (Social Action) approach would include information on how mathematics is used in our capitalist society. (See “Western Mathematics: The Secret Weapon of Cultural Imperialism” in the readings.) In addition, teachers might develop interdisciplinary units around social issues that integrate math skills.

The adjectives we used earlier to describe math and science reflect a Eurocentric perspective. The scientific method is considered the only valid tool for understanding our world (Barba, 1995). Science and math come to us as static, rule-bound procedures with little recognition of the conflict found in the discipline, “conflicts over data interpretation, credit for discovering ideas, censorship . . .” (Eva as cited in Tate, 1996, p. 196).

Inventions and discoveries are presented as the works of single individuals. “Group discoveries of knowledge are rarely acknowledged within the androcentric tradition of science [crediting one person for a discovery]” (Barba, 1995, p. 58). Native Americans, Chinese, Africans, and women scientists have long histories of group discoveries. Knowledge passed down through an oral tradition is discredited by Western science, despite the fact that yesterday’s folk remedies are often tomorrow’s medicines. For example, consider recent studies which “proved” that chicken soup can help make you better! Moreover, Western society has regularly assigned European names to principles developed by Asians and Africans.13

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13 “(1) the Pythagorean Theorem was developed in Babylonia 1000 years before Pythagoras, (2) Pascal's Triangle was created by Chinese and Persian mathematicians hundreds of years before Pascal, (3) a part of Fibonacci's book was copied line-for-line, diagram-for diagram from a book that Abu-Kamil wrote in Egypt 400 years earlier” (Multiculturalism in Mathematics, Science, and Technology, 1993, p. 5). This text is also a valuable resource for teachers.
Pluralizing Mainstream Curriculum

Hillis (1993) provides the following example of how mainstream curriculum could be changed to reflect the additive and transformative levels.

Mainstream (Eurocentric) Model: Traditional model; materials selected from a monocultural, Eurocentric perspective. Dominant ideology taught—other views neglected.

Example: Mrs. Haines is a high school English teacher beginning a unit of American Literature. Her curriculum consists of three readings: The Catcher in the Rye by J. D. Salinger, a novel that explores the life of an adolescent male in the 1940s; The Snows of Kilimanjaro by Ernest Hemingway, a short story about a man dying on the plains of Africa; and The Great Gatsby by F. Scott Fitzgerald, a novel about the "American Dream." Through these readings, Mrs. Haines is able to explore with her class the problem of human suffering.

Dominant voice: white male, American society.

Ethnic Additive Model: Added content to the existing curriculum. Mainstream perspective remains fundamental but is supplemented with ethnic material.

Example: Mr. Hernandez is an English teacher in the same building as Mrs. Haines. Like his colleague, Mr. Hernandez teaches Salinger, Hemingway, and Fitzgerald. However, he feels that he needs to expand the curriculum to include divergent perspectives. To accomplish this, he adds two additional novels: The Color Purple by Alice Walker, an exploration of the life experiences of an African-American woman, and The Chosen by Chaim Potok, a story portraying the relationship between a father and son in a Jewish community. Mr. Hernandez, like Mrs. Haines, facilitates class discussion on the problem of human suffering by examining each writer's ideas.

Basic nature of the curriculum; dominant voice supplemented with isolated alternative views.

Multicultural Model: Goal is a transformation of the curriculum. Does not disregard the mainstream perspective but views it as one perspective among many.

Example: Ms. Gibbs has constructed a unit on American literature. She has decided to present a multicultural curriculum that represents the contributions of all people. Instead of limiting the unit to Salinger, Hemingway, and Fitzgerald, she alters and expands the cultural perspectives presented. Her unit consists of Fitzgerald, Walker, and Potok. Ms. Gibbs's choice of material provides the soil for rich, insightful and critical dialogue. In this way, the students are not simply taught about one perspective of American literature. Rather, in Ms. Gibbs's class the students see that American Literature consists of writers who are men and women, of different ethnic and religious backgrounds. This multicultural view provides students with the opportunity to gain a broad understanding of the richness and heterogeneity that exist in our nation and culture, in both past and present.

 Allows a more comprehensive picture; allows opportunity to examine such critical concepts as culture, conflict, and identity. Transforms a Eurocentric curriculum into one of balanced ethnic and cultural perspectives. [Authors' comment: We hope that in time Ms. Gibbs would expand her readings to be even more inclusive. The addition of short stories, poetry and Latino/a, Asian, Middle Eastern, and Native Americans would be welcome. ]

Finally, math and science teachers are concerned about the numbers of girls and students of color going into these fields. Certain math courses, sometimes taken as early as middle school, are critical to the pipeline for future math- and science-related occupations. The underachievement of girls and students of color in these fields continues, as does their underrepresentation in the fields of engineering, banking, and accounting. Based on these facts alone, many schools have decided to evaluate their math and science curricula and instructional approaches. Equally important has been their willingness to consider changes in the times and sequencing of courses so that students who need prerequisites will have access to them, their experimentation with all-girl math and science classes, and their movement away from ability tracking. (See Chapter Seven for a discussion of tracking.)

**Steps to Becoming a Culturally Relevant Teacher**

It has been our intention in the first five chapters to provide the reader with a foundation for culturally relevant teaching. How the various pieces of information fit can best be demonstrated by outlining steps teachers can take as they move towards this goal. It also provides a review of the material we have been covering and a preview of what we will cover.

1. Teachers who can find someone to work with will have the built-in support needed to begin this process. It is very hard to be a change agent by yourself. Find allies to work with you—other teachers, administrators, parents, and students.

2. Do your homework. By that we mean:
   a. Develop a personal working definition of multicultural education. (Chapter One)
   b. Reflect on your own cultural/ethnic background. What lens are you using to view the world? Be aware of your positionality, and power and privilege, if applicable. (Chapter Two)
   c. Understand the role culture plays in students’ learning and how conflicts between home and school culture can influence academic achievement. Be aware of your and your students’ racial identity and its instructional implications. (Chapter Three)
   d. Review instructional approaches and cultural patterns of communication. Create a welcoming and affirming classroom environment. (Chapter Four)

3. Develop a culturally relevant curriculum.
   a. Evaluate the curriculum materials you have on hand.
   b. Get to know your students’ backgrounds—what they know and what interests them.
c. Start slowly by setting specific goals for pluralizing your content. (You may realize that you are starting at the Additive level, but you are starting.)
d. Find transformative information that will support your learning objectives.
e. Check out books or surf the Internet for multicultural lesson plans in your content area. Evaluate materials for compatibility with your definition of multicultural education.
f. Develop curriculum materials. Have a colleague review your materials.
g. Teach and assess instruction and learning.

4. Continue the process. Periodically review your definition of multicultural education.
5. Learn about culturally relevant literacy practices. (Chapter Six)
6. Develop alternative ways of assessment. (Chapter Seven)
7. Reach out to families and communities to support your students’ learning. (Chapter Eight)
8. Become knowledgeable about special education and students of color. (Chapter Nine)
9. Keep yourself informed. Listen to critics; their voices are valuable. They challenge and clarify your ideas.
10. Remember that both you and your students are learners in this process. If empowerment is a goal you have for your students, then it’s your goal too.

Readings

The readings for Chapter Five are a mixture of the practical and philosophical. “Incorporating Cultural Pluralism into Instruction” is an excerpt from an article by Branch, Goodwin, and Gaultieri. They have developed a list of twenty-five activities and assignments that correspond to Banks’ curriculum frameworks. Their suggestions are useful by themselves, but also as a guide for teachers who have developed their own materials and want to check “the level” of their lessons. Pollina’s article, “Gender Balance: Lessons from Girls in Science and Mathematics,” reminds us of the inseparable relationship between curriculum and instruction. The successes she reports are worth noting.

A chapter on multicultural curriculum would not be complete without reference to Afrocentricity. Schiele’s “Afrocentric for All” is a thoughtfully written piece that challenges readers to move beyond a Eurocentric perspective. Bishop’s “Western Mathematics: The Secret Weapon of Cultural Imperialism”

investigates the impact of western mathematics on indigenous cultures. Both articles represent transformative knowledge and readers are encouraged to see their applications in the classroom.

**Incorporating Cultural Pluralism into Instruction**

*Robert Branch, Yvonne Goodwin, and Jill Gualtieri*

**Level 1: Contributions Approach**

*Examples:*

1. Write a poem about a personal experience with nature. Read it aloud.
2. Construct a calendar containing the birthdays of noted American women (authors, scientists, politicians, mathematicians, artists, etc.).
3. Inform students about local cultural events and encourage students to bring such announcements to class.
4. Bring in newspapers from different countries in Africa, Asia, Europe, South America, or the Pacific.
5. Create a picture file of homes from different cultures.
6. Organize a food fair. Each child brings in a dish that is traditional in their family. Decorate the table with country flags and share recipes.
7. Discuss sporting events around the world, such as the running of the bulls.
8. Discuss family ethnic backgrounds during a "Who am I?" unit. Encourage students to bring in pictures of family members.
9. Display money from a variety of countries.
10. Construct "A day in the life of......"
11. Decorate the room with pictures of heroes, artists, scientists, and other famous people from various ethnic groups.
12. Arrange a Festival of Nations; have students grouped to display their cultures.
13. Celebrate Black History Month with displays, videos, observation of holidays, and discussion of heroes.

15. Introduce art work, dance, and music from other countries to your students; ask them to note similarities in technique or effect.
16. Compare elements of various folk literatures.
17. Have a buffet luncheon for the student body; students sit next to someone they don't know.
18. Celebrate Winter Solstice (or other seasonal celebrations of different cultures).
19. Create a time line of notable contributions of American women in science and technology; combine with photograph collection in item 14 above.
20. Read literature in which an adolescent from another country is portrayed; ask students to discuss similarities and differences between the fiction and their own lives.
21. In March, celebrate Women's Herstory Month and include a study of women's contributions to society.
22. Discuss different climates around the world in geography or science, perhaps related to the study of homes from different cultures (item 5 above).
23. Discuss lives and contributions of ethnic heroes.
24. Create an annotated bibliography including authors of both genders from different ethnic backgrounds.
25. Discuss the origins of names of the children in the class, including both first names and family names; note any similarities among children's names and differences in spelling.

Level II: Additive Approach

Examples:

1. Discuss how a worldwide adoption of the metric system would affect your subject area.
2. Study the origins of mathematics as it relates to topics within your subject area.
3. Assign students to write and present perspectives on topics different from those described in the textbook.
4. Discuss how import and export policies impact topics in your subject area.
5. Include words originally from other cultures on spelling lists.
6. Tell a Native American story about how an animal developed a body part to introduce a lesson in adaptation.
7. Try class cooking projects that utilize recipes from different cultures.
8. Present a mini-unit on Native American language and poetry to introduce a more "traditional" poetry unit.
9. Discuss the lives of black soldiers within Confederate and Union troops.
10. Include Australian art in art curriculum.
11. Add a literature study of ethnic minorities within American society.
12. Ask students to write a story or make a book about their own or a different culture and publish a class collection; have students record their book or story for sharing.
13. Include the Holocaust in your studies of the twentieth century.
14. Add works by authors of different cultural backgrounds when teaching reading.
15. Try a cross-cultural approach to literary themes; for example, read Little Red Riding Hood and Lon Po Po, the Chinese version.
16. Develop a unit showing the influence of other cultures on the development of American spoken language.
17. Present a whole unit on Native Americans, including pre-Columbian cultures as well as contemporary issues facing Native Americans in the United States.
18. Discuss food, clothing, and shelter found in different areas of the world.
19. Highlight the contributions of the Black Muslim movement in a social change unit.
20. Have students research an event and role play key elements of the event.
21. Have children present food menus and heritage costumes in class.
22. Distribute a list of cultural differences between the industrialized world and the developing world and discuss the reasons behind the differences.
23. Talk about how it would feel to trade positions with other cultures; for example, what it would mean if Europeans had only one month to talk about their history in an Afrocentric curriculum.
24. Describe the problems that specific immigrant groups have encountered with nativism.
25. Based on monthly themes, invite guest speakers to teach about mores from other cultures, such as rites of passage in Egypt, Japan, New Zealand, Thailand, and Botswana.

Level III: Transformation Approach

Examples:

1. Investigate the effects of sustainable development on the local people in the rain forests of Brazil and on the Brazilian government.
2. Have students research individuals historically omitted from the curriculum.
3. Contrast the reasons and patterns of migration to the United States for Italians, Asians, Slavs, and Africans.
4. Incorporate creation myths from a wide range of cultural traditions in Greek mythology.
5. Prepare a book that includes information about the children in the class based on questions they have about children living today in faraway places.
6. Ask adolescent students their opinions about communication skills, community involvement, leadership skills, workplace composition, self-concept, and conflict resolution.
7. Present a conceptual perspective of mathematics of different cultures in both ancient and present times.
8. Add literature units that include multicultural themes.
9. Explore the relevance of math or math games and their uses in other countries.
10. Engage students in social studies mapping exercises that include native or ancestral lands of students represented in the classroom.
11. Entertain arguments that Alexander Graham Bell did not invent the telephone.
12. Describe how current politics are affecting individual cultures.
13. Examine the American experience through literature written across cultural and political perspectives, such as the African-American experience in the nineteenth century, as described in *The Adventures of Huckleberry Finn*.
14. Compare civil rights problems from the 1960s to problems of today within a play written and performed by students.
15. Investigate how technology has changed the way students live.
16. Investigate how different cultural groups perceive media events.
17. Calculate and discuss the distortion of various map projections of the world. Examine one with the land area of all countries in the appropriate scale, e.g., the Peters projection.
18. Show a film about women in different countries; arrange for persons from those countries to address students, exploring points of view of different cultures.
19. Role-play a family situation in several cultures e.g., going on a date.
20. Consider alternatives to Columbus's "discovery" of America and Pizarro's and Cortes's conquests of native peoples.
21. Watch a movie of a historical event from a non-American culture and compare it to a movie on the same event made in the United States.
22. Have students participate in activities that involve developing a relationship with people from other countries, such as pen pals or international computer networking.
23. Teach students to determine universal cultural concepts such as belief in the unknown, economics, and traditions.
24. Have students discuss differences in manufacturing practices among the United States, Japan, and the European Community.
25. Discuss "westward" expansion from multiple perspectives, including that of the Native American. Emphasize the complex political motivations of this era.

**Level IV: Social Action Approach**

**Examples:**

1. After reading literature of cultural conflict such as *Othello, Heart of Darkness*, and *Apocalypse Now*, ask students to recommend ways to reduce social tension.
2. Have students form an organization to promote pluralism within school activities.
3. Have students examine different forms of media as shapers of "the norm," with particular attention paid to how cultural and gender stereotypes are perpetuated.
4. Arrange for students to telecommunicate with a school outside the United States.
5. Discuss prejudice and how prejudicial perspectives limit human development; identify ways students can act responsibly in their own lives.
6. Have students conduct research on environmental issues and formulate solutions; publish these in the school newspaper or another public forum.
7. Ask French language students to react to the same event, literature, or music (for example, the song "Telegraph Road" by Dire Straits) as French citizens of similar age; send their written reactions to a recording company.
8. Have students write an editorial on a news event, including their cultural viewpoints.
9. Produce a school play that compares the civil rights era of the 1960s with current civil rights legislation.
10. Develop a conservation strategy for a recently established national park.
11. Have students conduct a newspaper survey on current issues in state politics and write letters to the local newspaper editor reflecting their conclusions and concerns.
12. Report the desirable and undesirable effects of technology on people of the United States and other countries.
13. Invite police officials to the class to discuss problems and how students can help.
14. Sponsor a debate about whether pornography should be protected by the Constitution under freedom of speech.
15. Arrange switch-role debating from different cultural viewpoints; students first interview people from each culture to get needed information.
16. Accept community service as a class project.
17. Publish a collection of poetry written by women.
18. Have students critically analyze current textbooks for cultural bias.
19. Encourage students to rewrite certain pages of their textbooks to reflect multicultural perspectives.
20. Use class meetings to discuss how today's social issues are related to the class subject.
21. Have each student choose a Francophone country (region) and present it as if he or she were a part of it.
22. Discuss how household duties can be shared equally between men and women.
23. Teach reading by encouraging students to write or develop their own books and newsletters about issues or topics relevant to their cultural heritage.
24. Assign extra credit for class projects in which students mentor peers from cultural backgrounds different from their own.
25. Coordinate a student performance written by the students about alternative and less popular perspectives to topics related to your subject area.

Gender Balance: Lessons from Girls in Science and Mathematics

Ann Pollina

Are we emphasizing the right issues when we talk about gender in the mathematics, science, and technology classroom? We are and we aren't.

The need for equitable treatment of girls and women is beyond dispute: women are still greatly underrepresented in fields like physical sciences, engineering, and technology. As a matter of simple justice, there should be no field of academic inquiry closed to women.

The economic necessity argument is valid as well, particularly as women make up a greater share of our work force. And if we are to remain competitive in a world market, U.S. women must be well trained in mathematical, scientific, and technological fields.

But as important as these issues are, we cannot allow them to overshadow a third critical argument: The characteristic approaches that many girls and women bring to learning and scientific inquiry are vital to science and to science education.

**Feminizing Scientific Inquiry**

Too often in the past, we have focused on girls as if they were the problem. If not enough girls took math and science, we asked, “What is wrong with them, and how do we fix them?” How do we make them more aggressive, more analytical, more competitive, tougher, so that they will survive in these disciplines? For years, we gave girls what researchers at Smith College have called courses in remedial masculinity. Then we wonder why many girls lack self-esteem.

Instead of trying to change the way our female students approach mathematics, science, and technology, we need to study the ways they do learn. We need far more than a grudging willingness to change our pedagogy to simply accommodate girls’ learning styles. We must be willing to learn from them. Even more important, we must come to believe that the messages they have for us are of real value.

The work of a number of women scientists demonstrates how profoundly a woman’s perspective can enrich and enliven scientific study. The unusual insights of Barbara McClintock, for example, opened a new window through which to view the study of genetics. In 1983, McClintock won the Nobel Prize for her discovery that genes can rearrange themselves on a chromosome. The direction of her research was informed by a “feeling of the organism” (Keller 1983).

Jane Goodall and Dian Fossey, who revolutionized the understanding of primate behavior, did not hypothesize and then corroborate by observing a group of apes. Instead, they took a relational approach and focused on a single ape, tracing that primate’s interactions. Their work has become a model for wildlife observation.

These women’s formation of questions and approaches to problems represented a new way of looking at science: They introduced feelings and relationships into the discipline.

**Ten Tips from Girls’ Schools**

How do we begin to learn lessons from girls in the classroom? The collective wisdom of teachers from girls’ schools can provide all educators with insight into the learning styles of girls. Believing girls’ schools to be an untapped resource in our country’s efforts to find ways to inspire young women to study mathematics, science, and technology, the National Coalition of Girls’ Schools has sponsored three symposiums in these fields. Two were held at Wellesley College, in June 1991 and 1995; and a third in conjunction with the Dudley Wright Center at Tufts University in March 1993. Each brought together educators from public, independent, single-sex, and coeducational schools to examine research and proven strategies for teaching girls in the classroom.
Here are some of the messages from these workshops that I use in my high school classroom at Westover, an all-girls school in Connecticut.

1. **Connect mathematics, science, and technology to the real world.** My students remind me how much richer mathematics is when we do not divorce it from its history, its philosophical underpinnings, and its functions. Connecting any subject to the lives of real people and the good of the world is a powerful hook for girls.

Some specific exercises:

Collect examples of decorative borders from different cultures. My geometry students study transformation and isometry using these.

Establish links with other disciplines. Both the calculus and the European history classes at my school spend some time looking at the powerful effect Newton's laws of motion had on the thinking of the Enlightenment, and we share presentations between classes.

Divide a class into groups and ask them what sort of mathematics a prehistoric hunter-gatherer clan might need to survive. You will have a wonderful discussion about the nature of mathematics.

2. **Choose metaphors carefully, and have students develop their own.** For years we have asked girls to tackle problems and master concepts using metaphors and real-world problems more closely tied to boys' life experiences. We have taught fractions using batting averages and presented parabolas as paths of missiles and rockets. Presenting images of mathematics and science that are comfortable and meaningful for girls is more than a sign of our current preoccupation with political correctness.

In my classes, I often ask students to create their own metaphors. A teacher may gain valuable insights into students' own perceptions of learning style by asking questions such as:

"If math were a food, for me it would be ____ because _____."

My favorite response to this question was from a 9th grader entering Algebra I:

If mathematics were a food, for me it would be a sandwich because sometimes I like what's on a sandwich and sometimes I don't. When there's too much stuff on a sandwich, I can't fit it in my mouth.

After reading this, I knew what that student needed in a math classroom. This exercise is the kind of "window on students' thinking" that the National Council of Teachers of Mathematics speaks of in its *Teaching Standards* (Leiva 1993–95). Dorothy Buerk, who teaches mathematics education at Ithaca College, has developed a wealth of these exercises (Buerk 1985).

3. **Foster an atmosphere of true collaboration.** Collaborative learning has become the classroom panacea of the '90s. Although a collaborative environment is attractive to many girls, pulling desks into a circle does not assure a collaborative, noncompetitive experience. Small groups work for girls if all members are taught to listen and are responsible for one another's learning. Some teachers insist that a true group project is one that no single group member can complete without the group's help.
4. **Encourage girls to act as experts.** When the teacher is the touchstone for all knowledge and answers, students rarely exhibit self-confidence. Only when the group is responsible for verifying its own logic and when students critique their own work and that of their peers do they begin to see themselves as scientists. The technique of the teacher refusing to act as an expert has been used successfully for over a decade in the SummerMath program at Mount Holyoke College. The program is designed for high school girls to address underrepresentation of women in mathematics-based fields.

5. **Give girls the opportunity to be in control of technology.** The issue of the expert is also a critical one in technology. Both boys and girls need to recognize the masculine cast of the computer industry. Taking any computer magazine and comparing the number of men and women pictured or mentioned in advertisements will stimulate a good class discussion.

   At Westover, the computer room is staffed and serviced by students, usually from our Women in Science and Engineering (WISE) program. These girls are responsible for basic repairs, for teaching software, and for dealing with data emergencies. At times they teach the required computer literacy course. Girls need to see other girls in control of technology. In coed settings, an all-girls computer club may allow girls to develop more computer expertise.

6. **Portray technology as a way to solve problems as well as a plaything.** Girls use computers differently than do boys. Few girls will play with a computer just because it's there; most often girls use it as a tool, not a toy, and they need to see its relevance to their lives. One way to encourage girls to play on the computer is to emphasize the networking and communication capability. Single-use work stations can be isolating; pairing girls creates a comfortable atmosphere and stimulates discussion.

   When asked to create a dream machine, girls want to create things that can help make our lives better. Cornelia Brunner and Margaret Honey of the Center for Children and Technology have crafted a variety of exercises to explore technological imagination (Brunner and Honey 1990).

7. **Capitalize on girls' verbal strengths.** Strong writers and good readers—both girls and boys—have valuable tools at their disposal. Yet, often, we are not creative enough in teaching them how to use those tools to their advantage in a mathematics or science classroom.

   At the Coalition of Girls' Schools' symposiums cited earlier, teachers presented a wealth of situations in which they used writing. Students were encouraged to express the logic behind their solutions in essay or picture form. Proof might be essays and well-constructed arguments with a minimum of mathematical notation.

   My calculus students keep journals in which they reflect on their experiences in the course, comment on their progress, and set goals for themselves. Two possible journal questions:

   You died while doing your physics homework. Write your physics obituary.
You are a spider on the wall of your room observing you doing your mathemat-
ics homework. What do you see?

8. **Experiment with testing and evaluation.** Assessment methods must
reflect the research suggesting that girls do not think in linear right/wrong cat-
egories. Multiple-choice testing that requires forced choices or contains out-of-
context questions and topics unrelated to real-world experiments make no use
of girls' ability to synthesize, make connections, and use their practical intel-
gence. The work of Maryellen Harmon and her colleagues at Boston College's
Center for the Study of Testing, Evaluation, and Educational Policy suggests
that, for this reason, such assessments inhibit science education reform
(Madaus et al. 1992).

Alternate strategies that do work well for girls include *embedded assess-
ments*—activities in which students, usually working in groups, perform
experiments, discover patterns, and arrive at hypotheses. A teacher circulates
and observes student performance to evaluate them. Another form of assess-
ment is the *circus*, where stations with reflection questions or experiments are
set up around a room. Students go from station to station and are evaluated on
the quality of their investigation at each.

9. **Give frequent feedback, and keep expectations high.** Because girls still may
not expect to do well in mathematics and science, they tend to need more
encouragement than do boys. The role of the teacher in praising students and
verbalizing expectations is critical. Teachers at the girls' schools forums found
it vital to provide frequent feedback in the form of homework checks, quizzes,
and comments, thereby reinforcing students' belief in their control of the
material. Many said they use this strategy to develop the kind of self-reliance
that all students need to survive in an inquiry-based classroom.

10. **Experiment with note-taking techniques.** Girls are dutiful learners. They
can get so absorbed in taking down every note and diagram that they are too
preoccupied to take part in discussions. Teachers at the symposiums suggested
a variety of techniques to counter this tendency, ranging from the "no note
taking allowed" classroom to handing out copies of lecture notes or having
them available on the computer. My algebra and geometry students take notes
on reading material before coming to class. Most teachers at the symposiums
included some standard note-taking situations so that students could learn this
important skill.

**Single-Gender versus Coed Settings**
The number of single-gender experiments in schools from New Hampshire to
California bears witness to our interest in equity and our willingness to
change. Those experiments are also steeped in controversy, and for good rea-
son. If the purpose of such experiments is to divide girls from boys because
girls can't compete in a "real" mathematics or science classroom, then our
experiments, by conveying this message to girls, can do infinite harm. But if
we begin these experiments believing that our female students have something
to teach us, then what goes on in such a classroom can be more subtle and powerful than the absence of boys: it can be the empowerment of girls.

A recent, well-publicized experiment at the Illinois Mathematics and Science Academy in Aurora illustrates this point dramatically. In 1993, the academy, an experimental, residential school serving gifted and talented students, offered an all-girls’ section on mechanics as part of a yearlong calculus-based physics course. David Workman, the physics teacher involved, did not simply import his usual classroom methods, but was willing to learn from the young women. He found some approaches successful—collaborative processes, hands-on experimentation, connection of abstract concepts with practical application—and he made these the cornerstone of his class. Then—and this is most vital—he tried to import these methods into his coed setting.

Workman made it clear to the girls that there was nothing wrong with the way they related to physics or to the physical world. His powerful message:

I'm not just doing these things because you are incapable of learning physics the 'right way'; I am using the teaching methods that appeal to you because they are valid and important methods of scientific inquiry.

A report on the experimental section (Dagenais et al. 1994) showed it mirrored much of the atmosphere of all-girls’ classrooms that other academy teachers describe: a spirit of co-learning, with both teacher and students feeling free to ask questions, admit mistakes, take risks, express confusion, and so on; a profound sense of responsibility for one's own learning and that of others; and a special rapport between and among the teacher and the students.

**He Said, She Said**

Workman's initial efforts to replicate this collaborative atmosphere in his coeducational classes was foiled: many boys tended to blurt out answers to questions posed to the class as a whole, with predictable results. The other students were suddenly diverted from collective problem solving and inquiry to an explain-the-answer-to-me mode. "In this environment," said Workman, "all except the boldest and fastest hesitate to be open, ask questions, and take risks."

To get around this problem, Workman has his students write down answers rather than speak them. Then, moving from table to table, he confirms whether an answer is right or whether the student or group of students needs to work through the problem again.

These difficulties notwithstanding, the single-gender experiment has already helped to level the playing field. Last year, for example, girls performed on a par with their male peers (in prior years their performance declined relative to boys' as the semester went on); more girls enrolled in and successfully completed the yearlong physics course than ever before; and girls in the single-gender section gained more self-confidence than did those in coeducational sections.

Workman and his colleagues plan to further analyze the results of the experiment. "We're going to take what we learned and think harder about
how we can preserve the strengths of both male and female modes of learning in mixed classes in order to benefit everyone," he said.

In single-gender class experiments, the culture that surrounds a class is as vital as teaching itself. If we are willing to stop trying to change girls and ready to let a feminine approach to science inform our pedagogy, we may see some exciting results for boys and girls and for science and technology.

References

Reading

Afrocentricity for All

Jerome H. Schiele

In recent years, the concept of Afrocentricity has been used to convey several meanings. One consequence of this is that the higher education community has received a distorted conception of Afrocentricity, which has diminished Afrocentricity's true meaning. The objective of this discussion is to clear up some of the misunderstanding about Afrocentricity by offering it as an instrument for societal and human transformation for all.

Afrocentricity, or Afrocentrism, has probably received the greatest attention in primary and secondary education. There, Afrocentricity has been mostly associated with the exposure of African-American children to the historical accomplishments of people of African descent. Known as the curriculum of inclusion, the integration of Afrocentric content in primary and secondary schools is predicated on the assumption that the academic performance of
African-American children will improve if they have knowledge of the past accomplishments of their ancestors. Another prevailing view in the popular literature is that Afrocentricity is a new Black nationalist movement that promotes racial separation and exposes white racism. This form of Black nationalism is said to have emerged because of the disenchantment of African Americans with the post civil rights era, that is, with the perceived failure of civil rights legislation and philosophy to ameliorate the economic, social, and psychological status of African-Americans.

Although Afrocentricity is significantly related to African history, and can be said to have emanated from Black nationalist thought, it has been more appropriately described as a philosophical model predicated on traditional African philosophical assumptions. Indeed, Afrocentricity is one of three traditional philosophical models of this world (the others are the Eurocentric and Asiancentric models). Like the other models, Afrocentricity has a distinct set of cosmological, ontological, epistemological and axiological attributes. In other words, Afrocentricity is one means through which people can understand phenomena and define reality—a way through which the world, and all its elements, can be viewed.

Cosmologically, Afrocentricity views the structure of phenomena from a perspective of interdependency. All elements of the universe, such as people, animals, inanimate objects, etc.—are viewed as one. There is no demarcation between that which is spiritual or material. All elements are as seen as functionally interconnected. Ontologically, Afrocentricity assumes that all elements of the universe have a spiritual base, that is, are created from a similar universal substance. This is precisely why the cosmological perspective of Afrocentricity assumes the interconnectedness of elements. Thus, phrases such as "oneness with nature," "human-nature unity" and "harmony with nature" have been used to describe the cosmological character of Afrocentricity.

Epistemologically, the Afrocentric perspective places just as much emphasis on an affective way of knowing as it does on a cognitive way of knowing. Knowing (i.e., understanding events and reality) through emotion or feeling is deemed valid and important from an Afrocentric viewpoint. Axiologically, Afrocentricity significantly underscores the value of interpersonal relationships. This "person to person" emphasis fosters a human-centered orientation to life rather than an object or material orientation. Therefore, from an Afrocentric perspective, the value placed on material objects does not override the value in maintaining and strengthening interpersonal relations.

Though Afrocentricity is predicated on traditional African philosophical assumptions, and has special meaning for people of African descent, it is erroneous to believe that people of African descent are the only beneficiaries of Afrocentricity. Its philosophical attributes can and should be adopted by any group or person. Indeed, one of the primary reasons underlying the promotion of Afrocentricity over Eurocentricity, which is the philosophical foundation of western societies, is that Afrocentricity is viewed as a more humanistic philosophical model. This is because of Afrocentricity's emphasis on spirituality,
which is more likely to encourage higher standards of morality and compassion than the Eurocentric model’s emphasis on domination and control, materialism and individualism. It cannot be overstated that the major criticism levied against Eurocentricity is not that it is a “white” or European system but that it is an unlikely philosophical model to facilitate human and societal transformation towards spiritual, moral and humanistic ends.

It is because of the latter reason that Afrocentricity is offered to all racial and ethnic groups, especially those interested in promoting spirituality and humanism. Indeed, Afrocentricity provides hope for a decadent society, like the United States, that is deteriorating socially and morally. As noted psychologist Na'im Akbar has observed, a society that has abundant technology but at the same time is socially and morally decadent cannot be considered an advanced civilization. The adoption of the Afrocentric philosophical model can assist the United States in offsetting its emphasis on material affluence. This would truly help engender advanced civilization.

With its emphasis on a spiritual and collective understanding of human beings, Afrocentricity also offers a way for people to understand and highlight the similarities among all racial and ethnic groups. A major premise of Afrocentricity is that all people, regardless of racial and ethnic differences, are spiritual beings, created from a similar, universal source.

Finally, Afrocentricity provides a mode through which all people can liberate themselves from the restricted conceptions of human beings found in the Eurocentric philosophical model. When human beings are conceived primarily as material and physical beings, as is found in the Eurocentric model, considerable understanding about the extensive capabilities of people is precluded. In this regard, Afrocentricity's greatest advantage is that it offers a means through which all people can better realize their unlimited and vast potential as human beings.

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**Reading 4**

**Western Mathematics: The Secret Weapon of Cultural Imperialism**

*Alan J. Bishop*

Of all the school subjects which were imposed on indigenous pupils in the colonial schools, arguably the one which could have been considered the least culturally loaded was mathematics. Even today, the belief prevails. Whereas educational arguments have taken place over which language(s) should be

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taught, what history or religion, and whether, for example, “French civilisation” is an appropriate school subject for pupils living thousands of kilometres from France, mathematics has somehow always been felt to be universal and, therefore, culture-free. It had in colonial times, and for most people it continues to have today, the status of a culturally neutral phenomenon in the otherwise turbulent waters of education and imperialism.

This article challenges that myth, and places what many now call “western mathematics” in its rightful position in the arguments—namely, as one of the most powerful weapons in the imposition of western culture.

Up to fifteen years or so ago, the conventional wisdom was that mathematics was culture-free knowledge. After all, the popular argument went, two twos are four, a negative number times a negative number gives a positive number, and all triangles have angles which add up to 180 degrees. These are true statements the world over. They have universal validity. Surely, therefore, it follows that mathematics must be free from the influence of any culture?

There is no doubt that mathematical truths like those are universal. They are valid everywhere, because of their intentionally abstract and general nature. So, it doesn’t matter where you are, if you draw a flat triangle, measure all the angles with a protractor, and add the degrees together, the total will always be approximately 180 degrees. (The “approximate” nature is only due to the imperfections of drawing and measuring—if you were able to draw the ideal and perfect triangle, then the total would be exactly 180 degrees!) Because mathematical truths like these are abstractions from the real world, they are necessarily context-free and universal.

But where do “degrees” come from? Why is the total 180? Why not 200, or 100? Indeed, why are we interested in triangles and their properties at all? The answer to all these questions is, essentially, “because some people determined that it should be that way.” Mathematical ideas, like any other ideas, are humanly constructed. They have a cultural history.

The anthropological literature demonstrates for all who wish to see it that the mathematics which most people learn in contemporary schools is not the only mathematics that exists. For example, we are now aware of the fact that many different counting systems exist in the world. In Papua New Guinea, Lean has documented nearly 600 (there are more than 750 languages there) containing various cycles of numbers, not all base ten.¹ As well as finger counting, there is documented use of body counting, where one points to a part of the body and uses the name of that part as the number. Numbers are also recorded in knotted strings, carved on wooden tablets or on rocks, and beads are used, as well as many different written systems of numerals.² The richness is both fascinating and provocative for anyone imagining initially that theirs is the only system of counting and recording numbers.

Nor only is it in number that we find interesting differences. The conception of space which underlies Euclidean geometry is also only one conception—it relies particularly on the “atomistic” and object-oriented ideas of points, lines, planes, and solids. Other conceptions exist, such as that of the Navajos
where space is neither subdivided nor objectified, and where everything is in motion.\textsuperscript{3} Perhaps even more fundamentally, we are more aware of the forms of classification which are different from western hierarchical systems—Lancy, again in Papua New Guinea, identified what he referred to as “edge-classification,” which is more linear than hierarchical.\textsuperscript{4} The language and logic of the Indo-European group have developed layers of abstract terms within the hierarchical classification matrix, but this has not happened in all language groups, resulting in different logics and in different ways of relating phenomena.

Facts like these challenge fundamental assumptions and long-held beliefs about mathematics. Recognising symbolisations of alternative arithmetics, geometries, and logics implies that we should, therefore, raise the question of whether alternative mathematical systems exist. Some would argue\textsuperscript{5} that facts like those above already demonstrate the existence of what they call “ethno-mathematics,” a more localised and specific set of mathematical ideas which may not aim to be as general nor as systematised as “mainstream” mathematics. Clearly, it is now possible to put forward the thesis that all cultures have generated mathematical ideas, just as all cultures have generated language, religion, morals, customs and kinship systems. Mathematics is now starting to be understood as a pan-cultural phenomenon.\textsuperscript{6}

We must, therefore, henceforth take much more care with our labels. We cannot now talk about “mathematics” without being more specific, unless we are referring to the generic form (like language, religion, etc.). The particular kind of mathematics which is now the internationalised subject most of us recognise is a product of a cultural history, and in the last three centuries of that history, it was developing as part of western European culture (if that is a well-defined term). That is why the title of this article refers to “western mathematics.” In a sense, that term is also inappropriate, since many cultures have contributed to this knowledge and there are many practising mathematicians all over the world who would object to being thought of as western cultural researchers developing a part of western culture. Indeed, the history of western mathematics is itself being rewritten at present as more evidence comes to light, but more of that later. Nevertheless, in my view, it is thoroughly appropriate to identify “western mathematics,” since it was western culture, and more specifically western European culture, which played such a powerful role in achieving the goals of imperialism.\textsuperscript{7}

There seem to have been three major mediating agents in the process of cultural invasion in colonised countries by western mathematics: trade, administration, and education.\textsuperscript{8} Regarding trade and the commercial field generally, this is clearly the area where measures, units, numbers, currency, and some geometric notions were employed. More specifically, it would have been western ideas of length, area, volume, weight, time, and money which would have been imposed on the indigenous societies.

If there was any knowledge of indigenous measure systems at all, or even currency units, there is little reference made to them in the literature. Researchers have only fairly recently begun to document this area, and it is
perfectly clear that many indigenous systems did (and do) exist. Nevertheless, the units used in trade were (and still are) almost entirely western, and those local units which have survived are either becoming more and more westernised or are in the process of dying out. In some cases, there were simply no local units for measuring the kinds of quantities needed to be used by the western traders—as Jones' informant showed in Papua New Guinea in a recent investigation: "It could be said [that two gardens are equal in area] but it would always be debated" and "There is no way of comparing the volume of rock with the volume of water, there being no reason for it."10

The second way in which western mathematics would have impinged on other cultures is through the mechanisms of administration and government. In particular, the numbers and computations necessary for keeping track of large numbers of people and commodities would have necessitated western numerical procedures being used in most cases. According to the research evidence, the vast majority of counting systems in the world are and were finite and limited in nature, and with a variety of different numerical bases. There is certainly evidence of some systems being able to handle large numbers in sophisticated ways if the societal needs are there (e.g., by the Igbo people and the Incas),11 but though these, and presumably others, did exist, there was little evidence that they were even known by the colonial administrators, let alone encouraged or used. The one exception would have been the use by the Chinese, and by other people, of the abacus in certain colonies, which clearly was felt to be a sufficiently sophisticated system for administrative purposes.12

The other aspect to be imposed through administration would have been the language of hierarchy, through structuring people and their functions. It may seem a relatively insignificant example to choose, but it is very difficult for anyone used to the western obsession with naming and classification to imagine that there exist other ways of conceptualising and using language. The research of Lancy and of Philp have made us aware of this. As Lancy, for example, says:

In Britain, parents teach their children that the most important function of language is reference. They prepare their children for a society that places a premium on knowing the names and classes of things. The Kaluli of the Southern Highlands of PNG invest—if anything—more time in teaching language to their children than do the British, but their aim is very different. The Kaluli child learns that the most important language functions are expressive; specifically, that the competent language user is one who can use speech to manipulate and control the behavior of others.

Any enforced use of other language structures is thus likely to cause difficulties and confusion,13 but, more than that, any western European colonial governmental and administrative activity which concerned system, structure and the role of personnel would inevitably, and perhaps unintentionally, have imposed a western European mode of linguistic and logical classification.
The third and major medium for cultural invasion was education, which played such a critical role in promoting western mathematical ideas and, thereby, western culture. In most colonial societies, the imposed education functioned at two levels, mirroring what existed in the European country concerned. The first level, that of elementary education, developed hardly at all in the early colonial period. In India for example, the “filtering down” principle, whereby it was assumed that it was only necessary to educate the elite few and the knowledge would somehow “filter down to the masses,” was paramount. In some of the mission schools and in the latter years of colonialism when elementary schooling began to be taken more seriously, it was, of course, the European content which dominated. The need was felt to educate the indigenous people only in order to enable them to function adequately in the European-dominated trade, commercial and administrative structures which had been established. Mathematically, the only content of any significance was arithmetic with its related applications.¹⁴

Of much more interest to the theme of this essay is the secondary education given to the elite few in the colonised countries. In India and Africa, schools and colleges were established which, in their education, mirrored once again their comparable institutions in the “home” country.¹⁵ The fact that the education differed in French-controlled institutions from their English counterparts merely reflected the differences existing in the current philosophies of French and English education.

At best, the mathematics curriculum of some of the schools was just laughably and pathetically inappropriate. Mmari quotes some typical problems from Tanzanian colonial textbooks (recommended for use in schools by British colonial education officers)¹⁶:

If a cricketer scores altogether r runs in x innings, n times not out, his average is \( r/(x-n) \) runs. Find his average if he scores 204 runs in 15 innings, 3 times not out.

Reduce 207,042 farthings; 89,761 half-pence; 5,708 1/2 shillings to £s.d.

The escalator at the Holborn tube station is 156 feet long and makes the ascent in 65 seconds. Find the speed in miles per hour.

But then, “appropriateness” was entirely judged in terms of cultural transmission.

At worst, the mathematics curriculum was abstract, irrelevant, selective and elitist—as indeed it was in Europe—governed by structures like the Cambridge Overseas Certificate, and culturally laden to a very high degree.¹⁷ It was part of a deliberate strategy of acculturation—intentional in its efforts to instruction “the best of the West,” and convinced of its superiority to any indigenous mathematical systems and culture. As it was essentially a university-preparatory education, the aspirations of the students were towards attending western universities. They were educated away from their culture and away from their society. For example, Watson quotes Wilkinson, criticising Malayan education at the turn of the century in these terms: “unpractical, to make the people litigious, to inspire a distaste for manual and technical work and to create a class of literary malcontents, useless to their communities
and a source of trouble to the Empire."^{18} Mathematics and science—subjects which, in fact, could so easily have made connections with the indigenous culture and environment, and which could have been made relevant to the needs of the indigenous society—were just not thought of in those terms, despite many of the teachers' good intentions. They were seen merely as two of the pillars of western culture, significant as part of a cultured person's education in the nineteenth and early twentieth centuries.^{19}

So, it is clear that through the three media of trade, administration, and education, the symbolisations and structures of western mathematics would have been imposed on the indigenous cultures just as significantly as were those linguistic symbolisations and structures of English, French, Dutch or whichever was the European language of the particular dominant colonial power in the country.

However, also like a language, the particular symbolisations used were, in a way, the least significant aspect of mathematics. Of far more importance, particularly in cultural terms, were the values which the symbolisations carried with them. Of course, it goes without saying that it was also conventional wisdom that mathematics was value free. How could it have values if it was universal and culture free? We now know better, and an analysis of the historical, anthropological, and cross-cultural literatures suggests that there are four clusters of values which are associated with western European mathematics, and which must have had a tremendous impact on the indigenous cultures.

First, there is the area of rationalism, which is at the very heart of western mathematics. If one had to choose a single value and attribute which has guaranteed the power and authority of mathematics within western culture, it is rationalism. As Kline says: "In its broadest aspect mathematics is a spirit, the spirit of rationality. It is this spirit that challenges, stimulates, invigorates, and drives human minds to exercise themselves to the fullest."^{20} With its focus on deductive reasoning and logic, it poured scorn on mere trial and error practices, traditional wisdom and witchcraft. So, consider this quotation, from Gay and Cole in Liberia:

A Kpelle college student accepted all the following statements: (1) the Bible is literally true, thus all living things were created in the six days described in Genesis; (2) the Bible is a book like other books, written by relatively primitive peoples over a long period of time and contains contradiction and error; (3) all living things have gradually evolved over millions of years from primitive matter; (4) a "spirit" tree in a nearby village had been cut down, had put itself back together, and had grown to full size again in one day. He had learned these statements from this Fundamentalist pastor, his college bible course, his zoology course, and the still-pervasive animist culture. He accepted all, because all were sanctioned by authorities to which he feels he must pay respect.^{21}

One can understand Gay and Cole's discomfort at this revelation, but one can also understand how much more confusing it must have been to the student to learn that anything which was not "rational" in the western sense was not to be trusted.
Second, a complementary set of values associated with western mathematics can be termed objectivism, a way of perceiving the world as if it were composed of discrete objects, able to be removed and abstracted, so to speak, from their context. To decontextualise, in order to be able to generalise, is at the heart of western mathematics and science; but if your culture encourages you to believe, instead, that everything belongs and exists in its relationship with everything else, then removing it from its context makes it literally meaningless. In early Greek civilisation, there was also a deep controversy over “object” or “process” as the fundamental core of being. Heraclitus, in 600–500 BC, argued that the essential feature of phenomena is that they are always in flux, always moving and always changing. Democritus, and the Pythagoreans, preferred the world-view of “atoms,” which eventually was to prevail and develop within western mathematics and science.\textsuperscript{22}

Horton sees objectivism in another light. He compares this view with what he sees as the preferred African use of personal idiom as explanation. He argues that this has developed for the traditional African the sense that the personal and social “world” is knowable, whereas the impersonal and the “world of things” is essentially unknowable. The opposite tendency holds for the westerner. Horton’s argument proceeds as follows:

In complex, rapidly changing industrial societies the human scene is in flux. Order, regularity, predictability, simplicity, all these seem lamentably absent. It is in the world of inanimate things that such qualities are most readily seen. This is why many people can find themselves less at home with their fellow men than with things. And this too, I suggest, is why the mind in quest of explanatory analogies turns most readily to the inanimate. In the traditional societies of Africa, we find the situation reversed. The human scene is the locus \textit{par excellence} of order, predictability, regularity. In the world of the inanimate [by which he means “natural” rather than man-made], these qualities are far less evident. Here being less at home with people than with things is unimaginable. And here, the mind in quest of explanatory analogies turns naturally to people and their relation.\textsuperscript{23}

We can see, therefore, that with both rationalism and objectivism as core values, western mathematics presents a dehumanised, objectified, ideological worldview which will emerge necessarily through mathematics teaching of the traditional colonial kind.

A third set of values concerns the power and control aspect of western mathematics. Mathematical ideas are used either as directly applicable concepts and techniques, or indirectly through science and technology, as ways to control the physical and social environment. As Schaar says in relation to the history of mathematics: “The spirit of the nineteenth and twentieth centuries, is typified by man’s increasing mastery over his physical environment.”\textsuperscript{24} So, using numbers and measurements in trade, industry, commerce and administration would all have emphasised the power and control values of mathematics. It was (and still is) so clearly useful knowledge, powerful knowledge, and it seduced the majority of peoples who came into contact with it.
However, a complementary set of values, which is concerned with progress and change, has also grown and developed in order to gain yet more control over one's environment. An awareness of the values of control allied to the rational analysis of problems feeds a complementary value of rational progress, and so there is a concern to question, to doubt and to enquire into alternatives. Horton again points to this value when he contrasts western scientific ideas with traditional African values: "In traditional cultures there is no developed awareness of alternatives to the established body of theoretical tenets; whereas in scientifically orientated cultures such an awareness is highly developed." 

Whether that conclusion has validity or not, there can be no doubting the unsettling effect of an elitist education which was preaching "control" and "progress" in traditional societies, nor could one imagine that these values were what was needed by the indigenous population in the countries concerned.

Certainly, even if progress were sought by the indigenous population, which itself is not necessarily obvious, what was offered was a westernised, industrialised, and product-oriented version of progress, which seemed only to reinforce the disparity between progressive, dynamic and aggressive western European imperialists and traditional, stable and non-proselytising colonised peoples. Mathematically inspired progress through technology and science was clearly one of the reasons why the colonial powers had progressed as far as they had, and that is why mathematics was such a significant tool in the cultural kitbag of the imperialists.

In total, then, these values amount to a mathematico-technological cultural force, which is what indeed the imperialist powers generally represented. Mathematics with its clear rationalism, and cold logic, its precision, its so-called "objective" facts (seemingly culture and value free), its lack of human frailty, its power to predict and to control, its encouragement to challenge and to question, and its thrust towards yet more secure knowledge, was a most powerful weapon indeed. When allied to the use of technology, to the development of industry and commerce through scientific applications and to the increasing utility of tangible, commercial products, its status was felt to be indisputable.

From those colonial times through to today, the power of this mathematico-technological culture has grown apace—so much so that western mathematics is taught nowadays in every country in the world. Once again, it is mainly taught with the assumptions of universality and cultural neutrality. From colonialism through to neo-colonialism, the cultural imperialism of western mathematics has yet to be fully realised and understood. Gradually, greater understanding of its impact is being acquired, but one must wonder whether its all-pervading influence is now out of control.

As awareness of the cultural nature and influence of western mathematics is spreading and developing, so various levels of responses can also be seen. At the first level, there is an increasing interest in the study of ethno-mathematics, through both analyses of the anthropological literature and investigations in
real-life situations. Whilst recognising that many now-important ideas may well not have seemed to be so by early generations of anthropologists, there is, nevertheless, still a great deal of information to be gleaned from the existing literature.

This kind of literature analysis is, of course, aided by theoretical structures which help us conceptualise just what mathematics, as the pan-cultural phenomenon, might be. It is reiterated that mathematics is a cultural product—a symbolic technology, developed through engaging in various environmental activities. Six universal activities may be identified, by which I mean that no cultural group has been documented which does not appear to carry out these activities in some form. They are:

- Counting: the use of a systematic way to compare and order discrete objects. It may involve body or finger counting, tallying, or using objects or string to record, or special number names. Calculation can also be done with the numbers, with magical and predictive properties associated with some of them.

- Locating: exploring one's spatial environment, and conceptualising and symbolising that environment, with models, maps, drawings and other devices. This is the aspect of geometry where orientation, navigation, astronomy, and geography play a strong role.

- Measuring: quantifying qualities like length and weight, for the purposes of comparing and ordering objects. Measuring is usually used where phenomena cannot be counted (e.g., water, rice), but money is also a unit of measure of economic worth.

- Designing: creating a shape or a design for an object or for any part of one's spatial environment. It may involve making the object as a copyable "template," or drawing it in some conventionalised way. The object can be designed for technological or spiritual uses and "shape" is a fundamental geometrical concept.

- Playing: devising, and engaging in, games and pastimes with more or less formalised rules that all players must abide by. Games frequently model a significant aspect of social reality, and often involve hypothetical reasoning.

- Explaining: finding ways to represent the relationships between phenomena. In particular, exploring the "patterns" of number, location, measure, and design, which create an "inner world" of mathematical relationships which model, and thereby explain, the outer world of reality.

We now have extensive documentary evidence from many different cultures confirming the existence of all of these activities, and this structure is one which is enabling more detailed searches to be undertaken in the research literature. Ethno-mathematics is, however, still not a well-defined term, and, indeed, in view of the ideas and data we now have, perhaps it would be better not to use that term but rather to be more precise about which, and whose, mathematics one is referring to in any context. Moreover, the search should also focus on the values aspect as well. In considering the problems and issues
of culture-conflict in education, it is all too easy to remain at the level of symbolisations and language, whereas of much more significance educationally are the differences in cultural values which may exist. They need serious attention in future research.

At the second level, there is a response in many developing countries and former colonies which is aimed at creating a greater awareness of one's own culture. Cultural rebirth or reawakening is a recognised goal of the educational process in several countries. Gerdes, in Mozambique, is a mathematics educator who has done a great deal of work in this area. He seeks not only to demonstrate important mathematical aspects of Mozambican society, but also to develop the process of "defreezing" the "frozen" mathematics which he uncovers. For example, with the plaiting methods used by fishermen to make their fish traps, he demonstrates significant geometric ideas which could easily be assimilated into the mathematics curriculum in order to create what he considers to be a genuine Mozambican mathematics education for the young people there.30

Clearly, the ideas of the first level will inform and stimulate work at this second level—another reason why ethno-mathematical research needs to be updated. This activity is not restricted to developing countries either. In Australia with the Aborigines, in North America with the Navajos and other Amerindian groups and in other countries where there exist cultural and ethnic minorities, there is a great deal of interest in discovering and developing local, folk, or indigenous mathematics which may have been lying dormant for many centuries.31 These ideas may then help to shape a more relevant, and culturally meaningful, curriculum in the local schools.

One of the greatest ironies in this whole field is that several different cultures and societies have contributed to the development of what is called western mathematics: the Egyptians, the Chinese, the Indians, the Arabs, the Greeks, as well as the western Europeans. Yet when western cultural imperialism imposed its version of mathematics on the colonised societies, it was scarcely recognisable as anything to which these societies might have contributed. In Iran, in the early 1970s, for example, there appeared to be little awareness amongst the local mathematics educators of the massive contribution which the Muslim empire had made to the development of the mathematics which they were struggling to teach to their young people. Nowadays, with the rise of fundamentalism, there is growing and increasing awareness of both this contribution and also of an essential Islamic philosophy of education, which will shape the mathematical and scientific curricula in the fundamentalist schools.32 We are, therefore, beginning to see the assimilation, in place of the imposition, of western mathematics into other cultures. This is a worldwide development and can only help to stimulate cultural regrowth.

The third level of response to the cultural imperialism of western mathematics, is, paradoxically, to reexamine the whole history of western mathematics itself. It is no accident that this history has been written predominantly by White, male, western European or American researchers, and there is a concern that, for example, the contribution of Black Africa has been undervalued.
Van Sertima's book *Blacks in Science* is a deliberate attack on this prejudiced view of mathematical development. Various contributors to this book point to the scientific, technological, and mathematical ideas and inventions developed in Africa centuries ago, yet rarely referred to. Other contributors argue that the contribution of the Greeks to mathematics has been overemphasized; that they only consolidated and structured what had been thoroughly developed by the Babylonians and the Egyptians earlier; that Euclid worked in Alexandria and is more likely to have been African rather than Greek; that the archaeological evidence has either been ignored or misrepresented.

Joseph emphasises the strong role played by the Muslim empire in bringing mathematical ideas from the East to the notice of a wider people, not just in Europe. Needham's work demonstrates very well the contributions which began in China and grew through India where the Muslims made contact with them. There is certainly no reason to claim that what we know as western mathematics was entirely the product of western European culture.

In my view, however, the significance of cultural values has been underestimated in much of this historical analysis so far, and that when that dimension is fully recognised, there will be a great deal more re-analysing to do. The separation of symbolisations from cultural values is difficult to achieve, but we know how even the language of English carries different messages on both sides of the Atlantic because of the different cultural values existing there. The same symbolisations of mathematics may well have carried with them different kinds of values in different cultures in the past. Perhaps the best example of this is with India. Indian mathematics, along with that of other eastern cultural groups, had strong religious and spiritual values associated with it. Western mathematics on the other hand, was identified strongly with western science, with dehumanised, so-called “objective” knowledge, and with empirical and rational interpretations of natural phenomena. Yet, in most Indian schools today, it is western mathematics which is taught and it is the western values that are thereby fostered. Of course, many of the symbolisations (numbers, etc.) are the bases for our own symbolisations, and many of the ideas of arithmetic were developed by the Hindus. The values, though, are markedly different. Some Indian mathematics educators are now arguing for developments to redress the balance, although a further irony is that there may well be more interest in this kind of educational development among the Indian community in, for example, England than in India, where the educational conflicts are apparently felt less deeply. Nevertheless, the relationship between values and symbolisations is likely to be a promising area for further research.

I began by describing the myth of western mathematics' cultural neutrality. Increasingly, modern evidence serves to destroy this naive belief. Nevertheless the belief in that myth has had, and continues to have, powerful implications. Those implications relate to education, to national developments and to a continuation of cultural imperialism. Indeed, it is not too sweeping to state that most of the modern world has accepted western mathematics, values included, as a fundamental part of this education. In Hungary in 1988 the Sixth International
Congress on Mathematics Education (which is held every four years) was attended by around 3,000 mathematics educators. They came from every country in the world that was able to support participation, and those that were not there will now be purchasing copies of the proceedings and the reports. Such is the magnet of western mathematics and its principal acolyte, western mathematics education. Clearly, many societies have recognised the benefits to their peoples of adopting western mathematics, science, and technology.

However, taking a broader view, one must ask: Should there not be more resistance to this cultural hegemony? Indeed, there is some awareness to build on. In addition to the three major responses mentioned earlier, in recent years, as the kinds of evidence and issues referred to in this article have become more widely disseminated and more seriously discussed, so there has grown a recognition of the need to reflect these concerns at such congresses. At the Hungary conference, one whole day was given over to the theme of “Mathematics, education, and society” on which many papers were presented, discussion stimulated and awareness kindled. Included in that day’s programme were topics central to the issues discussed here.

Resistance is growing, critical debate is informing theoretical development, and research is increasing, particularly in educational situations where culture-conflict is recognised. The secret weapon is secret no longer.

Notes
6 “Pan-cultural” is used to convey the sense that all cultures engage in mathematical activities.

7 In the late nineteenth century and early twentieth century, one can also recognise the increasing contribution of American and Australian influences, which nevertheless stem from the western European cultural tradition.

8 A fourth candidate would be “technology.” Its influence is clear: see, for example, D.R. Headrick’s The Tools of Empire (Oxford, 1981); but what is rather less clear is the mathematical relationship with technology. As science and mathematics developed in their power and control, they undoubtedly influenced technology, particularly later in the imperialist era.

9 See Zaslavsky, op. cit. and Menninger, op. cit.
11 See Ascher, op. cit.
12 Even today, the abacus has survived the calculator invasion and is still in prolific use in the countries of Asia.
14 In the main, of course, there was felt to be little need for anything beyond reading, in order to understand either the bible translated into a local language, or simple work instructions. In India, after the orientalist phase, English was the language used predominantly in the schools and the acquisition of English became the goal of education to the exclusion of anything else.
15 For example, Budo College, Uganda, the Alliance High School, Kenya, Elphinstone College, India. See M. Carnoy, *Education as Cultural Imperialism* (Longman, 1974) and R.J. Njoroge and G.A. Bennaa, *Philosophy and Education in Africa* (Nairobi, 1986).
16 G.R.V. Mwar, “The United Republic of Tanzania: mathematics for social transformation” in F.J. Swetz (ed.) *Socialist Mathematics Education* (Southampton, PA 1978). Also says: “Textbooks of the period in question indicate the use of foreign units of measure of length, weight, capacity, volume, and currency which support this theory of direct interaction between business practices and the cultural background of the then dominant existing business community.”
17 P. Damerow says “The transfer of the European mathematics curriculum to developing countries was closely associated with the establishment of schools for the elite by colonial administrations. Under these circumstances it seemed natural to simply copy European patterns,” “Individual development and cultural evolution of arithmetical thinking” in S. Strauss (ed.), *Ontogeny and Historical Development* (Pennsylvania, 1986).
19 Indeed, there was no great attempt in the “home” countries themselves to make science and mathematics relevant either.
25 Horton, op. cit.
26 For a fuller examination of these ideas, see A.J. Bishop, *Mathematical Enculturation: a cultural perspective on mathematics education* (Dordrecht, Holland, 1988).
27 The caveat may perhaps seem unnecessary, but to a mathematician the word “universal” does cause certain problems. For further discussion of this general issue,

In order for mathematical knowledge to develop, it is necessary for these activities to integrate and to interact. Without this integration, the set of activities could be argued to be pre-mathematical.

29 See d’Ambrosio op. cit. and M. Ascher and R. Ascher, "Ethnomathematics," History of Science (Vol. XXIV, 1986) for different perspectives. The Aschers argue specifically for ethnomathematics to be the province of "non-literate peoples," while d’Ambrosio’s view encompasses all mathematical ideas not exposed by "mainstream" mathematics.


31 See P. Harris Measurement in Tribal Aboriginal Communities (Northern Territory Department of Education, Australia, 1988), and Closs, op. cit.


34 For example, B. Lumpkin, "Africa in the mainstream of mathematics history," in van Sertima, op. cit.


**DISCUSSION QUESTIONS AND ACTIVITIES**

1. **Take a previously written lesson plan and make it culturally relevant.** Be sure to consider both content and instructional strategies (Chapter Four).

2. **Brainstorm sources for transformative knowledge in your subject area.** Research sources and develop relevant unit or lesson plans. Share your work with other class members.

3. **How does Schiele define Afrocentricity? Why does he say that Afrocentricity is good “for all?”** Explain your answers. Do you agree?
4. Chapter Five begins with "School Teachers' Blues" and ends with "Steps to becoming a Culturally Relevant Teacher." What might your "blues" be in getting started? Explain your answers.

5. Write a reaction response to the article "Western Mathematics: The Secret Weapon of Cultural Imperialism." How might George Will or Gloria Ladson-Billings respond?

REFERENCES


