

# Multiculturalism in Science Education

Claudia Melear

**T**HE term multiculturalism refers to the process of recognizing, understanding and appreciating cultures other than one's own. Multiculturalism teaches an appreciation of the impact of differences: race, gender, class, age, sexual/affectional orientation, religion, and physical ability (Batts 1992a). Atwater (1989) discussed how teachers can begin to become multicultural. Recently the National Science Teachers Association (NSTA 1991) established a policy on multicultural science education. Banks (1988) describes the basic assumption of cultural pluralism: Schools should promote ethnic identification and allegiances; furthermore, educational programs should reflect the characteristics of ethnic students. Banks lists three goals for a culturally pluralistic program:

1. Promote the maintenance of groups.
2. Promote the liberation of ethnic groups.
3. Educate ethnic students in a way that will not alienate them from their home cultures.

Multicultural education focuses on the value of being different. It celebrates uniqueness and looks to it for what it teaches. In science education, multiculturalism means that teachers should teach culturally relevant material in ways that invite participation in culturally appropriate ways.

**The definition of multicultural in this article, as it applies to science education, applies to science topics that could be interesting and useful to groups underrepresented in science professions. The definition also includes directing skill development to science teachers in order to help them be more effective with these groups.** Multiculturalism, as a field of study, in science education is new. However, the literature in science education includes topics that could now be classified as **topics of major interest to multicultural groups**. The field is only recently becoming identified and unified under the multiculturalism heading. For example, science educators have been concerned about inclusion of minorities and women in science education for many years. Also, topics such as drug and sex education have historically been **included** in biology curricula, via both textbooks and in supplementary materials. However,

there has been no unifying theme to connect needs of underrepresented groups in science to topics in science. Multiculturalism in science education offers a way to connect the needs of women, minorities, and those with alternative sexual preferences, for example, with the information and understanding they need.

## *The Need for Multiculturalism Among Science Teachers*

A recent survey of graduate students in a science education research class at a large regional state university demonstrated that many science teachers do not know what to do about multicultural topics, as far as their teaching behavior is concerned. In North Carolina, where the survey respondents teach, or will teach, more than 50% of students in the public schools are African Americans. The population of student teachers at East Carolina University (at 10%) does not approximate that percentage. Therefore, cultural diversity could be very easily overlooked as not important, because racial and ethnic diversity is not obvious in the college classroom.

While African Americans comprise by far the largest minority population in Eastern North Carolina, Hispanics are an emerging group. The East Coast Migrant Health Project provides workers to more counties in North Carolina than to any other state on the East coast. The number of Hispanic migrant workers in North Carolina is estimated at up to 80,000 per year. Science teachers have and could provide much information on issues of importance to them.

**This survey, while small and from only one state with a large rural population, is nevertheless important when one realizes that 25% of American children are in rural schools (Sherman 1992). The respondents in this study teach rural children; therefore, what these graduate students in science education represent could be generalized to teachers in other rural settings. What seems obvious to teachers in more urban areas is not obvious to teachers in rural settings, a group that could constitute 25% of teachers. States that comprise the largest populations of rural children are Ohio, Illinois, Michigan, Pennsylvania, Texas, North Carolina, Georgia, Kentucky, Mississippi, Indiana, as well as predominantly rural states such as South Dakota, Wyoming and Idaho.**

Claudia Melear is Assistant Professor of Science Education at East Carolina University, Greenville, NC 27858.

In addition, these 25% of America's rural school children are more likely to be white and from two-parent families. Yet, they are poorer, less healthy, less educated and generally worse off than other American children. Rural children in America are more distant from services than are urban or suburban children, thus magnifying the importance of teachers providing them with information about health and well-being issues. Oftentimes, teachers with fewer connections to universities and other urban institutions feel the pressure of local school boards and administrators to follow state and local curriculums more closely than teachers who have quicker access to science education literature. Thus, they may not have the encouragement and information that they need to infuse local and state curricula with topics of major importance to multicultural groups.

### Science Education Graduate Student Responses

Sample questions/answers on a seven item survey:  
**What do you (will you) teach about African American student concerns?**

1. *Stress the fact that African American students can achieve equally with other students.*
2. *Famous black scientists—their contributions—available careers (yet, in a previous question to name three African American scientists, none was listed).*
3. *There are different styles of motivation and achievement because of diverse backgrounds.*
4. *I mention physiological/anatomical variations among races, including nose of black people.*
5. *Positive attitudes, positive feedback to African American students. (I) work hard to make science/chemistry relevant to their life.*
6. *That culturally they provide a diversity in America and have contributed as much as any group to our society (no African American scientists listed when asked in a previous question).*
7. *Nothing specific (genetic diseases such as SCA (sickle-cell anemia) would be the closest topic).*
8. *No efforts are made to focus on any individual cultures in reference to science contribution.*
9. *I don't see where this type of teaching fits into a science classroom.*
10. *I will try to make references that they can relate to.*
11. *Concerns about what? Underrepresentation?*
12. *Two students left the question blank.*

At least half of these responses show that these science teachers are not adequately prepared to teach half of their students in a culturally appropriate way, as described by Banks (1988). When asked to name African American and women scientists, many were unable to name even one from each group. Seven of the students listed only George Washington Carver

when asked to name three African American scientists. Two left the question completely blank. Two listed Eli Whitney (white) and Washington Irving (a writer). One listed two (presumably) former science teachers.

Reporting outstanding individuals in a minority group, such as the above-mentioned task, is the second phase, of five, in reaching the desired behaviors of a multicultural teacher, according to the models suggested by McIntosh (1984) and in Rosser (1990) for infusion of women into a discipline.

### Ways To Begin the Multicultural Approach

McIntosh suggests five phases when beginning integration of women's issues, a model that could also be followed for integration of persons of color (i.e. African Americans in science). The phases are:

- |                                                                |                                                                      |
|----------------------------------------------------------------|----------------------------------------------------------------------|
| I. <i>Womanless science</i>                                    | <i>African Americanless science</i>                                  |
| II. <i>Women in science</i>                                    | <i>African Americans in science</i>                                  |
| III. <i>Women as a problem, anomaly, or absence in science</i> | <i>African Americans as a problem anomaly, or absence in science</i> |
| IV. <i>Women as science</i>                                    | <i>African Americans as science</i>                                  |
| V. <i>Science redefined to include us all</i>                  |                                                                      |

McIntosh's Phase I is easy to recognize in science classes where a woman or African American scientist is never, or rarely, mentioned. Phase II would be recognizable by the inclusion of examples of women and minorities in science, either by specific historic biographies described by the teacher or on video; individually assigned class reports; or by having guest speakers who are women or minorities who work in a science field.

Phase III is recognizable by the plethora of information on "differences" of women and minorities, whenever the differences are seen as deficits. We now know that almost all scientific research has historically been performed on male subjects, thus, equating males with the norm. This miscarriage of scientific justice is now being rectified by, for example, the National Institutes of Health (e.g. old heart attack studies have little to contribute to knowledge of women and heart disease because the studies included only male subjects). New studies are currently being carried out that include women as subjects. Other examples of Phase III teach that African Americans and women are in some way victims, as deprived or defective variants of white men, or as protestors, with "issues."

Phase IV, is the category for a shift in focus. Since women have had half of the world's experience, and in many school districts, up to 50% of public school students are African American, Hispanic or Native American, we need to ask what that experience has been and is, and to consider it in science teaching.

Table 1. Matrix of some multiculturalism issues in biology education.\*

GROUP	Alcohol Education/ Substance Abuse	Domestic Violence/ Children of Alcoholics	AIDS Education	Disease Prevention/ Contamination of Water	Nutrition/ Prenatal Care	Environmental Associated Diseases
African Americans	XXXX	XXXX	XX	XX	XXXX	XXXX
Hispanics	XXXX	XXXX	XX	XXXX	XXXX	XXXX
Native Americans	XXXX	XXXX	XX	XXX	XXXX	XXXX
Women	XXXX	XXXX	XX	XX	XXXX	XX
Homosexuals	XXXX	XXX	XXXX	XX	XX	XX

Level of importance: XX Some  
XXXX Very

*Instructions:* Place an X (or Xs) in each column to indicate the level of importance to each multicultural group to receive in-depth instruction on these issues.

\*Preservice junior and senior biology education majors rankings

For example, we are beginning to incorporate a kind of pedagogy, cooperative learning, that has an appeal for girls and minorities. McIntosh says Phase IV is racially and gender-inclusive, multifaceted, and filled with variety. In science, perhaps we should teach that objective reality is not the only accepted view. Subjective and experiential realities of students should be encouraged. These foci validate a student's perception, whether or not the student is a girl or a minority.

Phase V is science with more useful and relevant topics that are learned more easily. Phase V is the inclusive curriculum, with a sense for all that we are both a part of and alien to the dominant culture. This phase emphasizes whatever science is necessary for group and individual survival and improved quality of life, and is a goal for science teachers to strive toward.

McIntosh warns that it is easy to get arrested in Phases II and III. A good sign for teachers and other science educators would be to get to Phases II and IV in the next year or two. Skip Phase III altogether until you can begin to see differences as unique contributions, rather than as deficits. For example, instead of viewing the learning preference of cooperation desired by many women and minorities as less valuable than the old lecture method, reframe that preference into a valuable piece of information to inform your science teaching. To wit, if more than half the population prefers the cooperative learning method, maybe that becomes the new norm.

### Framework for Multicultural Biology Teachers

Tiedt and Tiedt (1986) list four components of multicultural education for teachers: Provide them with a realistic perspective for cultural diversity, women's concerns, the rights of children, and issues

important to many other groups. These four components provide a framework for multicultural education appropriate for biology teachers.

Biology education should address relevant issues in the lives of students. Table 1 lists some biology issues suggested by the Tiedt and Tiedt framework, and their importance to various multicultural groups. The rankings were the opinions of preservice junior and senior biology education majors. The first two columns in Table 1 involve substance abuse and the resulting impact on life style. Multicultural groups such as African Americans, Hispanics and Native Americans have a high incidence of substance abuse. Therefore, topics such as these should have increased time allotted to them in schools with high minority populations. Additionally, because AIDS is a life or death issue, all students should receive instruction on transmission and prevention of AIDS.

Multicultural biology issues important to Hispanic migrant workers are listed in Table 1: Disease Prevention/Contamination of Water, Nutrition/Prenatal Care, and Environmentally Associated Diseases (such as pesticide exposure). Most of these topics are included in biology curricula already. Some of these topics would have compelling interest to other groups, such as women, Native Americans, and African Americans, as well as to the majority group. Table 2, a blank, is suitable for duplication for use with both teacher and biology student groups. Biology teachers and science methods teachers can begin to think in terms of what they already do that is multicultural in nature by examining and adding to the list in Table 2. Discussion of these various topics, some of which are emotion laden, will demonstrate to class members the influence of culture in our pluralistic society. Members of various groups will have different views. A teacher may elect to show the already completed grid, rather than using the blank. Teachers who are just beginning to study

Table 2. Matrix of some multiculturalism issues in biology education.

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**Level of importance: XX Some  
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**Instructions: Place an X (or Xs) in each column to indicate the level of importance to each multicultural group to receive in-depth instruction on these issues.**

multiculturalism may feel more comfortable with this approach. In addition, a relaxation technique such as visual imagery is frequently used prior to a multicultural activity, because of the nature of discussions on cultural diversity (Batts 1992a).

### Cultural Diversity

Cultural diversity can be addressed via learning style. (Douglass 1979; Hale-Benson 1986; Keefe 1987; Kuerbis 1988; Melear 1994a & 1994b; Melear & Pitchford 1991; Myers 1980; and Shade 1982 & 1989). Learning style information introduces the topic of learning pluralism in a nonethnic and non-gender way; therefore, it might be a good place to begin a discussion on diversity. I use the Myers-Briggs Type Indicator as a measure of learning style to introduce learning diversity.

Learning styles of African Americans have been described by Shade (1989) and Hale-Benson (1986) as a culturally induced cognition. Native American and Mexican American learning styles are described in Shade (1989). Science instruction for African Americans based on their learning style is presented by Melear (1994a & b). Batts (1992b) reports that denial of cultural differences, such as learning style, is a modern form of racism. **General differences in learning style described by these authors are that women and many minorities have a more affective or feeling mode of learning. That is, these groups, more than many white men, like to use subjective values over objective ones, in making decisions. They like to discuss and converse about topics, rather than have information, as facts, thrown to them. Learning style differences can be measured and explained in non-threatening ways for both students and teachers.**

Multicultural discussions led by African American guest speakers can provide stimulus to address the issues of importance concerning the nonmajority populations. African American education majors spoke to

the author's science methods course students about their school experiences. A Hispanic health care advocate came to the same high school science methods class to speak about the migrant workers experience.

Ethnic differences can also be addressed following the activities described by Atwater (1989) for pre-service teachers. Many of these ethnic awareness process activities are appropriate for in-service teachers as well as college faculty. The activities focus on stereotyping, racism, the classroom environment, and characteristics of a multicultural science teacher. One brief example, described by Atwater, is to have students examine seating patterns of minority students during their student teaching experience and then discuss the implications of their findings.

### Women & Minorities

The culture of the scientific enterprise is a topic worthy of discussion, as science has historically been done primarily by European and European American males (i.e. persons of one culture). Science, therefore, has historically been a monoculture. As more women and minorities comprise the scientific community, science as a discipline may change (LaRussa 1991; Matthews 1992). LaRussa cites Bruffee, a social constructionist, who says that a discipline, such as science, is defined by members of the group. When the membership of a discipline changes to be more inclusive and pluralistic, the values, texts, and "ways of knowing" (Belenky et al. 1986) of the discipline change. Matthews (1992) cites numerous authors who argue the case for a masculine bias in science.

### Rights of Children

There has been a recent explosion in the literature on children of alcoholics, with ensuing literature available to teachers (NACOA 1988). This teaching resource needs to be used by science teachers, since

they are a logical group to disseminate current information on alcoholism. For example, most high school biology textbooks include a chapter on alcohol and drugs. This unit could be expanded by a teacher to include a description of the roles that children adopt in addictive families, as well as describing support groups that help families recover (Black 1981). Moreover, there is evidence that alcohol is abused by high school students on a regular basis; ignoring this reality by withholding information that would help students deal with their developing habits is unconscionable for science teachers. When I taught high school biology, a member of Al-Anon visited my classes and discussed not only what it is like to love an alcoholic, but also how it is possible to live with one. Frequently, students who had sat quietly all year would become vocal when the Al-Anon visitor, the expert on alcoholism, was there.

The rights of children include not only nonmajority groups but all children of abuse. However, children's rights are an issue in multicultural education because children are a minority and need protection, which science teachers can promote.

### **Issues of Importance to Other Societal Groups**

Homosexuals are a reality in our society and need affirmation in the sense of acceptance of their sexual orientation diversity and because of AIDS. Because of their knowledge about AIDS (Speece 1992), biologists are a logical group to introduce affirmation to this group of children (Willis 1991) who may have higher risk for both suicide and AIDS. Biology teachers also have the natural opportunity in reproduction classes to address the topic of homosexuality.

### **Ways To Begin Learning About Multiculturalism**

First, accept the long-term nature of infusing yourself and your classroom with a multicultural approach. Batts (1992a) teaches that becoming aware of long-held stereotypes about various multicultural groups is actually the first step in developing a multicultural attitude. Suggestions for becoming a multicultural science teacher are to:

1. Begin at Phase II of McIntosh's infusion scheme by introducing the contributions of minorities and women to science.
2. Present ways to get girls interested in science (for a catalog of resources contact Women's Educational Equity Act Publishing Center, Education Development Center, Inc., 55 Chapel St., Newton, MA 02160, 1-800-225-3088/617-969-7100).

3. **Measure the learning styles of yourself and your students (Myers-Briggs Type Indicator has never been charged with bias and is the most widely used. Order from Center for Application for Psychological Types, 1-800-777-CAPT).**
4. Use Tables 1 and 2 to begin a dialogue on biology topics of both importance and relevance to various cultural groups.
5. Invite minorities to serve on a panel to speak about their experiences.
6. Attend a conference on multiculturalism. An example attended by the author is "Changing Racism: A Personal Approach to Multiculturalism" and is sponsored by VISIONS, INC., 68 Park Ave., Cambridge, MA 02138.

Heterogeneity promotes creativity and innovation (Hanson 1992), both of which are hallmarks of science excellence. Multicultural education acknowledges and values differences; it also teaches directly to those differences and to the needs of multicultural groups. Multicultural education acknowledges the needs of minorities, women and others, rather than looking at them as though they were somehow outside the norm, and therefore, not in the purview of science education. Science classes that value diversity and inclusiveness build democratic cultures. Finally then, teachers and schools that promote multiculturalism are actually promoting better science teaching.

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