

ANGELA CALABRESE BARTON, MELINA FURMAN, BEN MUIR,  
JOHN BARNES, AND STEPHAN MONACO.

### **13. WORKING ON THE MARGINS TO BRING SCIENCE TO THE CENTER OF STUDENTS' LIVES**

#### INTRODUCTION

In this chapter we use the lens of a preservice teacher, Ben, to understand how a collaboration, which took root through a transformative action research project, brought together an experienced teacher, a preservice teacher, a doctoral student, a university researcher, a school principal and a group of middle school students, to build a new practice of science teaching and learning in an urban middle school.

The school, The Bronx School for Science Inquiry and Investigation (BxSSII), is a neighborhood middle school with a focus on science located within a predominantly Latino immigrant community in New York City. One of the driving themes of the school, brought to life in many different capacities, is the goal to develop a vision and practice of science education that deeply connects to students' lives and communities while, at the same time, attends to current standards in science education and the other school-based subjects.

In describing the unfolding of this collaborative project, we draw from the ideas of Black and Chicana feminisms to make the case that one of the critical features of building a new practice of teaching and learning in the school was a close emphasis on solidarity building. We use, in particular, the notion of margin and center to show how the dialectic between margin and center can serve as a site for solidarity building – a site of empowerment and growth when people work together both within and against the system.

While our collaboration stretched across many individuals, to understand more fully the role that this vision of solidarity played in our partnership, we focus on the experiences of Ben, who was a preservice teacher working at BxSSII as part of the Urban Science Education Fellowship, a yearlong teacher education program based on a partnership between Teachers College and several urban middle schools. We focus on Ben's experiences because we believe that learning to teach for social justice is an especially challenging endeavor and to understand the unfolding of this project through Ben's experiences is particularly powerful. In particular, we describe how Ben was able to author new and different spaces of collaboration with other school participants and with the community than are typically supported in an urban school and in preservice teacher experiences. We continue to explain how these spaces enabled significant opportunities for growth for teachers and students based on new relationships of mutual trust and understanding. We note that while Ben is a co-author of this chapter, we all felt

that it would make the most sense to write about Ben's experiences in the third person.

#### TRANSFORMING SCHOOLING AS AN ACT OF SOLIDARITY BUILDING

Chicana feminists have written about how "marginalized peoples" often live in the borderland or within the margins of dominant culture (Anzaldúa, 1987, hooks, 1983, 1994). Borderlands are the "geographical, emotional and/or psychological space" occupied by marginalized peoples (Bernal, 1998). Borderlands have special meaning because those who live in the borderlands develop, for the purposes of survival, a kind of *critical consciousness* "that straddles cultures, races, languages, nationalities, sexualities and spiritualities" (Bernal, 1998, p. 560). In Black feminist writing, hooks refers to the borderlands, or the space on the margin occupied by black families, as a socializing setting where Black children learn to deal with the individual and institutional racisms and prejudices prevalent in society, and to develop empowering attitudes toward their own ethnicity that may not be as visibly active as the prevailing negative images and evaluations of Blacks in popular culture depict (Ward, 2000). Likewise, she argues, the margin, because of its separateness from the center, provides a safer space for Black children to construct an identity that includes blackness as positive and valued, to observe the social world critically, and to oppose ideas and ways of being that are disempowering to the self.

Yet, Black and Chicana feminists also argue that the margins or the borderlands are alive, and part of their dynamicity rests in how they intersect with the center. The borderland, like hooks conceptualization of margin - center, is purposefully intended to acknowledge the powerful, critical, and political stance supported by and sustained through a shared history of domination and resistance. However, the borderlands also challenge the dualistic thinking imposed by margin and center, one is normally drawn to think about, because the very act of imploding the dualism of the margin and center shatters the assumption that to be marginalized means that one *is* marginal (Bernal, 1998; Elenes, 2001).

Both Black and Chicana feminists agree that perhaps the most important quality of the borderland or the margin is that it serves as a place of solidarity from which to challenge the assumptions and practices guiding dominant culture. The borderland reflects a kind of cultural knowledge made up of individual experiences and community memories that becomes "part of the fabric of how we think about schooling" (Gonzales, 2001, p. 653). This is an important point about the borderland. Weaving cultural knowledge into the landscape of schooling calls into question official knowledge and deficit model ways of thinking and acting within schools. It also places cultural knowledge (as it plays out through individual's and groups identities, lived experiences, and worldviews) on equal footing with "academic knowledge".

In terms of urban science education, the borderland or the margin - center metaphor powerfully positions how we think about, or frame, what it means to teach and learn science or to engage in urban science education reform. The

politics of urban education in the 21<sup>st</sup> century in the US is marked by Discourses of accountability where decisions about day-to-day life in classrooms are made by individuals who may never set foot in such classrooms, let alone that school or neighborhood. Attention to the cultural knowledge one has from growing up in an urban neighborhood, or to the pragmatic realities one confronts when stepping foot into an urban school or a neighborhood for the first time with the best intentions of teaching, are not reflected in such Discourse.

The urban school setting, and the players within, are often teaching and learning in the borderlands of US education society. But, like Bernal or hooks suggest in their own work around Chicana and Black culture, we believe there is great power in owning this borderland and in fostering spaces of critical consciousness that both develop separate from and in dialectic relationship with the dominant Discourse (and practice) of urban schooling. In our collaborative we often call these spaces *hybrid spaces* in reference to the new, often unpredictable, spaces of participation that become alive within the margins of everyday practice, when the contribution of various authors merge with the common goal of creating new ways of doing and being that were not afforded to themselves before (Moje, 2004).

Through Ben's story, in this chapter we hope to show how teachers, researchers, students, and other school officials, can use the borderland *as a place of strength for building solidarity*— for building with others new empowering spaces of mutual trust and understanding. Thus, in the remainder of this chapter we do three things. First, we situate our story in two narratives (urban teaching and urban teacher preparation) to provide a context for how our collaboration worked with and against the dominant Discourse in urban education. Second, we share two vignettes from Ben's teaching which capture our collaborative efforts to promote equitable teaching and learning in science education through solidarity building in hybrid spaces. Third, we discuss the implications these stories have for collaborative research in school reform and teacher education.

#### POSITIONING THIS STORY IN TWO NARRATIVES

Before we move on to discuss how the recursive acts of solidarity building developed within the borderlands and how they were supported and transformed by the dialectic relationship between margin and center, we first pause for a moment to describe two dominant narratives which shape our collaboration: (1) the urban science teacher shortage; (2) urban teacher preparation.

##### *The Urban Science Teacher Shortage*

One of the biggest inequalities in educational opportunities faced by urban children living in poverty is the diminished access to highly qualified teachers in general, and science teachers in particular. Although the shortage of teachers is a problem that affects the entire United States, research shows that the effects of teacher shortages and the provision of qualified teachers are not equally spread. They have disproportionately affected students who are in low-achieving schools, schools with high numbers of students of color and students with high numbers of children

who qualify for free or reduced-price lunch (NCTAF, 2003; Zeichner, 2003). As Zeichner (2003) remarks, an important gap exists “between the rhetoric about providing all students with fully qualified and effective teachers and the reality of only some students having access to these teachers.” (p. 491).

In 2001-2002, for instance, only 44% of the teachers hired in New York City schools were certified (Gandara & Maxwell-Jolley, 2000). The results published in *The Condition of Education* (NCES, 2003) report that the percentage of public high school students taught selected subjects by teachers without certification or a major in the field they teach was much higher in high minority and high poverty schools than in low minority and low-poverty schools in 1999-2000. In general, statistics show that students already exhibiting low academic performance have a higher probability of being taught by an underprepared teacher.

Science education is not an exception to this state of affairs. Ingersoll (1999) has shown that children attending high poverty urban schools have limited access to certified science teachers or to administrators that support high-quality science teaching. In impoverished urban districts of cities like Los Angeles and New York, Darling-Hammond (1999) reports that the percentage of uncertified and under-qualified science teachers outweighs the percentage of certified and qualified teacher and therefore most students take science courses with underprepared teachers.

According to Ingersoll and Smith (2003) and the National Commission on Teaching and America’s Future (NCTAF, 2003), the shortage of qualified teachers is fundamentally caused by a high rate of teacher attrition. The Commission’s report argues that, against the common wisdom that the ability to improve schools and instruction is limited by a national teacher shortage, the real school-staffing problem is teacher retention.

The statistics presented in the report show that the inability to support high quality teaching in many of American schools is driven not by too few teachers entering, but by too many leaving. Although each year more than enough new teachers graduate to meet the country’s needs, they show that in just three years it is estimated that almost a third of the new entrants to teaching will leave the field, and after five years almost half will be gone. As they state: “When we read about how many teachers a school district must hire in the fall, I should be asking instead about how many left last spring—and why” (p. 8).

Unfortunately, the widespread inequalities make easy to predict that schools serving high poverty minority communities are those with the highest rate of teacher turnover and attrition. At a national level, the report shows that the annual rate of teacher turnover for high poverty public schools is 20%, in comparison to 12.9 % in low poverty schools. The consequence of this high level of teacher turnover and attrition causes, in turn, urban high poverty schools to be staffed with the highest percentages of first year teachers, the highest percentages of teachers with less than five years of teaching experience, and the lowest percentages of veteran accomplished teachers.

*A Call for a Specialized Preparation*

There is no question about the compelling need for effective science teachers in urban schools serving high poverty communities. However, what is more difficult to agree upon is, first, how to prepare teachers to develop the tools they need to become effective and, moreover, what being effective means in the context of urban science education.

Teaching in high poverty urban settings can be a truly challenging endeavor. On a daily basis, many urban teachers must deal with “horrendous conditions” (Haberman, 1995, p. 25) in the context of institutions that, in many ways, are deeply dysfunctional. These constraints include, for instance, limited resources and support, big classroom sizes and school cultures where the pedagogy of poverty is the norm rather than the exception (Cochran Smith, 2004; Haberman, 1995; NCATF, 2003).

Additionally, there is another important factor that shapes teachers’ experiences in urban schools and causes early burnout: the cultural divide between most teachers and their students. At present, the composition of the American teaching force is relatively homogeneous. Teachers are mostly White European American teachers from middle-class backgrounds who only speak English. On the contrary, the vast majority of students in inner city schools are racial and ethnic minorities, live in poverty conditions and speak a first language other than English (Banks et al., 2005; Ladson-Billings, 1999).

The differences in their life experiences deeply mark the ways teachers can relate to their students. Most urban teachers do not have the same cultural frames of reference and points of view as their students and, in many ways, come from “different worlds” (Banks, Cochran-Smith, Moll, Richert, Zeichner, & LePage, 2005). As a result, most teachers have difficulty constructing curriculum, instruction and interactional patterns that can help students to bridge home-school differences and see them in deficit ways (Cochran Smith, 2004).

In science education, the process of bridging experiences becomes even more challenging, since teaching science requires enculturating students into a particular way of discourse that “takes them beyond the boundaries of their own experiences to become familiar with new explanatory systems, ways of using language and styles of developing knowledge” (Hogan & Corey, 2001, p. 215). For many students, this is a true cross-cultural experience. As Haberman (1995) has pointed out, “the school is trying to transform them into the kinds of people doing things they have never seen or experienced first hand” (p. 25).

Given this scenario, we agree with others who claim that providing a specialized preparation for urban teachers is crucial to increase teacher retention and avoid their sense of failure and early burnout (Cochran Smith, 2004; Haberman, 1995; Ladson-Billings, 1999). Haberman states that the traditional approach to teacher education is counterproductive for future teachers in poverty schools since it leads them to perceive students as deficient or “abnormal.” As he puts it: “Completing a traditional program of teacher education as preparation for working [in today’s urban classrooms] is like preparing to swim the English Channel by doing laps in

the university pool. Swimming is not swimming... 'Teaching is not teaching' and 'kids are not kids'" (cited in Ladson-Billings, 1999, p. 233).

These views are consistent with reports of teachers who started to teach in an urban setting after being successful teachers in different contexts and ought to "relearn" how to teach in order to perform effectively with their new student population (Roth et al., 2004; Tobin, 2000). In his article "Becoming an Urban Science Educator," Ken Tobin (2000) describes how being an experienced educator with middle class students in suburban-like schools was not enough for him to succeed teaching poor minority students in a west Philadelphia City high school. As he reports: "Every day I enacted activities that I expected to be successful, but they fell short of my expectations and eluded the students' interests." (p. 101). Tobin recalls how being successful in this new environment meant learning to negotiate with students his right to teach them science and being able to connect his enacted curriculum to the interests and knowledge of young people who were ethnically, culturally and socially very different from himself.

#### BUILDING SOLIDARITY

In this section we share two short vignettes (Finding science in the community and Reflecting with children) that describe how Ben, in collaboration with the other authors of this chapter and his students, began to build solidarity by coauthoring hybrid spaces that opened new opportunities for student and teacher growth. What is most important about these spaces is that they afforded the participants' development in ways that challenged both what has been generally described for urban school scenarios and what is typical for preservice teacher experiences. In this way, the borderlands became a space for the participants to work both within and against the system and, in doing so, served as a space for building solidarity, as new relationships based on trust and understanding emerged among teachers, students and everyone involved in the partnership.

##### *Vignette 1: Finding Science in the Community*

As part of a life science curriculum unit called "From farm to store," Mr. Monaco's sixth graders were learning about topics such as the biology of plants, organic and intensive farming techniques, regional and non-regional food distribution and food packaging. The main purpose of the unit was to generate student understanding of the ways food -of both animal and vegetable origin- was produced, processed, and ultimately transported to the consumers. The unit also had the goal of creating awareness of the ways that food production can impact the natural and social environment.

Ben believed that living in a large city made most children feel disconnected from science and nature. He was therefore concerned that students might not find the unit topics relevant to their own lives, and thus might not feel any connection to the subject matter. As he put it, for urban children "learning about what a farm is like is the same as learning about what an atom is like."

This concern led Ben to bring a new idea to our science team meeting. In this weekly meeting Ben, Mr. Monaco and Melina -who worked as Ben's mentor and school-university liaison- discussed ideas to enact the schools' mission of bringing science closer to students' lives. Ben's suggestion was to create what he called "community experiences": activities focused on science topics that had connections to the school neighborhood. He believed that these community experiences had the potential to make the life science curriculum more relevant to students. The team found the suggestion very appealing, since we shared his interest in creating links between the community and the science classroom, and decided to go ahead with it. Ben's idea became the seed for a transformative action research study that focused on understanding the impact of community experiences on students' perception of the relevance of the science curriculum to their lives.

Ben took the lead, looking for resources in the school's neighborhood that could be connected to the unit topics, and contacting the people in charge of them. Based on the information he gathered, the collaborative coauthored a community experience that involved a field trip to a local grocery store and a greenmarket, where farmers sold produce directly to consumers on the street. The activity's main purposes were to show students how the topics they had been learning about in science class were also present in their own neighborhood, and to have students collect data in both contexts to compare the organic versus intensive way of producing and distributing food.

This seemed like a particularly compelling activity for it challenged how access to quality food is framed for urban youth at the same time it positioned students as experts in where and what food is available in their communities. It also opened up considerable opportunity to critique the food system in the US, in terms of access, availability, and affordability. Relevance here resided in both what students already knew content-wise, and in the struggle to survive in the city.

During the visit, students split in two groups. One group went to the grocery store with Ben, while the other group went to the greenmarket with Mr. Monaco. Afterwards, the groups switched locations so every child had the chance to visit both markets. Students had to compare how produce was grown, distributed, and sold at the two markets. They did so by observing different fruits and vegetables, examining their prices and studying their packages. They also had to record as many places where products came from as they could and take pictures at each location of what they believed was important to share with other students.

Finally, students interviewed the produce manager at the grocery store and a farmer at the greenmarket about their lives. They asked them questions about where the food they were selling came from, and how it had been produced and transported to their markets. Ben created worksheets to scaffold students' work, which the children used to record their observations and interviews.

Back in the classroom, the whole class discussed their findings regarding the differences between both markets. Ben recalled that students made a lot of observations about each place and were very interested in sharing what they found with others: "They had all sorts of things to compare about the markets, which was the main point of the trip." Mr. Monaco, then, guided the classroom conversation

toward students' reflecting on how their choices when buying food had an impact on the environment.

*Vignette 2: Reflecting with Children*

In order to assess the impact of community experiences on students' perception of the relevance of the science curriculum to their lives, Ben decided to interview a few students in conversation groups. He thought that talking to students outside class in the more informal space of a group interview would allow him a deeper understanding of their thinking.

Over the year, Ben conducted four 45-minute focus group interviews in the science classroom during lunchtime. He randomly selected four children, two boys and two girls, from a list of student volunteers. Interviewing four students, he believed, would give him a variety of perspectives, while also being a manageable group size. Although Ben was mainly responsible for conducting the interviews, on some occasions Mr. Monaco participated as well. During the interviews Ben asked students to openly share what they found interesting about the science topics they had been learning, especially within the community experiences, and to discuss how they saw these topics connect to their lives.

DISCUSSION

*Building Solidarity in the Community Experience*

The visit to the markets created a new hybrid space for Ben and the students to interact differently around urban science teaching and learning. In this way, it became a site for solidarity building, as it enabled new kinds of relationships among all the participants that supported new spaces of collective empowerment based on mutual trust and understanding.

For students, this meant to engage in ways of learning science that positioned their lives and resources at the center of a science lesson. For instance, the experience allowed them to see the many ways in which science-related topics were present in their own communities. The visit also challenged the traditional ways in which the students viewed people in their neighborhoods by positioning community members, such as farmers and grocery store managers, as experts in science-related matters. Additionally, the experience positioned students in a way that was atypical of the science classroom, asking them to be producers of knowledge by gathering and analyzing actual data outside of a classroom environment. In doing so, the activity supported students in leveraging resources that were not usually drawn upon in science classes, such as interpersonal skills for conducting interviews.

The experience also afforded Ben the opportunity to see students under a different light. While Ben went into the project expecting to foster students' connections with science, he came to realize that the community visit had also provided him with new insights into who his students were. This new



understanding of his students was key to developing Ben's trust in their resources and abilities. He saw that the students interacted differently and drew upon resources and skills that he had not seen in the science classroom, nor that he had imagined would have a place in science learning. Also, the community experience gave him deeper insight into how extending opportunities for participation, such as interviewing or taking pictures, could show him what the students found meaningful:

One thing that worked really well was having members of each group have different roles. One person was the team leader, one was the photographer, one interviewed the farmer and one interviewed the produce manager. I got to see different strengths the students have that I don't normally see in the classroom, like interpersonal interviewing skills. It will also be interesting to see what kinds of photos the students took to see what they thought was important.

The markets visit also challenged Ben to reconsider what he meant by a community connection. Initially he thought he would provide the students with an experience that would show them that science topics existed in everyday events in their community. However, by listening carefully to the students talk about their experiences, he soon learned that these newfound community connections had become integrated into their everyday lives, such as affecting how and why students and their families made choices when deciding where to shop and what to buy. Ben realized that students were not only *seeing* scientific topics in their everyday lives as he had expected, but also *using* science to make choices and influence other people's actions, as the following quotes illustrate:

[Carmen:] My grandmother, I went food shopping with her last month and, um, I was reading some macaroni and cheese, the back. I think it came from, um, Virginia or something like that. It started with a V, maybe Vermont, and she told me, and I told her: "Look at this macaroni and cheese and all the way it came from, wherever it came from," and she said: "Oh, um." I thought it was not organic. It's not regional. And I told her to not buy it because it came from a long way.

[Daniel:] I tell my mother: "Buy those regular eggs, buy the, um, cage free eggs. Yeah, because things have been added like pesticides. Cause they give that to the chickens and the chickens going to lay that. The chickens would lay antibiotics and I would eat that and get sick and have to go to the hospital."

[Jessica:] My mom was working that day because she's a home attendant. Me and my dad I meet her at the supermarket, and me and my dad were waiting. He was going to choose, I think, spaghetti in a box. It came from, I think it was Vermont, yeah, VT is Vermont, and he was going to take it and I was like: "Dad don't buy it, it comes from a long distance, and while it was it in trunk something might have happened to it," and it was dented, too.

[Ben:] So, did you buy different spaghetti?

[Jessica:] We bought, instead of spaghetti, we bought macaroni and it came from, and I think it came from Queens.

Finding that students' connections also involved using science to make changes for themselves and others was a new insight for Ben, as he had not expected that to happen – at least, not after only a few months of school:

I was really surprised with the connections they came up, the things they were doing, the way they were taking things that they learned in science class and really try to make some changes in their lives. It was bigger changes that I expected to hear from them ... We decided to only focus on having the students learn how the community works, and we did not attempt to use our planned activities to create change within the community. Interestingly though, as we made the scientific content more connected to the community and students' lives, they began to use their new knowledge to create change for themselves.

Ben's findings helped him reconceptualize the potential of including community experiences in his teaching. He grew aware that the connections that children were making were equally important to the teacher's efforts in understanding the students as they were to the students' learning. In this way, the markets community experience supported him in building solidarity with his students, as he started to understand them better as people and trust in their capacities. What is most important is that he began to articulate how building solidarity could inform his teaching. He started to recognize that an important part of good science pedagogy entailed being able to identify and capitalize the resources students already possessed into science learning, and that developing understanding and trust with students was crucial to enable teachers to do that.

#### *Building Solidarity in Reflecting with Children*

Conversations with students became hybrid spaces by challenging the typical roles of teachers and students in the science classroom in two main ways. First, they positioned students as experts of their own learning process and the teacher as a learner. These spaces gave children epistemic authority and helped Ben become aware of the value of seeking students' perspectives to guide his teaching. Moreover, they opened a space for Ben to reconsider the meaning of relevance and who was responsible for creating it. In this way, these conversation groups became sites for solidarity building by opening spaces for new kinds of conversations between students and teachers where students' perspectives were placed at the center of science instruction. These conversations afforded all the participants new chances to develop mutual understanding and trust with one another.

First, conversation groups with students opened a space for students to reflect on the place of science in their lives that challenged the traditional roles of teachers and students in the classroom. Students were able to teach Ben about their experiences with science in and outside school and, at the same time, he was able to learn from students' stories and reflections.

Also, analyzing what students told him in the groups allowed Ben to start seeing his students' perspectives as essential tools to make his teaching meaningful to

them. This was an important development for him, as he began to consider how part of a teacher's job entailed actively seeking for students' perspectives to inform his practice. In fact, at the beginning of the project Ben was skeptical about the value of doing focus group interviews. He had decided to gather evidence from students mainly because it was part of the requirements of the Urban Science Education Fellowship. He believed that a teacher's perception on what students had experienced during an activity (what he called "informal research") could be pretty accurate as long as the teacher was reflective enough. Thus, he thought that conducting conversation groups was not going to give him much more information on students' perception of the relevance of the science curriculum, compared to what he had noticed from their class participation. In this quote, Ben wondered about the benefits of collecting data in a systematic way:

Will doing formal research tell us things that informal research [i.e. done by a teacher in a non systematic way] won't? As a teacher you can tell if students are engaged in a project or not. Why spend all the time and energy on formal research if you are going to come up with the same answer?

Contrary to his expectations, the conversation groups opened, for Ben, a new space to understand how science learning played out in the complex worlds of children. In fact, many of the students' responses surprised him, as they challenged his initial expectations on the kinds of connections that students would make with the content. He became aware of the fact that teachers could not easily predict what students had gained from a science activity, no matter how reflective they were. This new awareness led him to start trusting students as key informants of his teaching.

Over the year, Ben found in the conversation groups a space to learn from, with and about the students. These spaces offered him the chance to learn more about students' interactions and struggles with science. He became aware, for instance, of some misconceptions that students had developed after the unit, which raised questions for him about how to teach the topic in the future. Perhaps most importantly, he was able to grasp the ways students found the content meaningful. This was especially significant for him since he did not share a cultural background with them, as he reflected in this quote:

I still am learning those perspectives that all students bring to the table. I'm still learning what the students, these students who I am not like [bring]. My life style is so different from theirs, and their knowledge is so different from mine. [I am learning about] what they know and how I can bring that to what I'm teaching to them.

In addition, listening to his students in the conversation groups helped Ben reconsider what he understood by relevance. He also started to see children as partners in the construction of curriculum relevance. At the beginning of the study Ben believed that it was the teacher's responsibility to show their students that science was part of their everyday experiences in order to engage them in science learning. Urban science teachers had, in his views, the extra challenge to learn about students' communities and what mattered to them, especially if they did not

share a cultural background with their students. That understanding would give them the tools to create more meaningful instruction and curriculum.

Students' responses in the conversation groups challenged Ben's initial ideas on who was responsible for creating relevance. For example, he learned that students were able to make more of those connections after participating in the interviews and being asked to actively reflect on the relevance of the curriculum, as he explained in this quote:

One thing that I discovered after several focus group interviews with the students is that the focus group interviews themselves seemed to increase the amount of relevance of the science curriculum. Because the students knew I was going to ask them how the science curriculum connected to their lives, I believe they started thinking about those connections more.

This finding showed Ben that talking with students about the relevance of the science class was not only important to grasping how the curriculum was already relevant for them. He realized that these conversations were key to creating relevance. He became aware of the fact that, although it was essential that teachers tried to make explicit the connections between science and students' lives, the curriculum did not become truly relevant for students until they actively reflected on the connections between the science that they were learning and their lives. This new awareness had profound implications for Ben's views of himself as a teacher. He began to shift his position from a "relevance provider" towards a participant in the collective construction of relevance. He realized that the connections between science and student worlds were not just there, ready to be revealed. On the contrary, they were successfully created as students actively tried to find them both by themselves and by engaging in conversations with teachers and other children. This awareness led him to trust his students in a new way, as he started to see them as responsible for creating curriculum relevance.

Lunch-time conversations became a regular happening in Mr. Monaco's classroom, and eventually these conversations led to opportunities for students to co-plan curriculum with our science team. As a result, during the last months of school the students and us co-planned 6 lessons on food and nutrition. In this way, conversation groups opened a new space in the science classroom where a joint search for meaning could begin to happen, based on new relationships of mutual trust and understanding among the participants.

#### SOLIDARITY BUILDING, URBAN SCHOOL REFORM AND TEACHER EDUCATION

Ben's story shows how building solidarity can shape the landscape of urban schooling in ways that afford teachers and students new opportunities for significant growth. As Chicana and Black feminists have argued, the hybrid spaces that Ben coauthored with other school participants show that there is great power in owning the borderlands. By creating new spaces in the margins that emerged in dialectic relationship with –but also separate from– the center, teachers and

students were able to challenge the traditional Discourse and practice of urban schooling. In describing Ben's story, we demonstrated how solidarity building can support teachers and students in coauthoring new ways of being and doing in the science classroom that challenge deficit views of what is possible within the context of urban schools in high poverty communities.

Solidarity building gains a new meaning within the two narratives that we presented regarding the current urban teacher shortage and the call for a specialized preparation to teach science in urban schools. Coauthoring hybrid spaces in the margins afforded Ben significant opportunities for growth that are not typical of preservice teacher experiences. As many science educators have argued, being an effective teacher in urban schools involves developing a specialized pedagogical toolkit that allows teachers to bridge the culture of school and of students' homes by building on the resources that students bring to the learning process. This specialized toolkit must also support them in bridging the cultural gap between themselves and urban children (Bouillion & Gomez, 2001; Calabrese Barton, 2001; Varelas, 2002; Vora & Calabrese Barton, 2005). Yet, researchers have also shown that student teaching and other extended forms of preservice teacher preparation fall short in developing the specialized tools that teachers need to succeed in the demanding environment of urban schooling in ways that afford all children meaningful opportunities to learn (Haberman, 1995; Zeichner, 2003). Hybrid spaces, therefore, became sites that supported Ben in developing trust and understanding towards his students in ways that enabled him to develop new visions and tools for his future practice.

Finally, our stories speak about the importance of solidarity in building strong school and university research collaborations around teacher education. The two narratives that we have presented regarding the current context of urban teacher education speak about the urgent need to develop new ways to prepare teachers to succeed in urban schools. We believe that establishing and sustaining school and university research collaborations is essential to understand how to best support beginner teachers in their first steps within an urban school. However, building strong partnerships is often challenging, especially given the competing agendas of universities and urban schools. As our study shows, a critical feature of our partnership was a close emphasis on solidarity building. Thus, we argue that solidarity can become the cement that holds research collaborations together and make them stronger in ways that significantly affect all the participants involved, affording for them new contextualized understandings of what it means to teach and learn in an urban school.

#### REFERENCES

- Anzaldúa, G. (1987). *Borderlands, la frontera: The new mestiza*. San Francisco: Aunt Lute Books.
- Banks, J., Cochran-Smith, M., Moll, L. C., Richert, A., Zeichner, K. and LePage, P.. (2005). Teaching diverse learners. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world* (pp. 232-274). San Francisco: Joey-Bass.
- Bernal, D. D. (1998). Using a Chicana feminist epistemology in educational research. *Harvard Educational Review*, 68(4), 555-582.

CALABRESE BARTON, FURMAN, MUIR, BARNES, MONACO

- Bouillion, L., & Gomez, L. (2001). Connecting school and community with science learning: Real world problems and school-community partnerships as contextual scaffolds. *Journal of Research in Science Teaching*, 38(8), 878-898.
- Calabrese Barton, A. (2001). Science education in urban settings: Seeking new ways of praxis through critical ethnography. *Journal of Research in Science Teaching*, 38(8), 899-917.
- Cochran-Smith, M. (2004). *Walking the road: Race, diversity and social justice in teacher education*. New York: Teachers College Press.
- Darling-Hammond, L. (1999). America's future: Educating teachers. *Education Digest*, 64(9), 18-35.
- Elenes, A. (2001). Transformando fronteras: Chicana feminist transformative pedagogies. *International Journal of Qualitative Studies in Education* 14(5), 689-702
- Gandara, P., & Maxwell-Jolley, J. (2000). *Preparing teachers for diversity: A dilemma of quality and quantity*. Santa Cruz, CA: Center for the Future of Teaching and Learning.
- Gonzales, F. (2001). Haciendo que hacer - cultivating a Mestiza worldview and academic achievement: braiding cultural knowledge into educational research, policy, and practice. *International Journal of Qualitative Studies in Education* 14(5), 641-656.
- Haberman, M. (1995). The dimensions of excellence in programs preparing teachers for urban poverty schools. *Peabody Journal of Education*, 70(2), 24-43.
- hooks, b. (1983). *Feminist theory from margin to center*. Boston: South End Press.
- Hogan, K., & Corey, C. (2001). Viewing classrooms as cultural contexts for fostering scientific literacy. *Anthropology and Education Quarterly*, 32(2), 214-243.
- Ingersoll, R. (1999). The problem of underqualified teachers in American secondary schools. *School Science and Mathematics*, 28(2), 26-30.
- Ingersoll, R., & Smith, T. (2003). The wrong solution to teacher shortage. *Educational Leadership*, 60(8), 30-33.
- Ladson-Billings, G. (1999). Preparing teachers for diverse student populations: A critical race theory perspective. In A. Iran-Nejad & P. D. Pearson (Eds.), *Review of research in education* (Vol. 24, pp. 211-247). Washington, DC: American Educational Research Association.
- Moje, E. (2004). Working toward third space in content area literacy: An examination of everyday funds of knowledge and discourse. *Reading Research Quarterly*, 39(1), 38-70.
- National Center for Education Statistics. (2003). *The condition of education, 2003*. Washington, DC: U.S. Department of Education.
- National Commission on Teaching and America's Future. (2003). *No dream denied: A pledge to America's children*. Washington, DC.
- Roth, W.-M., Tobin, K., Carambo, C., & Dalland, C. (2004). Coteaching: Creating resources for learning and learning to teach chemistry in urban high schools. *Journal of Research in Science Teaching*, 41, 882-904.
- Tobin, K. (2000). Becoming an urban science educator. *Research in Science Education*, 30(1), 89-106.
- Varelas, M., Beker, J., & Luster, B. (2002). When genres meet: Inquiry into a sixth-grade urban science class. *Journal of Research in Science Teaching*, 39(7), 579-605.
- Vora, P., & Calabrese Barton, A. (2005). *Exploring tensions in teacher learning within the context of urban science education*. Paper presented at the National Association of Research in Science Teaching (NARST), Dallas, TX.
- Ward, J. (2000). Raising resisters: The role of truth telling in the psychological development of African American girls. In L. Weis & M. Fine (Eds.), *Construction sites: Excavating race, class, and gender among urban youth* (pp. 50-64). New York: Teachers College Press.
- Zeichner, K. (2003). The adequacies and inadequacies of three current strategies to recruit, prepare and retain the best teachers for all students. In *Teachers College Record* (Vol. 105, pp. 490-519): Teachers College Columbia University.

#### AFFILIATION

*Angela Calabrese Barton*  
*Department of Teacher Education, Michigan State University*

*Melina Furman*

*Department of Mathematics, Science and Technology, Teachers  
College Columbia University*

*Ben Muir*

*Science Department, The Bronx School for Science Inquiry and  
Investigation*

*John Barnes*

*Principal, The Bronx School for Science Inquiry and Investigation*

*Stephan Monaco*

*Science Department, The Bronx School for Science Inquiry and  
Investigation*