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Teaching Science to Students from Rural Mexico: Learning more about ELL Students' Communities of Origin.

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Abstract
George Roberts has been teaching ninth-grade Earth science in Gardston, Iowa, for 10 years. This year, as chair of Gardston High School's science department, he agreed to have all the English Language Learner (ELL) students assigned to his classes. George's goal was to learn more about the needs of these students and arrive at a set of techniques he could share with the rest of his science team. Unlike many other science educators, George has a distinct advantage: The majority of ELLs at Gardston High School immigrate from a particular community.

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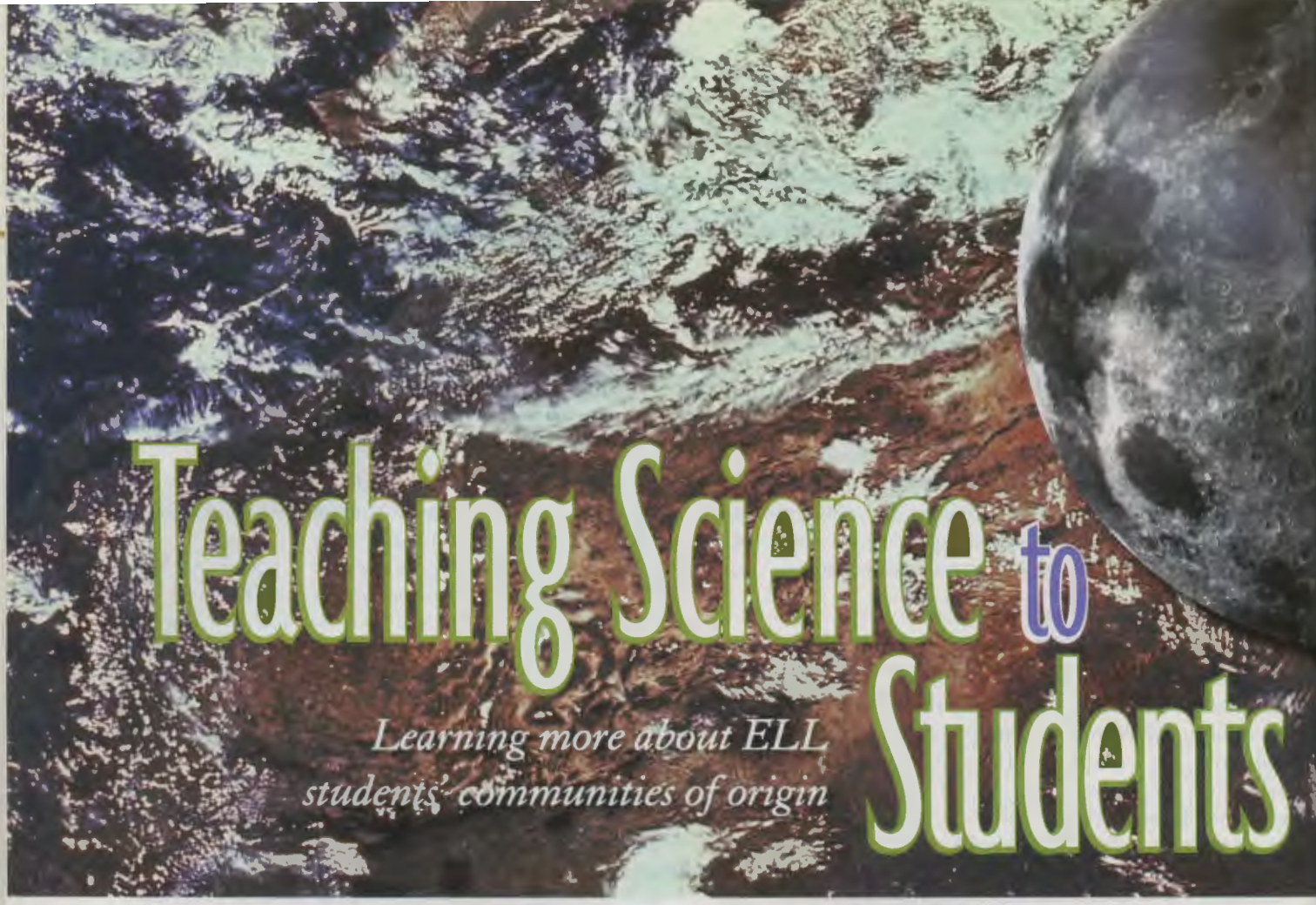

Teaching Science to Students

Learning more about ELL students' communities of origin

Katherine Richardson Bruna, Dennis Chamberlin, Hannah Lewis, Edna Mónica López Ceballos

George Roberts has been teaching ninth-grade Earth science in Gardston, Iowa, for 10 years. This year, as chair of Gardston High School's science department, he agreed to have all the English Language Learner (ELL) students assigned to his classes. George's goal was to learn more about the needs of these students and arrive at a set of techniques he could share with the rest of his science team. Unlike many other science educators, George has a distinct advantage: The majority of ELLs at Gardston High School immigrate from a particular community.

Understanding the rural community of origin of his Mexican ELL students can help George learn more about his students and teach them better. This article reports on a visit some of the authors made to the shared hometown of George's students in hopes of uncovering aspects of the students' former lives that stand to impact their experience in his classroom.

Use of pseudonyms.
Names of people (aside from the authors) and places described in this article have been changed as a condition of the primary author's research project, which requires that people and place confidentiality are maintained through pseudonyms.

Supporting ELL science teachers

There is lack of infrastructure in Gardston, as well as in other Iowa communities, to support teachers' abilities to effectively address the rapid ethnic diversification of their classrooms. In response, the state of Iowa is engaging in innovative capacity-building efforts to develop the needed knowledge and skills among its educational professionals. One of these initiatives involves providing teacher educators and administrators the opportunity to travel to Mexico so they can be immersed in the language and culture of the new immigrants' hometowns and thus be more aware of the impact of these differences on student learning.

As part of an exploratory information-gathering process to plan for one of these trips, I (Katherine Richardson Bruna) had the opportunity to travel to Pueblo to see where so many of Gardston's new immigrants come from. I am involved in the design and delivery of professional development to ELL science teachers in Iowa. Accompanying me on the trip were my coauthors—a photojournalist (Dennis Chamberlin) and a graduate student in sustainable agriculture (Hannah Lewis). Upon return, the final coauthor, a teacher in Mexico (Edna Mónica López Ceballos), helped us make

sense of our insights. Here we share those insights because we believe the information will benefit not only George, but all science educators of students from rural Mexico and quite possibly other "developing" countries.

Mexican immigration: A national pattern

Gardston is just one of many traditionally "non-ELL" cities to which now nearly entire communities in rural Mexico are coming to lay down new roots. In doing so, they are bypassing the usual gateway states such as California, New York, and Texas, for example (Lyman 2006). What Gardston is experiencing speaks to the national pattern of U.S. immigration. Over the last three decades, immigration from Mexico has come to account for almost 40% of the total national immigration increase, up from below 800,000 in 1970 to a swelling 8 million in 2000 (Camarota 2001).

Among other factors, changing economic policy in Mexico is responsible for this dramatic increase, most of which comes from the rural sector, as members of the small landholder class, a reported 64% of them, migrate to the United States in order to earn enough money here to survive as farmers there (Pastor and Wise 1997). Given these figures, attention to the education of children from rural Mexico in U.S. schools is rapidly becoming a national priority.

Most Gardston ELLs come from a town we will call Pueblo in the central state of Michoacán, one of the largest sender regions of Mexican immigrants to the United States. Over the last decade and a half, residents of Pueblo have, through family and community migration networks (Winters, de Janvry, and Sadoulet 2001), gone north to Gardston to work at Ryler, one of the world's largest meatpacking plants, where Pueblo immigrants are now reported, according to members of the Gardston Mexican community, to comprise 50% of the plant workforce. These migration networks have dramatically changed

ALL PHOTOS COURTESY OF DENNIS CHAMBERLIN

In rural Mexico, a woman pours fresh well water in buckets.

the demographic landscape of Gardston, and of George's Earth science classroom.

Before our trip, George had some basic questions about his students' background. One question he had, for example, was about the nature of their science education. He understood science teaching in the United States as driven by the goal of being "the big competitor," but in Mexico, an "underdeveloped" country, he asked, "What drives science teaching?" From his questions, it was clear George was curious about the background his students brought into the classroom. Here we describe what we learned from our visit to Pueblo in order to provide, for George and others, some answers.

The community context of rural Mexico

Pueblo, like other rural *ranchitos*, is a poor community. In rural, small-town Mexico, poverty is the norm. In towns with fewer than 2,500 residents, for example, it is reported that 73% of families are in the lowest 4% of the nation's income distribution (Farm Foundation 2006). The manifestation of this poverty is widespread and is indicated by "measures of level of living" such as dirt floors, lack of access to piped water, one-room dwellings, unavailability of milk and eggs, low literacy rates, and low family income (Young, Freebairn, and Snipper 1979).

Since Pueblo has been in a sender-receiver relationship with Gardston for nearly 15 years, the measures of level of living in this particular rural Mexican community have been significantly improved. Pooled money earned working at the plant in Gardston has enabled the completion of several significant public-works projects, including the provision of electricity and piped water to homes (see photo, p. 37), and the renovation of the church and its adjacent plaza. However, due to the history of poverty in the community and the resultant need for children to assist their families in basic subsistence agriculture practices, the value of a formal education has not been fully realized.

For teachers, understanding poverty as central to the community context of rural Mexico means recognizing statements to the effect of "Mexican students and families don't care about education," are tremendously simplistic. Because of larger sociohistorical forces, formal education has *had* to take a back seat to the immediate concerns of survival. But, importantly, when these concerns are alleviated by migration to places like Gardston, formal education becomes an investment in the future, in a way it may have never been before for a family. Science teachers can play an integral role in nurturing this investment by using the inquiry-based nature of science to capture student interest in schooling and, significantly, to build connections between students' lives and the curriculum.

Due to chores, children do not typically eat before school; mid-morning, mothers bring food to school.

The knowledge and skills of rural Mexican immigrants

Because children play important roles in contributing to household survival in Pueblo, they have extensive real-world experience that can, if properly mobilized, be an asset to classroom science-learning. Children grow up watching family members tend livestock, plant, and harvest. Boys, primarily, help with these farming activities, while girls help with food preparation. Both genders assume full responsibilities for these activities when the family deems them ready. The seventh-grader we stayed with in Pueblo helped his dad milk, move, and feed the cows, for example, and load sacks of cut straw used as feed from the field into storage.

The agricultural knowledge and skill sets so central to life in Pueblo could be drawn on as funds of knowledge (Moll et al. 1997) in the science classroom. For example, processes of biology could be elucidated through reference to the cultivation of plants and animals and, better yet, examined through living curriculum, such as the use of science-garden projects (Hammond 2001) or small farms, which allow these youth to really demonstrate what they know. Encouraging Mexican immigrant students to share their talents and stories, and seeking out what they already know about the natural world and related science phenomena, can be a way of tapping valuable sources of information (Barton 2003) and providing students with affirmation and esteem-enhancement in the classroom setting.

Raising the perceived status of Mexican immigrants is a necessary project in "host" communities, such as

Gardston. Because the immigrants come to work at meatpacking plants, for instance, their identities quickly become tied to that high-stigma industry. In one Gardston High School science classroom observed, for example, a teacher talked about a pig-dissection activity as if it were preparation for their future work in the plant. In this way, students' identities as capable science learners are overshadowed by the circumstances that have brought them here and further made invisible by existing currents of race-, class-, and language-based prejudices.

Cultural discontinuity: Environment, curriculum, and instruction

Cultural discontinuity refers to a lack of congruence, or fit, between home and school environments (Nieto 2004). This is exactly what students from Pueblo are likely to experience when they begin to attend school in Gardston. Because of the small size of their hometown rural communities and the level of poverty that characterizes those places, new Mexican immigrants are likely to be overwhelmed by the stature and resources of American schools.

A rural Mexican school.

Things that most American students take for granted—such as lockers, cafeterias, media centers, electronic pencil sharpeners, drinking fountains, classroom televisions, and colorful, print-rich environments—will be absolutely new to, and thus a source of distraction and diversion for, youth from rural Mexico. In addition, the school space itself may be alienating, as rural Mexican schools are single-level, ranch-style buildings with open-air passageways around a central courtyard (see photo on this page); this is very different than the highly enclosed and institutionalized feel of many U.S. schools.

As in the United States, students in rural Mexican schools attend school approximately seven hours a day. However, students in rural Mexico are likely to receive instruction not from certified teachers but by *docentes*—providers of instructional services with life-skills related to a particular subject who travel into the rural community to teach. In Pueblo, all teachers at the middle school (no high school exists) come from outlying communities, not from Pueblo itself.

Because of the lack of teacher training, pedagogy in these communities is characterized by direct instruction (teacher lecture) with occasional Initiation-Response-Evaluation (IRE) sequences—teacher initiation of a question, student response, and teacher evaluation. Teachers teach using state-provided materials and the curriculum is considerably narrower than in the United States, with electives being nonexistent. Students in these communities rarely have textbooks, so valuable instructional time is spent with the teacher standing in front of the whiteboard writing down information for students to copy as notes.

For U.S. science teachers, it is important to know that students from rural Mexico *are* exposed to a science curriculum. At the middle school in Pueblo, for example, students take biology, chemistry, and physics. However, the nature of their exposure is very different. Given the lack of textbooks, students are not socialized into using the textbook as a resource for learning, nor are they used to inquiry-based science and alternative learning structures, such as cooperative learning. Preparing students to orient to the textbook and to other classroom resources, such as posters or other reference materials, will take time and effort. Similarly, students will need practice with and time to adjust to inquiry-based learning and cooperative work, which will feel much "looser" than what they are used to.

Family circumstances and involvement

In Mexico, in general, families are not expected to be formally involved in their children's schooling. As with the larger sociohistorical forces shaping poverty in Mexico's rural communities, the reasons for this seemingly minimal family involvement are complex. Schooling only became secularized in the mid-19th century (Secretaria de Educación Pública 2000) and, because of the culture of political corruption in the country, schools, as state and not religious institutions, were suspect (UNESCO 2005). This meant that families did not strike up easy relations with schools, generally leaving schools to do what is regarded as "their work" without too much family intervention.

The kind of middle-class family involvement practices typically regarded as the "norm" in the United States, such as parent-teacher conferences and associations, fundraising, and back-to-school nights, are unheard of

in Mexico. Similarly, while literacy is improving among the younger generations, the kind of literacy resources typically assumed to exist among adolescents and their parents in U.S. middle-class homes (e.g., magazines, web-surfing, school e-mails and newsletters) has no tradition in rural Mexican students' lives. For example, the home where our team stayed had no cookbooks, television guides, or newspapers; there was the *Bible*—a testimony to the continuing importance of religion in Mexican history and culture. In fact, the meaning of *educación* in Mexico goes beyond what we attribute to it; it does not mean just schooling, but the process of learning to be a well-mannered and moral individual. Thus, families, in Mexico, to their way of thinking, are an important part of *educación* because they provide the moral fabric. Schools contribute to the work of families in achieving this goal, not the other way around.

In Pueblo, families are only called to the school for disciplinary reasons. For these reasons, U.S. science teachers will need to take proactive, creative steps to provide opportunities for families to get willingly involved. Communication with the home is a place to start, but newsletters will not be enough. Phone calls, with the assistance of a bilingual paraprofessional, are likely to have more success in getting families into the classroom for conferences. Free family science nights, with child care and refreshments, with sufficient advance bilingual advertising, can begin to build bridges between the school and the families and begin to establish *confianza* [trust], another important element of Mexican interpersonal relations. Again, science gardens or small farms provide a perfect opportunity to tap into knowledge and skills that exist in the families of rural Mexican immigrant students and foster genuine connections between the curriculum of the school and the funds of knowledge of the home.

Humanizing science pedagogy with rural Mexican youth

Criticizing his country's investment in industry, a Pueblo farmer quipped to us, "*No se puede comer tornillos ni tuercas* [You can't eat nuts and bolts]." This quote encapsulates the centrality of agriculture in these rural communities and, with that, the associated skepticism of the alienated, mass-produced, disconnected ways of living associated with industrialization. It is helpful to remember this quote when we think about how best to work with new immigrant students from rural Mexico. It helps us understand that we need to think of schools as places of cultivation and harvest, of sowing seeds and reaping fruits, of putting humanity back at the center.

We need to practice a humanizing science pedagogy with these youth (Bartolomé and Macedo 1997), which recognizes the real-life resources these ELL students bring to their science learning and the real-life purposes to which they may put science learning in their lives here, if they stay, or there, if they return. Quite possibly, in trying to make science education more meaningful for these ELL students, we will achieve another, unanticipated, outcome. We will make it more meaningful for *all* students so that, for George Roberts as well as others, science education in the United States becomes more than just about global competitiveness; it becomes about learning. ■

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