

Dominican Republic Project

Digest



# Dominican-American Students and Science: A Guide for Science Teachers



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Digest



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# 1

## Dominican-American Students and Science: A Call to Action



One of the central principles of science education can be stated simply: "Know your students and teach them accordingly." As a science teacher, do you know your students? Nationwide, for example, 42% of public school students are from minority groups, nearly a 100% increase since the 1970s (Dillon, 2007). The profile of America's school children has undergone a remarkable transformation in the past 30 years. In the American West, Whites now comprise a minority of public school students (~46%), and even in the Midwest, the whitest region of the nation, minorities now comprise 26% of school students. The most pronounced growth in minority enrollment has been among Latino students. From 1972 to 2005, for example, this student population has increased from 6% to 20% nationwide (Dillon, 2007).

Within the Latin-American population, the number of Dominican-Americans in the United States in general and New York City (NYC) in particular has also grown rapidly. In NYC, for example, Dominican Americans comprise the largest Latino subgroup with a population greater than 500,000 (Torres-Saillant and Hernandez, 1998). Dominican Americans have also comprised the largest share of students entering the NYC public school system since the 1980s.

One might predict that the dramatic rise in Latin American and Dominican American K-12 populations has resulted in concurrent increases in the number of Latin American and Dominicans Americans attending post-secondary schools. Sadly, this has not been the case; between 1996 and 1999, for example, only 5% of Dominican Americans graduated from college (Leavitt, 2001:52). Only a fraction of these college graduates majored in the sciences.

A brief look at the state of secondary science education in the United States partially explains the paltry representation of Latin-Americans in college and university science programs. At every grade level, White students are characterized by higher science content and inquiry skills than Black and Latino students (Rakow, 1985). Black and Latino student performance in math and science have remained well below those of White students. As Lee and Luykx (2006) point out, White and Asian American 8th grade math and science performance is very similar to that of African American and Latino 12th graders.

One conclusion – the wrong one – that might be drawn regarding the gap in performance between Latino and non-Latin-American students is that Latin-American students have little enthusiasm for studying the sciences or pursuing professions that require higher-level science education. Current and future science teachers of Latino populations need to know that their student's attitudes toward science do not appear to parallel performance measures. Indeed, Rakow (1985) and Kahle (1982) found that minority student's positive attitudes toward science were comparable to, or in some cases greater than, White students. Additionally, science career choice aspirations were similar among racial and ethnic groups (Lee and Luykx, 2006). Likewise, a "funds of knowledge" study conducted through the DR Science project revealed that 80.8% Dominican-American students have aspirations for higher education, and that the careers they wish to pursue in the future include many high-skilled occupations (e.g., lawyer, doctor, teacher, nurse, Nehm et al., 2008). In this same study, Dominican students reported liking science a "fair bit" and viewed science as "somewhat important" while at the same time reporting that their teachers talked about science jobs "very little or not at all" and generally did not encourage students to pursue science.

Such findings suggest that as science educators we need to concern ourselves with a second "gap", one that perhaps supersedes the disparity in achievement between Whites and Latinos; it is the gap between Dominican American youth's stated interest in science and science education and the degree to which we as science teachers recognize and act upon their interest. Clearly we need to do a better job of capitalizing on Dominican student's basic valuing of science as a course of study and career pursuit.

In order to help teachers have a greater impact on the science education of Dominican-American students, the website [www.drscience.org](http://www.drscience.org) provides three digests that introduce important tools, resources and strategies for classroom application: DR Digest 2: *Cultivating a Sense of place*; DR Digest 3: *Mining Funds of Knowledge*; and DR Digest 4: *Designing Culturally Relevant Curricula*. Collectively, we hope these digests provide guidance for teachers who want to make science accessible to the diversity of students who sit in their classrooms.



# Mining Dominican-American Students' Funds of Science Knowledge



When students encounter new science content in academic settings, these encounters are mediated through knowledge that they have collected through a lifetime of prior experiences with people, places, and texts. In other words, students do not arrive in our classrooms as “blank slates” with “zero balances” in their intellectual bank accounts; rather, they possess highly personal, and sometimes vast, scientific ‘funds of knowledge’ in the form of meteorological, geographical, biological, and ecological concepts formed through day-to-day living in particular places and times.

The DR funds of knowledge research program set out to identify and value typically unrecognized cultural and cognitive capital harbored by Dominican American students in order to generate knowledge for the production of culturally-relevant science curricula and enhance science teacher professional development. A simple principal has guided the program: science educators can leverage Dominican American students’ funds of science knowledge by rigorously investigating their student’s currently held scientific beliefs, values, and knowledge, and how their life experiences in the DR and local communities have shaped them. This work has produced findings that “provide a first step in building a resource bank that can be used to build curricula that more explicitly connect students’ lived experiences with school science topics.” (Barba and Reynolds, 2003). We have learned, for instance, that Dominican American students, from their frequent travels to the DR have intimate knowledge of, and exposure to cows, plantains, and palm trees, three organisms that are not readily observed in New York City. Our hope is that such knowledge paves the way for teachers becoming more informed in their choices of topics and examples connected to scientific ideas.

The crucial task of investigating students’ funds of knowledge should not be left to university-based researchers and science educators surveying large and distant student populations. While Dominican-American students may share certain life experiences, there is a danger in assuming that they hold uniform perspectives on the scientific world. One could argue that the teachers working directly with Dominican-American students are in the best position to unearth both the shared and highly individualized aspects of students’ knowledge funds, and then to build instructional experiences based on a sophisticated understanding of what their students know about scientific phenomena.

## The DR Project Funds of Knowledge Survey

One method of investigating students’ funds of science knowledge is to use and expand upon the survey developed by the DR Science Project (see **Appendix**). While the data that have been collected thus far have unearthed helpful information regarding Dominican-American students’ perspectives on the scientific world, the benefits of 7-12 science teachers administering the survey may include: (a) increasing the reliability and generalizability of the study by expanding the sample size; (b) delivering data directly into the hands of those in the optimal position to make use of it in the science classroom; and (c) revising the survey to include questions that inform instruction on topics that may have been overlooked in the current survey.

## Anticipation Guides and Funds of Knowledge

An Anticipation Guide is another powerful tool for mining student’s funds of knowledge related to science or any other knowledge domain. It consists of two basic activities: (a) Before a unit of study, students present and discuss the origins of their beliefs and knowledge regarding central topics, concepts, or issues related to the subject matter; (b) After a unit of study in which they encounter new information, students reflect upon and reexamine their beliefs and knowledge regarding central topics, concepts or issues related to the subject matter. In addition to helping teachers know what their student’s know as a starting point for curriculum design and instruction, Anticipation Guides directly benefit students by initiating two intellectual processes that are central to successful learning of academic content: activation of prior knowledge and metacognition (thinking about one’s thinking).

Steps for Designing and Implementing an Anticipation Guide include: (1). Identify key information, concepts or issues that students will encounter in a unit of scientific study; (2). Create a short list of statements that present a perspective on the target information, concepts or issues. It is helpful to include statements that you anticipate are consistent with student’s beliefs or experiences and others that you anticipate will contradict their beliefs or experiences (see Duffelmeyer, 1994 for additional information); (3). List the statements on a handout or display and provide a space for students to indicate whether they agree or disagree with the statement; (4). Facilitate whole or small group discussions in which students share their responses and their justifications for them;

(continued)

(5). Review student responses to the Anticipation Guide and collect resources (e.g., from [www.DRScience.org](http://www.DRScience.org)) and plan instruction informed by what students “know” about the topic; (6). After students have participated in instructional activities related to the topic, ask them to evaluate, reassert, and/or change their original responses and locate specific evidence in the unit resources that supports their current perspectives; and finally (7). Facilitate a second whole-class or small group discussion in which students share their responses and their evidence-based conclusions. We provide one simple example of an anticipation guide below.

### Sample Anticipation Guide for Earthquake Study

<b>Part 1: What do you think?</b>			
<p><b>Directions:</b> Before we begin our unit on Earthquakes, read each statement in Part 1. If you believe that a statement is true, place a checkmark in the <i>Agree</i> column. If you believe that a statement is false, place a checkmark in the <i>Disagree</i> column. Be sure to explain your answer.</p>			
Statement	Agree	Disagree	Why?
1. Earthquakes occur more frequently in New York City than the Dominican Republic (DR).			
2. One reason that earthquakes occur frequently in the DR is because it is very hot there.			
3. The surface of the earth is fractured much like a cracked eggshell.			
4. Earthquakes occur mostly on land.			
5. Every day there are earthquakes occurring on Earth.			
6. Geologists study earthquakes by traveling deep within the Earth's core.			

### Post-instruction Anticipation Guide

<b>Part 2: What do you think now?</b>			
<p><b>Directions:</b> Now that you have read, heard, and seen more about earthquakes, review your responses to Part I of the anticipation guide. If you still believe that a statement is true after what you have learned about earthquakes, place a checkmark in the <i>Agree</i> column. If you still believe that a statement is false, place a checkmark in the <i>Disagree</i> column. In the “Textual Support” column, note evidence from the materials that support or refute your original ideas.</p>			



“Sense Of Place” (SOP) has recently emerged as an important theoretical framework for exploring a broad array of issues in contemporary education. While its meaning varies based on the educational field in which it is used, all definitions appear to encompass one’s personal connection with a particular spatial location. Sanger (1997), for example, who has discussed SOP within the context of environmental education, defined SOP as “an experientially based intimacy with the natural processes, community, and history of one’s place.”

Within the field of science education, considerable research has focused on how increasing one’s SOP can be used to enhance teaching and learning outcomes (Sanger, 1997, and references therein). Sanger (1997) has discussed how contemporary science education considers students’ relationships with their “lived” environments as marginal, uninteresting, and unimportant. The purported marginalization of SOP in education is thought to be related to students’ alienation from their natural environment and alienation from science itself (Sanger, 1997). Curriculum that integrates SOP is potentially important because culturally congruent curricula and culturally-aware teachers have been demonstrated to offset the well-documented disengagement in learning science among many urban and minority student populations (Bouillion and Gomez, 2001).

Understanding student’s SOP and helping students explore their own connection to their environments has particular significance for teachers of Dominican-American students. This is because Dominican-American communities include a large number of “transnational villagers” (Leavitt, 2001). “Transnationalism” refers to a pattern of living and working in the United States for most of the year but keeping strong social, economic, and political ties to one’s homeland. This transnational connection extends beyond politics and economics, however; it includes familial relationships, religion, and culture (Leavitt, 2001). The DR thus remains a central part of many Dominican American students’ lives; indeed, many Dominican Americans have been known to “mythologize” the DR as a “paradise” (Gray, 2001:198).

Teachers and school leaders point out the challenges of educating students who in effect live in two very different worlds, namely the need to address “gaps” in student’s content knowledge and academic literacy skills resulting from their movement back and forth between countries. The transnational character of Dominican-American students, however, can and should also be seen as providing opportunities to enhance teaching and learning outcomes. Specifically, geological, meteorological, geographical, biological, and ecological knowledge about the Dominican Republic, which Dominican-American students harbor to varying extents, can be “mined” during science instruction to generate improved understandings of scientific patterns and processes (e.g., climate, earthquakes, etc.). Science curricula can be constructed in ways that prompt students to contrast natural history components of the Dominican Republic with their new environment in New York City or other areas, thereby making use of their personally experienced environments and ecologies.

Below we review a variety of resources intended to help science teachers gain a better understanding of the transnational environments that are fundamental to forming Dominican-American student’s beliefs, values, and concepts related to the natural world. While some of the resources, such as the Nature Galleries and Video Libraries links on [www.DRScience.org](http://www.DRScience.org) focus directly on geological, meteorological, geographical, biological, and ecological features of the Dominican Republic, others offer perspectives on the life experiences and culture of Dominican Americans.

#### Books and articles:

Torres-Saillant, S. and R. Hernandez. 1998. *The Dominican Americans*. Greenwood Press. (A good starting point.)

Gray, D. M. 2001. *High Literacy and Ethnic Identity. Dominican American Schooling in Transition*. New York: Rowman and Littlefield (A personal account of Gray’s schooling experiences).

Diaz, Junot. 1997. *Drown*. Berkley Publishing Group. 224p. (Short fiction stories by a notable Dominican-American author).

Grasmuck, Sherri and Patricia R. Pessar. 1991. *Between Two Islands: Dominican International Migration*. University of California Press. 280p.

Hernandez, Ramona. 2002. *The mobility of workers under advanced capitalism: Dominican migration to the United States*. New York: Columbia University Press. (A readable introduction to the history of Dominican migration to New York City from an economic and sociological perspective).

Leavitt, P. 2001. *Transnational Villagers*. University of California Press. 281p. (A "bird's eye view" of the Dominican-American experience).

Lopez, Nancy . 2003. *Hopeful Girls, Troubled Boys. Race and Gender Disparity in Urban Education*. Taylor and Francis. (Rich portrait of Dominican-American secondary school experiences in New York City).

Pons, Frank Moya. 1998. *Dominican Republic: A National History*. Markus Wiener, 543 p. (A useful general reference on Dominican history).

Cambeira, Alan. 1997. *Quisqueya la Bella: The Dominican Republic in Historical and Cultural Perspective*. Sharpe, Me., Inc. (Perspectives on Latin America and the Caribbean Series). 286p.

# Designing Culturally Relevant Curricula for Dominican-American Students



If one of the central principles of science education can be stated simply: "Know your students and teach them accordingly", it follows that our science curricula should be consistent with this mantra. It refers to not only the science ideas that students bring into the classroom, but their cultures and worldviews as well (Cobern, 1994). In accordance with this idea is the perspective that science faculty and science teachers need to recognize and value the unique cultures and viewpoints that students bring with them into their classes. Successful science teachers connect science with students' day to day lives, cultures, and worldviews rather than ignoring them (National Research Council, 2004).

Unfortunately, this is very different from the way in which most science classes have been and continue to be taught. This is due, in part, to the fact that many teachers working in New York City schools have little knowledge, experience, or understanding of the students with which they work. As a result, they lack important resources that appear to be necessary to achieve substantial change.

While student culture was once viewed as a barrier to science learning, or even as a deficit (Trueba and Bartolome, 1997), new research is challenging this notion and is revealing that worldview and culture can be powerful sources of capital (sensu Bourdieu, 1986). If employed in the science classroom, this capital can be used to leverage both knowledge gains and student engagement (Roth and Barton, 2004; NRC, 2004). Even more important is the idea that ignoring student worldviews may be a fundamental reason for why so many students are disconnected from both schooling and science (Cobern, 1994).

In *Digest 2: Mining Funds of Knowledge*, we presented the anticipation guide as an effective tool for helping science teachers uncover their student's beliefs and knowledge regarding central topics, concepts or issues related to targeted scientific subject matter. The following section outlines two instructional activities that advance scientific learning by leveraging the knowledge that Dominican American students have acquired through their uniquely transnational status.

## Activity 1: Dominican American Ambassadors to the Natural Disaster Youth Summit (NDYS)

NDYS (<https://media.iearn.org/node/185>) was organized in May 2004 and held its first meeting in Hyogo, Japan in September 2004 to commemorate the 10th anniversary of great Hanshin Awaji Earthquake. In addition to annual summits, participating schools conduct a variety of network based collaborative projects and on-line forums to promote awareness of the devastation caused by natural disasters and how to cope with the effects of Earthquakes, Volcanic Eruptions, Wildfires, Floods, Hurricanes, Landslides, Tsunamis, Droughts and so on.

The lives of all Dominicans and Dominican American have been directly or indirectly touched by the great earthquake of 1532, which destroyed the city of Santiago (the Dominican Republic's second largest city) and the more recent devastating earthquake of August, 1946. Despite the historical connection Dominicans have with earthquakes, there are currently no schools in the Dominican Republic (or schools in the USA with large Dominican American populations) that belong to the NDYS network of 32 countries.

The NDYS represents an ideal forum for Dominican-Americans to develop and share knowledge on a topic of cultural relevance, and then share what they know and have learned with other youth from cultures that have a vested interest in understanding and coping with natural disasters. Through interviewing relatives in the States and the DR, sharing and writing about personal stories that they have heard or read about related to DR earthquakes, and studying its natural history, plate tectonics, climate change, biodiversity and ecosystems, students can educate themselves and their peers on an breadth of science related topics including:

- (1) Why are there more frequent and destructive earthquakes in the DR than in New York?
- (2) How has its location in a major earthquake zone impacted the individual lives of Dominicans, its natural history, and its ecology?
- (3) What can we learn from older generations of Dominicans about how to prepare and respond to earthquakes and other natural disasters?
- (4) What is the current state of disaster preparation and response on the DR and how adequate is it?

## Activity 2: DR Field Explorers

Students who regularly visit or spend parts of the year in the DR are ideal candidates to undertake scientific field expeditions and return to their classrooms with artifacts from natural world. During their time abroad, they can collect digital photographs, drawings, maps, and journal entries that identify different habitats, species, and ecosystems in the DR. They can also make small collections of seashells or other common artifacts from the natural environment. At the same time, their classmates can conduct expeditions in comparable environments in NYC for comparative studies of biodiversity in the two locations. As students become “field” experts in their respective locations of scientific inquiry, they can produce reports, digests, and multi-media presentations for the purpose of sharing their acquired knowledge with classmates as well as teachers.

In addition to collecting physical artifacts from the Dominican Republic, transnational students can use their time abroad to collect citizen science perspectives related to a variety of scientific concerns. For example, they can conduct interviews and surveys that reveal attitudes and beliefs of the Dominican population in regard to issues ranging from conservation, endangered species, ecosystem health, global warming, and eco-tourism. Again, the information they collect can be compared to related data that classmates have obtained from similar studies of Dominican-American populations.

Many of your students view science as something practiced by individuals wearing white coats peering through microscopes in distant laboratories. They may assume that the concerns of these individuals have little in common with Dominican and Dominican American populations; they may also assume that scientists do their work in far away locations like NASA and the Amazon River Basin, not the neighborhoods of Washington Heights or Santiago. When Dominican-American students travel to the DR, you can prepare them to employ scientific methods in order to investigate how the transnational experience impacts the ecology of Dominican-Americans. Through guided inquiry projects, students can explore what the natural sciences can teach us about the following topics:

- (1) The immigration patterns of Dominicans;
- (2) The eating habits of Dominicans;
- (3) The occupations that Dominicans pursue in NYC vs. the Dominican Republic;
- (4) The attitudes and habits of Dominicans and Dominican American in regard to exercise and other physical activity.
- (5) The attitudes and habits of Dominicans and Dominican American in regard to resource conservation and the treatment of animals.

By immersing themselves in these paths of inquiry as they travel between the DR and USA, Dominican-American students will begin to see that science and the work of scientists is central to everyone’s lives.



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For additional resources, visit:

[www.DRScience.org](http://www.DRScience.org)

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