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Multiculturalism in Environmental Science: A Snapshot of Singapore

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Students' perceptions of the environment can differ based on sociocultural factors and experiences. Understanding how students develop environmental perceptions is an important step toward developing an inclusive environmental science curriculum. This article presents preliminary data from a study conducted in Singapore in which students' environmental perceptions were elicited through a series of draw-and-explain tasks and personal interviews. In addition to adding an international dimension to multicultural issues, we also discuss knowledge construction within the context of the science classroom and highlight some implications for sustainable living.

An Example of Multiculturalism in Singapore

Zarinah is Malay and Mei Ling is Chinese; both of them are Singaporeans (pseudonyms are used in place of actual names for all students mentioned in this article). They are ninth grade students in the same school. In her definition of an environment, Zarinah wrote, "An environment is a place where tree grows, flower blooms and *most importantly we survive* [italics added]. This is the place where all organisms thrive and survive. They interact with each other." Conversely, Mei Ling defined an environment as, "Beautiful environment. *Where we live at* [italics added]. Must be clean, just like that." When asked to describe the environment in greater detail, they replied,

> it's a kind of countryside area which is also part of the environment. … [The organisms] depend on each other like they have a community. (Zarinah)

> the sea, and the coffee shop or some, like, some shop selling some things at the beach. Yeah, like swimming suit and drinks that some people like to have … a beautiful environment then we can live peacefully and comfortable. (Mei Ling)

The ability of these two students to produce such contrasting views of an environment is surprising given that they received similar instruction; Zarinah focuses on dependent relationships whereas Mei Ling thinks of the environment as something that supports people. Equally remarkable, on the other hand, is the similarity expressed by Mei Ling and Zarinah regarding their conceptualization of life, specifically how it is sustained by the environment. Thus, it is likely that these students' perceptions of an environment are the outcome of their individual backgrounds as well as broader social contexts in Singapore. Accordingly, students' environmental perceptions are not independent of human activities but are coded and reinforced by their sociocultural experiences.

Introduction

Banks (1996, p. 5, cited in Salili & Hoosain, 2001) defined multicultural education as "an education for

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functioning effectively in a pluralistic democratic society." Although there is general consensus about what multicultural education stands for (loosely summarized as equal opportunities for students from diverse backgrounds via the recognition and inclusion of multiple cultural perspectives), there is less agreement over its exact dimensions and boundaries (Salili & Hoosain, 2001). Multicultural education is not just another subject to be taught by a "multicultural teacher," nor is it "exotic knowledge that is external to the real work that goes on in most classrooms" (Nieto, 1996, p. 315). On the contrary, multicultural education should be pervasive. It should be seen in all things from lesson plans to peer relationships, and it is applicable across various schools and subjects. Nieto reiterated this notion by stating that multicultural education is not simply a program, a teacher, or some methodological blueprint; rather, it is an ideology because it permeates *everything*.

Unfortunately, multicultural education is often absent from science classrooms because many teachers believe that scientific concepts and principles are independent of culture. In many academic circles, science *is* truth; theories and laws help legitimize the power of science as a way to describe and explain the world. Indeed, we can see that it would be difficult to connect gender and ethnicity to the structure of an atom or the theory of relativity. Banks (2004) suggested that this widespread belief may explain why multicultural education is viewed as a relevant undertaking only in subjects such as social studies and language arts. It is, however, important for students to see that what counts as knowledge is not some universal mode of thinking and operating but that the inherent complexity of human society leads to multiple perspectives on every issue. Reality is far from static, and student learning is influenced by implicit cultural assumptions, perspectives, and biases. Therefore, although science is invariably a theory-laden subject, it is also a vibrant manifestation of unique sociocultural factors that aid our understandings and explanations of phenomena.

Environmental science is one area that is more likely to incorporate social perspectives because there is some overlap between its scientific components and other subjects such as geography, social studies, and history. Global environmental issues such as climate change illuminate social contexts inherent in science and provide opportunities to accentuate social issues that are otherwise hindered by a conservative science curriculum (Dillon, 2002). In addition to expanding multicultural applications in the school curriculum, using a multicultural framework in environmental science is a way of acknowledging that students have different perceptions of the environment. Attempts to cultivate positive environmental behaviors will be better served if we have a deeper understanding of the sociocultural factors that shape students' perceptions of environmental issues. Educators' awareness of differences in environmental perceptions can also support the development of an effective environmental science curriculum (Peter, 1997). It is important to understand how students think and act within a particular social context (Allemann-Ghionda, 2001; Gay, 2001) so that knowledge of the practices of a particular society—its culture—allows us to predict the impact that society will have on its environment (Tonies, 1989).

The investigation and subsequent understanding of students' perceptions is essential to promoting meaningful learning because social groups access and experience the environment in ways that differ from the mainstream. Furthermore, an examination of fundamental differences in values reflected in students' environmental perceptions also allows us to identify possible connections between social practices and variation in environmental concern. In other words, there is the likelihood that students' perspectives on environmental issues are rooted in state ideologies reflected within the school curriculum. Finally, by exploring Singapore students' environmental perceptions, this study adds an international dimension to multicultural issues that may have been hitherto framed only within the context of the United States. Therefore, the purpose of this article is to explore the multicultural nature of student learning in environmental science by examining Singaporean students' perceptions of an environment and understanding how these ideas might reflect value orientations toward land use.

Context

Singapore is a city-state situated at the southern tip of the Malay Peninsula in Southeast Asia. Prior to its establishment as a trading port in 1819 to protect British interests from the Dutch, Singapore was a sleepy fishing village ruled by local chieftains and largely inhabited by Chinese and Malays. As a result of the increased trade, migration, and economic prosperity, Singapore's population exploded over the next century. Not surprisingly, efforts by the Singapore government to address infrastructural issues associated with the country's independence from British colonial rule in the 1960s involved intensive land use planning schemes that increased the amount of built-up areas, and correspondingly reduced the amount of agricultural, unmanaged, and undisturbed (natural) areas (Kong, 2000; Kong, Yuen, Sodhi, & Briffett, 1999). Given the cultural sanctions imposed by colonialists in Singapore's history, nature has come to be perceived as a resource for human exploitation rather than a living system essential to human survival (Shiva, 1997). This, coupled with the rise of industrialization, has led to Singapore becom-

ing a densely populated nation, saturated with over 4 million people in a highly urbanized setting.

Singapore's population is divided into three main ethnic groups: Chinese (dominant), Malay, and Indian. Despite being widely considered a multicultural society that promotes ethnic diversity, there is a tendency for the dominant group (Chinese) to label individuals from say Sumatra and Bangladesh as people who represent homogeneous Malay and Indian "cultures," respectively. From a community perspective, Tan (2004) added that "minorities are more likely to have cross-ethnic ties than the Chinese" (p. 86). Thus, it may be possible that cultural assumptions exist, specifically one which presumes that Singaporeans will understand and appreciate individual differences because of racial tolerance in the country.

In Singapore, the Ministry of Education (MOE) writes a national curriculum that is closely followed by all schools. Housed within the MOE is the Curriculum Planning and Development Division, which designs and conducts reviews on course syllabi across different subjects to "develop the individual and educate the citizen" (Ministry of Education, 2004).

The site for this investigation was Yiwai Secondary (pseudonym), a public school that serves an urban neighborhood in northeastern Singapore. It has a large number of students from low-income families and the student–teacher ratio is relatively high. A total of 76 ninth-grade students from two classes participated in the study. These students had completed a semester of geography during the previous school year, and this study provided an opportunity to assess their environmental perceptions following instruction in environmental science as presented in a geography class. In Singapore, environmental science is not taught as a distinct subject nor is it a part of the science curriculum; it is infused into other subjects such as moral education and geography (Kong et al., 2000). Consequently, geography was selected as the focal subject because it incorporates a wide range of environmental topics and its status as an exam subject implies that differences in environmental perceptions will have a greater impact on student learning.

Methods

To elicit students' perceptions of an environment, we asked all 76 students in the study to construct drawings and answer open-ended questions. Thereafter, we analyzed all their responses and interviewed several of the students on an individual basis. Multiple sources of data gave the researchers a richer set of information and also strengthened the study by checking the consistency of data between sources (triangulation). Specifically, students were asked to complete a series of draw-and-explain tasks that required them to draw pictures of (a) the environment and (b) land use. Drawings, in particular, represent a key component of qualitative research in relation to young people's thoughts about environmental issues (Alerby, 2000). At the same time, students were asked to define the terms *environment* and *land use* in their own words. Thus, students completed two drawings (one each of the environment and land use) and two written assessments (one definition each of the environment and land use) that elucidated their environmental perceptions. By allowing students to contextualize their ideas using drawings and open-ended questions, we were able to obtain a wider range of responses that led to new and interesting insights into students' environmental perceptions.

A total of 4 students (2 boys and 2 girls) were selected from the study sample for personal interviews because the authors wanted to provide a rich and detailed account of individual students' experiences and the meanings associated with their draw-and-explain tasks. This approach leads to a heightened awareness of social structures and "the mobilization of collective action to directly address inequalities" (Stevenson, 2004, p. 45). These selections were based on the following criteria: students' responses on the draw-and-explain tasks were (a) representative of the ideas that we found most interesting across all 76 students (by that we mean responses that exemplified human–environment associations in the Singapore context) and (b) perceived as reflecting different views of the environment. Mei Ling (F) and Yao Ming (M) are Chinese whereas Zarinah (F) and Aziz (M) are Malay. Interviews began with questions related to the students' drawings and led into further questions that probed their ideas and value orientations. These interviews helped to validate students' responses on the draw-and-explain tasks and allowed us to gain a richer understanding of their environmental perceptions.

Interview data were analyzed inductively, that is, no prior assumptions were made about which aspects of data were important, and they were coded using case-specific criteria to organize and analyze data on an emergent basis (Strauss & Corbin, 1998). During the coding process, data were fragmented into smaller parts and analyzed for similarities and differences. Events that were found to be conceptually similar were then grouped into categories. Once a category was identified, its properties and dimensions were developed to help identify patterns and variations in the data (Strauss & Corbin, 1998).

Interpretive Findings

These preliminary findings are meant to provide a snapshot of students' environmental perceptions in Sin-

gapore using a detailed analysis of 4 students who had completed a semester of geography. This is by no means a complete representation of ninth-grade students at Yiwai Secondary nor is it an attempt to generalize the results to include all Singapore students.

"Draw a Picture of What You Think an Environment Is"

Mei Ling and Yao Ming drew largely urban areas whereas Zarinah and Aziz drew rural landscapes. Yao Ming's picture is shown in Figure 1, and Aziz's picture is shown in Figure 2.

When Yao Ming and Aziz were asked to describe their drawings, they said,

> Forest, then here are some of the poor people living and here is some … some richer people living. (Yao Ming)

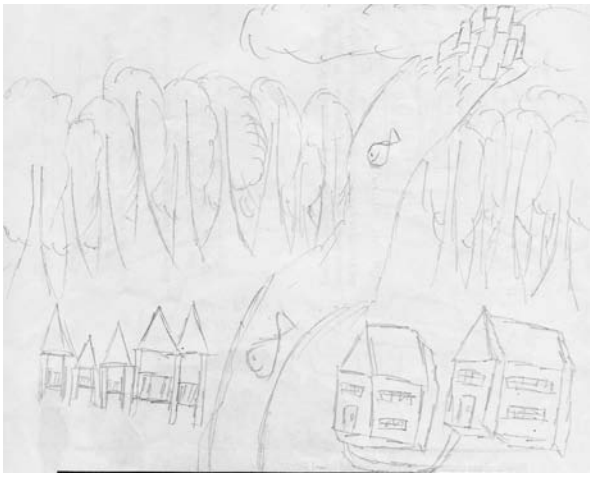

Figure 1. Yao Ming's drawing of an environment.

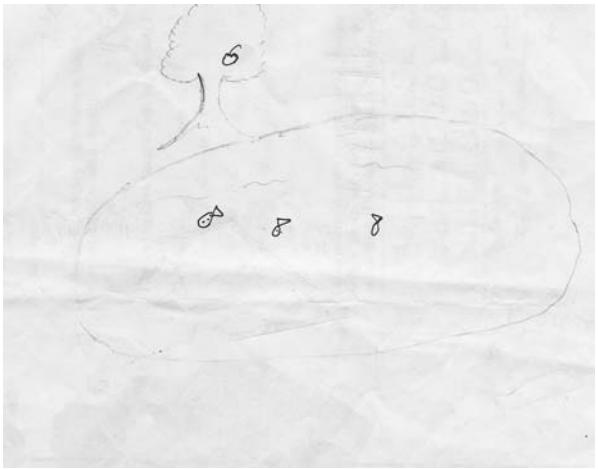

Figure 2. Aziz's drawing of an environment.

> So they ask me to draw an environment and this is like, for me this is a lake and this is a tree. (Aziz)

Furthermore, when both students were asked to describe any items they would like to add to their drawings, they responded with the following:

> Some farms for the poorer people, then here they have huge swimming pool or basketball courts for them to play. (Yao Ming)

> Actually, I wanted to finish up the … a log over here, tree, fishes, uh … tortoise and all that. (Aziz)

In similar fashion to the responses from Mei Ling and Zarinah mentioned earlier, these students' responses highlighted the different ideas they had about an environment.

It seemed that Yao Ming and Mei Ling tended to view an environment as a built-up place whereas Zarinah and Aziz identified it with natural areas. According to Payne (1998) and Rickinson (2001), some children differentiate between the concepts of *environment* and *nature,* with the environment thought to consist of human-made objects and nature often perceived as a "pure" phenomenon. In this case, the Chinese students distinguished one from the other, viewing the environment mainly as a place with human constructions such as buildings. In contrast, the Malay students conceptualized both environment and nature to mean the same thing, that is, a place with minimal human interference.

"Draw a Picture Illustrating How Land Might Be Used"

Not surprisingly, all 4 students drew urban landscapes reflecting the prevalence of high-rise buildings in Singapore. This reinforces the notion that children relate to land use as something that is known or experienced (Payne, 1998). The following are pictures from Mei Ling's picture is shown in Figure 3, and Zarinah's picture is shown in Figure 4.

In addition, when they were asked to describe their drawings, Mei Ling and Zarinah replied as follows:

> [The tree] was placed here so they can see the tree and it's quite good for the eyes, like if you are bored at home, you can see outside got so many trees then feel comfortable. (Mei Ling)

> Buildings in countryside don't really have buildings that we have in Singapore in modern city so sometimes when the area gets flooded or any natural disaster occurs, their house is affected negatively. So

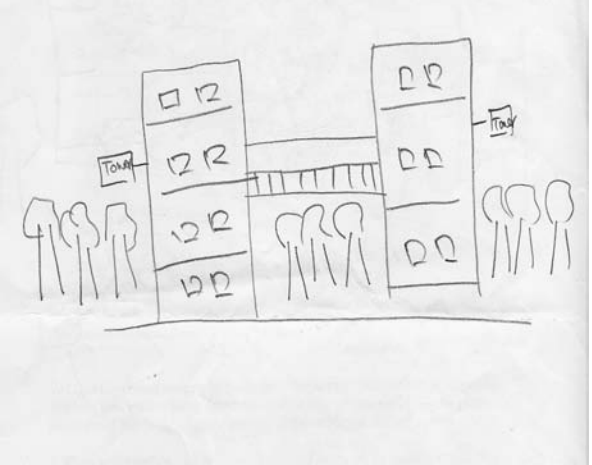

Figure 3. Mei Ling's drawing of land use.

Figure 4. Zarinah's drawing of land use.

> it's good to have a building which is made of cement. (Zarinah)

Regardless of ethnicity, these students' views of land use seemed to be prompted by the importance of aesthetic beauty (Mei Ling) and protection from the elements (Zarinah).

From a broader perspective, decisions regarding land use appear to stem from anthropocentric (land is valued because it benefits humans) rather than ecocentric (land has intrinsic worth) roots. Not only are students' environmental perceptions an indicator of their value orientations, it is also possible that student learning in Singapore emphasizes the use rather than conservation of natural resources such as land. Similarly, Kong et al. (1999) found that Singaporean youth exhibited overtly utilitarian values with regard to land use; they defended the construction of /necessary amenities" that would provide recreation opportunities, aesthetic enjoyment, and economic gain.

These views toward land use may be explained in part by Singapore's transformation from idyllic island to built-up city. In fact, the landscape in Singapore has become a /constructed" environment designed to meet human needs such that "the form of nature which Singaporeans have become familiar with is managed messicol vegetation[1] which was deliberately planted to provide some balance in an increasingly urban environment" (Kong, 2000, p. 260). This does not mean that students are directly taught anthropocentrism. Rather, it uncovers the societal curriculum in schools, one that consumes cultural diversity by devaluing indigenous knowledge and inculcating learners with socially valid views and beliefs (Robertson, 1993; Salili & Hoosain, 2001; Shiva, 1997). In other words, the environmental science curriculum in Singapore reflects a set of core values that globalizes understanding via the transfer of dominant ideologies (Banks, 1993; Rees, 2003), specifically one that prioritizes development over conservation.

Interestingly, only the Chinese students in this study stressed *cleanliness* as an essential component of the environment. Mei Ling wrote that the place where we live at "must be clean, just like that." Yao Ming defined an environment as a place that "has to be clean." When they were asked to elaborate on their written responses, both students emphasized the importance of keeping the environment clean.

> Now Sentosa[2] is quite clean and because last time it is quite dirty so I draw this to, you know, tell them that the Sentosa and environment have to be clean. Then we'll live quite nice. (Mei Ling)

> [Cleanliness] is quite important so we will not smell the rubbish smell, so if they have dogs the dogs will not go and eat the rubbish and get sick. Even if we live in the forest we must keep the place clean, not just the HDB[3] flats must be clean, the forest also. (Yao Ming)

This reveals the impact of legislative measures designed to promote Singapore as a "clean and green city." In fact, national campaigns such as "Keep Singapore Clean" have been in place since the 1960s, and students' responses in this study demonstrate that the importance of cleanliness reflects much of the reality of their given environment (Savage, 1993).

[1]This refers to vegetation planted by humans for harvest as well as aesthetic and recreation purposes.

[2]Sentosa is an offshore island that has been converted into a theme park.

[3]The Housing Development Board (HDB) is an organization that provides affordable public housing and develops residential projects.

Another point of interest was the importance of *convenience* in several interview responses, particularly with regard to getting from place to place. Convenience, however, was a category that was only associated with the women in this study. For example, in her drawing of land use, Mei Ling explained that she put a bridge between the buildings so that "there is no need to come down [to the road] again." During her interview, Zarinah said that the construction of roads is good because "the traveling time and distance is shortened and it's easy for us if there is a road instead of walking." Such gender-based differences could be explained by differing socialization experiences between men and women (Steel, 1996). For example, despite changing attitudes concerning the division of household labor in developed countries, Singapore remains a largely patriarchal society in which women still perform the bulk of household chores. For these 2 students then, their responses reflect the importance of maximizing time to meet the demands of home and school (work). Thus, parents may have inadvertently become role models for their children, causing them to adopt certain environmental values consistent with broader societal experiences.

Discussion

Multiculturalism in Environmental Science

In contrast to a conventional view in which learning science is seen as a passive, linear mechanism, this study presents learning as an active process where meaning is constructed by individuals based on their sociocultural experiences. Nussbaum (1997) added that, "even aspects of ourselves that we may easily think of as universal and invariant … are actually shaped in complicated ways by the culture's view of personal identity" (p. 123). Consequently, even though students are taught environmental science content in a like manner, their understanding of the material will differ based on sociocultural dimensions that are unique to each individual. For example, from a historical perspective, Malays in Singapore mainly resided in *kampongs,* a term used to describe a collection of wooden houses with very few modern conveniences in a rural setting, giving it a village-like quality. This may explain the students' inclination to associate an environment with nature. This is further emphasized in Kong's (2000) description of Singaporean's affinity for nature, in which some participants reported more exposure to nature because they grew up in a Malaysian *kampong* village. Conversely, the Chinese students in this study may have had limited contact with natural areas in Singapore possibly because of protective parents and/or the abundance of other recreation and entertainment options (Kong, 2000; Kong et al., 1999), thus resulting in urban-centered conceptualizations of an environment.

In sum, the ways in which students conceptualize the environment reflect personal, social, and cultural realities. These patterns form part of their cognitive repertoire, give predictability to everyday life (Bowers, 1996; Tonies, 1989), and affect the way they react to the environment. Consequently, educators need to embrace the sociocultural variables that shape students' perceptions if they are to improve student learning in environmental science.

Moving Beyond Ethnicity in the Science Classroom

Merely focusing on ethnic diversity (emphasizing the coexistence of multiple ethnic groups in Singapore) is insufficient to promote multicultural learning in environmental science, nor is multiculturalism simply about tolerance for "others." Rather, there is an urgent need to focus on complex differences that include class (e.g., Malays living in kampongs) and gender (e.g., convenience in the environment) so that both teachers and students can view their classroom using a multicultural lens. As Allemann-Ghionda (2001) stated, it is important to "bring about a kind of education in which the specific life background and knowledge of minority students is kept in mind and inspires the setting and content of teaching at all times" (p. 15).

If teachers teach using cultural blinders, environmental science will continue to be a confusing subject because various concepts will mean many things to different people (Cherif, 1992). Not only that, Malays and other ethnic minorities in Singapore become the victims of a biased education because they are essentially invisible within the curriculum. Their knowledge claims, although legitimate, are rendered useless in a monoculture that perpetuates the homogenization of schools and the larger community (Bowers, 1999). Learning becomes a *cultural ritual,* a matter of knowing what to do or say that reflects the popular worldview rather than one of conceptual understanding and the expression of individual ideas. It behooves each of us, as multicultural educators, to enrich the curriculum with the perspectives and experiences of *all* students (Nieto, 1996).

Multiculturalism and Its Implications for a Sustainable World

When conceptualized as a cultural system, schools have a specific set of values and educational decisions that reflect mainstream ideology (Banks, 2004; Nieto,

1996). Based on this line of reasoning, it is not surprising that environmental values exhibited by these 4 students parallel the exploitative views associated with western science. Although it is impossible for environmental science education to remain value free, it should, however, reflect the inconsistency between sustainable living and anthropocentric views. There is a need to recognize "alternative pathways of cultural development that are essential to living within the limits of the Earth's ecosystems and to a viable and just form of community existence" (Bowers, 1999, p. 163).

More critically, it suggests that Singaporeans might need to cultivate humanity, specifically the ability to appreciate that environmental issues are a basic, human concern. According to Nussbaum (1997),

> Our task as citizens of the world, and as educators who prepare people to be citizens of the world, will be to "draw the circles somehow toward the center," making all human beings like our fellow city-dwellers. In other words, we need not give up our special affections and identifications, whether national or ethnic or religious; but we should work to make all human beings part of our community of dialogue and concern. (p. 60)

That said, it is also important to keep in mind that students' environmental perceptions reveal their personal priorities and that "their view of the world reflects their situation in the world" (Wals, 1992, p. 46). For example, if Singapore students perceive land use in urban settings, their environmental concerns may not reflect the Western ideology of wilderness ecology or preservation but may instead focus on events affecting their daily lives, such as waste disposal and the issue of cleanliness. Payne (1998) suggested that a preoccupation with the "naturalness" of nature can undermine the broader purpose in environmental science, which is to provide people with the knowledge and skills to improve environmental quality.

Conclusion

The findings illustrate that students learn environmental concepts differently. As the ecological landscape in Singapore continues to be transformed by urbanization, a deeper understanding of students' environmental perceptions becomes increasingly salient because these views will determine how they choose between development and conservation (Kong et al., 2000). Development, in particular, implies a globalization of the priorities and prejudices of the West where land use change is justified by economic logic and rationality (Shiva, 1997). Further research into students' perceptions of other environmental topics across different sociocultural contexts can illuminate the diversity of their conceptualizations and value orientations, thus allowing us to see the intrinsic value of the "other."

From a multicultural perspective, an awareness of the assumptions, values, and categories of thinking in a cultural context sensitizes educators to the complex relationship between humans and the environment (Bowers, 1996) and highlights the cultural heterogeneity that characterizes classrooms. There is a need to explore "the routines, patterns and rhythms of children's daily lives" so that we can begin to grasp what it is like for them to be in this world (Payne, 1998, p. 20), particularly in the realm of science. Additional research on other ethnic minorities with regard to their environmental perceptions will help us understand how specific social and cultural identities influence people–environment associations. This information will also promote a retooling of the environmental science curriculum in Singapore so that it reflects a variety of human interests, experiences, and ideologies.

If we are to be successful at solving the environmental crisis (which is in part a crisis of sociocultural ignorance), we need to adopt a new concept of teaching and learning in environmental science, one that "helps students understand environmental issues in the context of their lives, and their lives in the context of environmental issues" (Dillon, 2002, p. 1112). By moving away from a traditional "assimilationist" ideology toward the creation of a multicultural citizenship, both teachers and students will be able to improve environmental quality through an appreciation of global diversity (Banks, 2001).

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America is at a crossroads today. We shall either become a great multicultural society—the first truly multicultural and multiracial democracy on the planet—or we shall revert to our most sinister side that describes the worst part of our historical past, a compassionless society in which only the elite have power and privilege and in which we judge people not by the content of their character but by their race, their culture, their gender, their exceptionality or their sexual orientation. We can be a better nation than that.

—G. Pritchy Smith, NAME Founder (1996)