

Becoming Culturally Responsive Science Teachers

Culturally responsive teaching is based on the idea that culture is central to student learning. Several cultures intersect in the classroom: the students' and teachers multiple cultures, the culture of science, and the culture of school. Tied to these cultures are ways of thinking that are important for learning both in and outside of school. For educators the challenge is explaining mainstream culture while recognizing, respecting, and using students' identities and backgrounds as meaningful sources for creating optimal learning environments (Nieto, 2000; The Education Alliance, 2004).

Specifically we will examine four dimensions of culturally responsive science teaching: 1) recognizing our own and others' worlds, 2) developing relationships to form inclusive communities, 3) providing access (to the culture of science and school) through curriculum and instruction, and 4) critiquing, challenging, and changing the culture of school and school science.

On Thursday we will discuss how to apply some of what you are learning in your multicultural education course to our science teaching. For example Banks' theory of multicultural education can help us better understand how to become culturally responsive teachers and help us be accountable to each of our students. The goal is to be purposeful about becoming culturally responsive science teachers.

Excerpt from Banks, 1995. Handbook of research on multicultural education. New York: Macmillan.

Multicultural education promotes critical analyses of our society and its institutions. Students develop critical thinking skills in schools and classrooms where they are free to ask questions and examine course content, the media, popular culture and themselves for biases. The defining characteristic of a multicultural school is not the demographic makeup of the student body, but the willingness to ask, "Who's voice is not being heard? Why wasn't it included?" and, "How can this be changed?"

One of the goals of multicultural education is to acknowledge the experiences and perspectives of oppressed groups that are commonly excluded from mainstream academia (eg. racial, ethnic, class, gender, etc.). To accomplish this, the traditional Western canon used in shaping the curriculum must be reformulated and transformed to teach "a more truthful, complex and diverse version of the West" in schools. (Banks, 1994, p. 4) Rather than excluding traditional Western perspectives and accomplishments, multicultural education seeks to incorporate those of people of color and women into the canon. It celebrates the pluralism of our society while helping students to understand the common traditions and heritage that unite us.

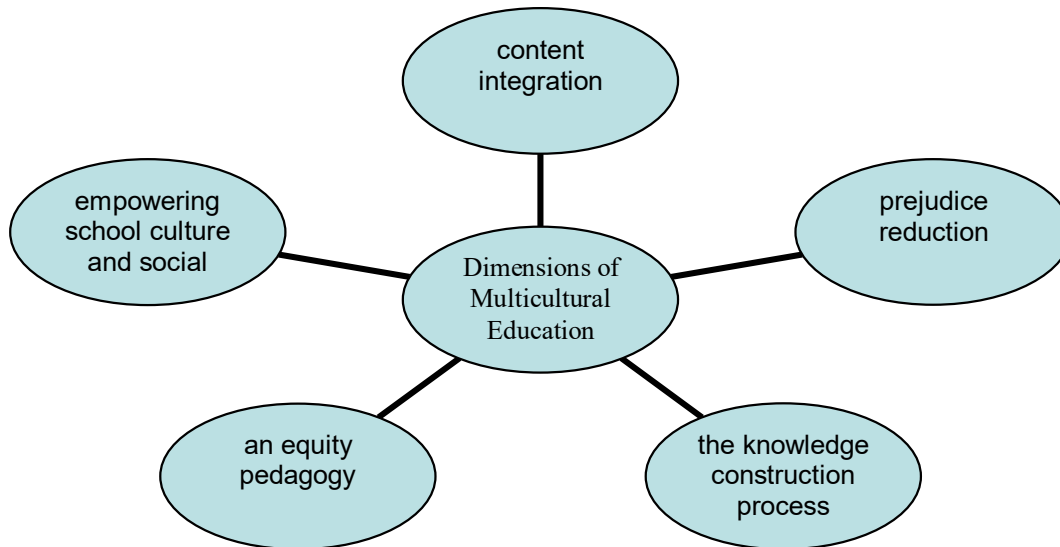
Within multicultural education, the organization and practices of a school recognize and accommodate all students and families. Teaching methods are altered according to the learning styles of students. Language differences are respected and parents are included in school planning and events. The grouping practices of the school are revised to allow all students to participate and excel in challenging courses.

Multicultural education aims to eliminate prejudice, racism and all forms of oppression. To do this, "it is imperative that multicultural educators give voice and substance to struggles against oppression and develop the vision and the power of our future citizens to forge a more just society." (Sleeter, 1991, p.

22) Multicultural education addresses issues of white privilege, challenges the status quo, and compels students and teachers to identify their own biases. It increases awareness and understanding of racism, how it has shaped our society in the past and the manifestations of racism, classism and oppression in the contemporary world.

The Dimensions of Multicultural Education

I have identified five dimensions of multicultural education. They are: content integration, the knowledge construction process, prejudice reduction, an equity pedagogy, and an empowering school culture and social structure (Banks, 1995a). Although the five dimensions of multicultural education are highly interrelated, each requires deliberate attention and focus.



- 1. Content integration** deals with the extent to which teachers use examples and content from a variety of cultures and groups to illustrate key concepts, generalizations, and issues within their subject areas or disciplines.
- 2. The knowledge construction process** describes how teachers help students to understand, investigate, and determine how the biases, frames of reference, and perspectives within a discipline influence the ways in which knowledge is constructed within it (Banks, 1996). Students also learn how to build knowledge themselves in this dimension.
- 3. Prejudice reduction** describes lessons and activities used by teachers to help students to develop positive attitudes toward different racial, ethnic, and cultural groups. Research indicates that children come to school with many negative attitudes toward and misconceptions about different racial and ethnic groups (Phinney & Rotheram, 1987). Research also indicates that lessons, units, and teaching materials that include content about different racial and ethnic groups can help students to develop more positive intergroup attitudes if certain conditions exist in the teaching situation (Banks, 1995b). These conditions include positive images of the ethnic groups in the materials and the use of multiethnic materials in a consistent and sequential way.
- 4. An equity pedagogy** exists when teachers modify their teaching in ways that will facilitate the academic achievement of students from diverse racial, cultural, and social-class groups (Banks & Banks, 1995). Research indicates that the academic achievement of African American and Mexican American students is increased when cooperative teaching activities and strategies, rather than competitive ones, are used in instruction (Aronson & Gonzalez, 1988). Cooperative learning activities also help all students, including middle-class White students, to develop more positive racial attitudes.

However, to attain these positive outcomes, cooperative learning activities must have several important characteristics (Allport, 1954). The students from different racial and ethnic groups must feel that they have equal status in intergroup interactions, teachers and administrators must value and support cross-racial interactions, and students from different racial groups must work together in teams to pursue common goals.

5. An empowering school culture and social structure is created when the culture and organization of the school are transformed in ways that enable students from diverse racial, ethnic, and gender groups to experience equality and equal status. The implementation of this dimension requires that the total environment of the school be reformed, including the attitudes, beliefs, and action of teachers and administrators, the curriculum and course of study, assessment and testing procedures, and the styles and strategies used by teachers.

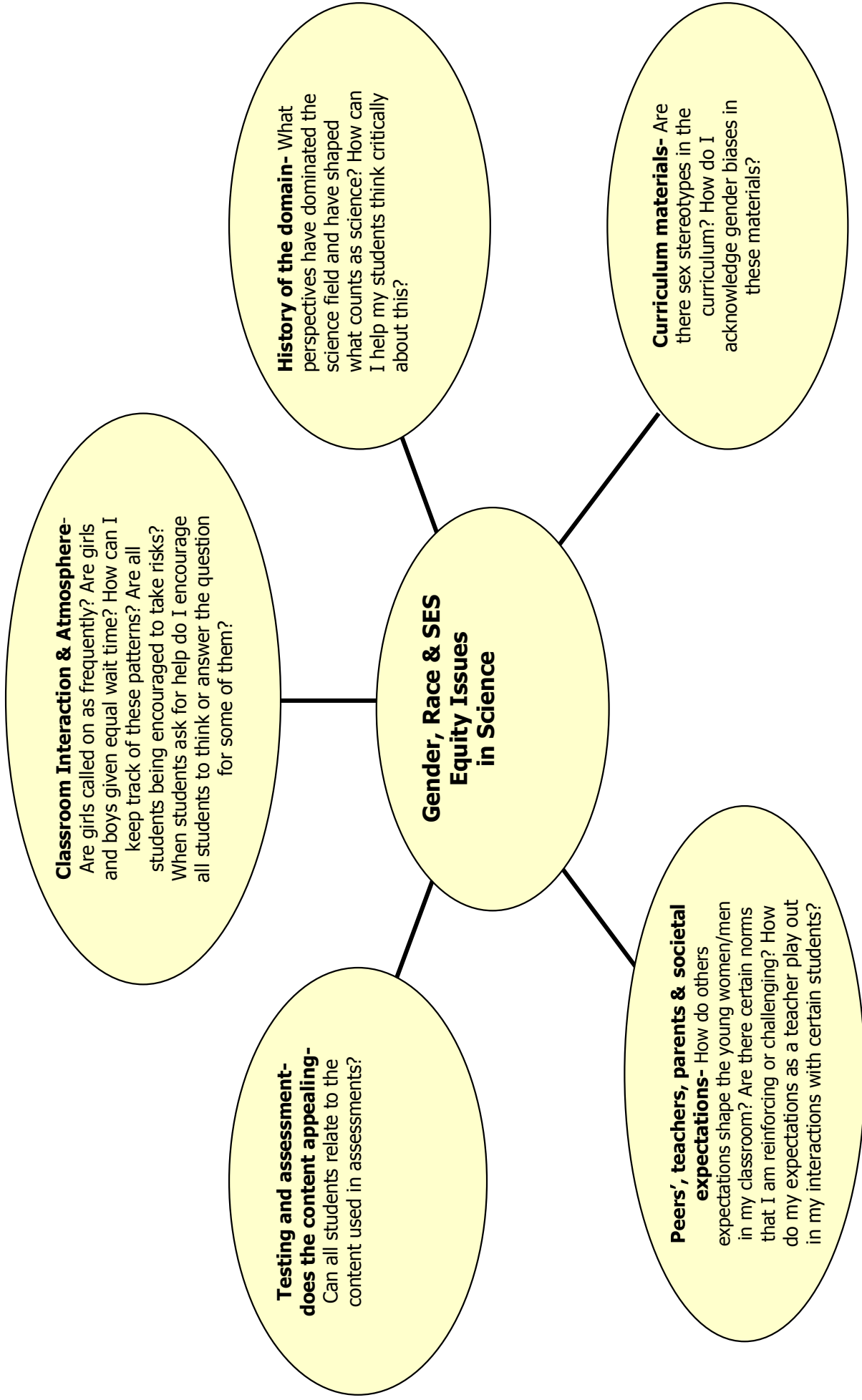
To implement multicultural education effectively, teachers and administrators must attend to each of the five dimensions of multicultural education described above. They should use content from diverse groups when teaching concepts and skills, help students to understand how knowledge in the various disciplines is constructed, help students to develop positive intergroup attitudes and behaviors, and modify their teaching strategies so that students from different racial, cultural, and social-class groups will experience equal educational opportunities. The total environment and culture of the school must also be transformed so that students from diverse ethnic and cultural groups will experience equal status in the culture and life of the school.

Excerpt from Atwater, 2001. Science Education & Black Americans.

All students seek acceptance, belonging, success, and enjoyment. Consequently, multicultural science teachers give their students the opportunity to reason about science, to argue about alternative explanations for their science results, and to test their ideas and those of others (Atwater, Crockett, & Kilpatrick, 1996). Science teacher candidates are more likely to become multicultural teachers if they make connections between the knowledge about cultures of various groups and its relevance to effective teaching practices. These teachers learn how to think strategically about: (1) learners—their differences and their different needs; (2) the interactions of Black American learners with science, the particular school, and community context; and (3) ways to engage their learners with important substantive scientific ideas (Oakes, 1996).

Black Americans are not homogeneous in their thinking and understanding of science; however, most Black Americans have experienced discrimination (Hill et al., 1993). Therefore, the way Black Americans view their opportunity to learn science in a classroom is based on their prior and present experiences in society and science classes (Atwater, 1994; Atwater, Crockett, & Kilpatrick, 1996).

For historically marginalized groups in science (young women, low-income students, and ethnic minorities) additional issues to think about include...



Notes from Geneva Gay on becoming culturally responsive science teachers

1. What do students bring to class? A knowledge of themselves, they know themselves very well, just as you know your science content well – get them to help you with the information you need about them – get them to tell you about themselves
2. Get some primers about multicultural education and start studying- you can't expect to know all about each ethnic group in the first year, but you'll learn, just as you've learned science content
3. Students can be lazy – get them involved, have high expectations
4. Gender and equity – when do we find about women of color anywhere in our curriculum? Introduce your concepts with references and information about groups that get left out
5. Take abstract concepts, take these concepts to their real lives, and then bring those real-life examples back to the abstract concept – make connections for your students
6. Carter G. Woodson, one of the most important black scientists that most folks know nothing about – he was an expert on peanuts (talk to kids about peanut butter and introduce them to Woodson)
7. A black girl who wants to be a cosmetologist has to know about chemistry and hair – take those science concepts and use real-life examples for illustration/teaching
8. Food is something all students can relate to – you could just teach nutrition and integrate many scientific concepts into this subject
9. Blacks experience more diabetes than the general population; teach about diabetes and its causes, chemistry, etc. What kinds of things can you teach that are relevant to your black students?
10. Lactose intolerance and asthma – more subjects that would have relevance in a diverse classroom
11. Transforming the environment – Jerry Lipka working with Alaska natives – teaches math and science through the culture of his students; everything in the curriculum relates to where these students are coming from
12. Terry McCarty, “A Place to be Navaho” – did the same thing as Lipka with Native Americans
13. Kids can learn helplessness – this can be due in part because some don't have an understanding of the “words” of science – make kids rephrase what they think so that you are sure they are understanding; make them write and explain how they interpret what you are teaching them
14. Students have trouble turning the “cultural code” into “academic code” – they have trouble making the transition; teachers speak so much in “academic code” – try to find a voice that relates to where the students are; begin where they are and help them make transition from there to abstract or academic concept
15. Eavesdrop on students – what are they saying that you can use? “Hooked up” – what does that mean to them and how can you turn it into a science word/concept? Scientific synonyms

16. Translate what I just gave you into your language – have fun and be playful – science is not sacrosanct
17. Do you have to be an expert at what you're teaching? You need to know enough to know how to know. If you had to know everything, you wouldn't teach anything.
18. Give them some of your insights, your experiences, and then try to get theirs.
19. Build foundations for community in the classroom. Do you have a name you would like to be called, is there something that makes you angry, when are you having the most fun in a classroom, etc. are pieces of information to get from your students to build this sense of community
20. You don't have to teach all positions, but you do need to acknowledge different ideas, methods, etc. There can be a way/method/idea that works better than others and that's your job to show the students this "better way" but do provide the evidence for this "better way"
21. Model what you want from students (my model is know, think, feel, do) – there is a bias in any form of knowledge but there is a way we want students to engage and to think – MODEL IT
22. Style shifting – students need to know how to shift from their cultural style (i.e. if the teacher is teaching problem solving and says that you must follow the step-by-step method of 1), 2), 3), etc., keep in mind that not all students problem solve using this type of method; begin where the student is and then take the student to where you want her to be. Do acknowledge where the students are, know where they are.
23. Any discipline that continues to do what it has always done without overhauling/changing, is a dead discipline (I don't know if she said "dead", but you get the idea)
24. Do everything 3 ways 1) your way 2) dominant other 3) plus one. That means that you teach from all three perspectives, the second refers to the group that is most prevalent in the classroom (where are they coming from?), and the third refers to another perspective that you might choose to show your students – this is modeling diversity
25. Model diversity. When I teach, I use an example from my own culture – this challenges me to monitor my own speaking, thinking, etc. I have to think about it consciously. It's not habitual to come up with multicultural examples, so I have to think about it consciously. I have to read about it, learn it.

A sample assignment from a biology class. How does this fit into to Banks' theory? How might it be culturally responsive and how is it not?

SOME IMPORTANT SCIENTISTS

African American Scientists

- Benjamin Banneker (1731-1806) Astronomer
- George Washington Carver (1864-1943) Agricultural Researcher, applied science
- Ernest E. Just (1883-1941) Research Biologist
- Charles H. Turner (1867-1923) Biologist
- Matthew Henson (1865-1955) Explorer, North Pole
- Percy Julian (1899-1975) Research Chemist
- Shirley Jackson (1946-) Physicist

Women in Science

- Alice Hamilton (1869-1970) Industrial Medicine
- Florence Rena Sabin (1871-1953) Public Health Physician
- Lise Meitner (1878-1968) Nuclear Physicist
- Leta S. Hollingworth (1886-1939) Educational Psychologist
- Rachel Fuller Brown (1898-) Biochemist
- Gladys Anderson Emerson (1903-) Biochemist and Nutritionist
- Maria Goeppert Mayer (1906-1972) Nuclear Physicist
- Myra Adele Logan (1909-1977) Physician and Surgeon
- Dorothy Crowfoot Hodgkin (1910-) Crystallographer
- Jane C. Wright (1920-) Physician and Chemotherapist
- Rosalyn S. Yalow (1921 -) Nuclear Physicist in Medicine
- Sylvia Earle Mead (1935-) Marine Biologist

CRITERIA FOR BIOLOGIST PAPER

I. The Paper

A. Content of your report

1. Introduction (paragraph #1)

_____/10 POINTS

- Briefly describe the purpose of your paper, include the name of the scientist.
- Describe why you chose the person.
- In 1 or 2 sentences give an overview your paper. Describe what the rest of your paper is about. For example:
In this paper, I describe two major discoveries made by Dr. X, a bioastronomist, and discuss how her work will influence the way that science studies life on other planets such as Mars.

2. (Paragraphs # 2 & 3)

_____/10 POINTS

Describe your biologist's major discovery. Use examples from your reading. What did he/she do? How did he/she do it? Why was/is this discovery important to science?

3. Summary and conclusions (Paragraph 4)

_____/10 POINTS

Describe how your biologist's work influences us today or how his/her work will affect us in the future. Include your opinion about this scientist's work.

B. Structure of your paper

_____/10 POINTS

- Title, effective and appropriate _____/2 pts
- Correct spelling and grammar _____/2 pts
- Clearly expressed thoughts _____/2 pts
- Within word limits _____/2 pts
- Bibliography (At least 3 references, correct format) _____/2 pts

II. The Poster

_____/10 POINTS

- Originality- Uniquely designed _____/5
- Content- Summarize major findings in bullet format _____/5

TOTAL POINTS

_____/50 POINTS



Science for All



My philosophy for becoming a culturally responsive science teacher	Strategies for my classroom & for working with individuals
1) recognizing our own and others' worlds Banks: the knowledge construction process	
2) developing relationships to form inclusive communities Banks: prejudice reduction & equity pedagogy	
3) providing access (to the culture of science and school) through curriculum and instruction Banks: content integration	
4) critiquing, challenging, and changing the culture of school and school science. Banks: empowering school culture and social structure	