

Navigating Interculturality: African American Male Students and the Science Classroom

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We examine science learning and teaching as intercultural processes taking place at powered boundaries of race, culture, language, and subject matter. Through close analysis of a classroom event, we describe the ways in which a group of teachers and researchers came to understand the experience of an African American male student in a 7th grade science class. The group developed a layered interpretation by unpacking subtle ways in which subject matter, student sense-making, and implicit structures of race, culture, and language based in Whiteness as privilege interacted to shape unfolding interactions. Building from their analyses, they also imagined pedagogical practices for disrupting racialized orders of inequality in the science classroom.

In this article we examine science learning and teaching as intercultural processes taking place at powered boundaries of race, culture, language, and subject matter. Through close analysis of a classroom event, we describe the ways in which a group of teachers and researchers came to understand the experience of an African American male student in a 7th grade science class. In their analysis, the group developed new interpretations of the student's participation. They did so by examining the ways that subject matter, student sense-making, and implicit structures of race, culture, and language based in Whiteness as privilege interact to influence what and who counts as scientifically knowledgeable in the science classroom (Harris, 1993/1995; Martin, 2009). Through their concerted interpretive work, the group came to see in very real ways how socio-historically structured inequalities live in present-day, moment-to-moment interactions in the science classroom.

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Interculturality in the Science Classroom

What does it mean to say that teaching and learning are fundamentally intercultural processes? In our work, this means understanding the ways in which diverse points of view, histories, meanings, and sense-making practices come into contact in real time as students and teachers navigate academic subject matter, and likewise understanding that this navigation inevitably takes place at powered boundaries of culture, race, class, and language (Lee, 2007, 2008; Lee, Spencer & Harpalani, 2003; Martin, 2009; Nasir, Rosebery, Warren & Lee, 2006; Warren, Ogonowski & Pothier, 2005). These boundaries are powered because they are governed by “the settled expectations of Whites” (Harris, 1993/1995, p. 1731) regarding what counts as knowing and who counts as knowledgeable (Martin, 2009). Through these expectations, certain meanings and certain practices – certain ways of knowing, seeing, speaking, writing, acting, valuing – are privileged over others, in society as in school (Gee, 1990; Heath, 1983, 1989; Ladson-Billings, 2003; Lee, 2008; Nasir, 2000, 2002). Thus, how these powered boundaries are navigated interactionally, moment-to-moment by teachers and students matters greatly. This is especially important when the teachers are European American and the students are African American or from other historically non-dominant communities. This structure of settled expectations, which is by its very nature exclusive (Harris, 1993/1995), is precisely what educators and researchers must work to transform on many scales, including the scale of everyday classroom practice, if as a nation we are to achieve a truly excellent, engaging, and just educational system for all students.

A particular understanding of human diversity shapes our view of teaching and learning as fundamentally intercultural processes. By diversity we mean the myriad ways in which we, human beings, engage the world and make sense of our experience as we participate in the multiple – sometimes complementary, sometimes conflictive – activities of our everyday lives. From this vantage point, every one of us, throughout our lives, develops varied ways of knowing, talking, and acting to accomplish purposes valued by us and by the communities in which we participate (Erickson, 2002; Gutiérrez & Rogoff, 2003; Lee, 2007; Nasir et al., 2006; Rogoff, 2003).

This view of diversity contrasts with the dominant usage in which diversity refers to non-White, non-middle class, non-European American people and communities as “other,” outside of the unmarked “norm” or “mainstream” of human learning and development (Cole, 2000; Erickson, 2002; González, Moll & Amanti, 2005; Gutiérrez & Rogoff, 2003; Lee, 2009; Moll, 2000; Rogoff, 2003; Spencer, 2008). The view of human diversity sketched here takes a different approach. It assumes that we are all in a deep sense culturally heterogeneous beings, who routinely navigate in, through and across multiple communities, developing, discarding, appropriating, resisting, and adaptively transforming meaning-making practices as we do life.

Thus, all students, not just non-White students, bring varied, culturally and historically constituted experiences and ways of knowing, talking, acting and valuing to the science classroom, as do their teachers (Ballenger, 1997; Bang & Medin, 2010; Calabrese Barton & Tan, 2009; Gutiérrez & Rogoff, 2003; Hudicourt-Barnes, 2003; Rosebery, Ogonowski, DiSchino, & Warren, 2010; Warren, Ballenger, Ogonowski, Rosebery & Hudicourt-Barnes, 2001). This diversity encompasses individual as well as historically developed community perspectives, social practices, meanings, and values (Gutiérrez & Rogoff, 2003; Nasir, et al., 2006). In this light, then, every social interaction involves human beings in coping with diversity, that is, in

navigating interculturality. This is as true in the science classroom as it is in any other communicative context in life.

Knowing that we are all dynamically complex, culturally heterogeneous beings takes us only so far, however. Why? Because it omits the ways in which the constellations of practices – ways of conceptualizing, representing, evaluating and engaging the world – associated with dominant White, European American, middle class communities have historically been and continue to be privileged over those of non-dominant communities in American public schools and U.S. society more generally (Heath, 1983, 1989; Ladson-Billings, 2003; Lee, 2008; Martin, 2009). This hierarchy of meaning-making practices structures boundaries of power and privilege that students from historically non-dominant communities, and often African American males in particular, encounter routinely and must learn to navigate adaptively, in school and out.

Powered Boundaries in the Science Classroom: An Example

To bring these ideas to life in relation to science teaching and learning, we briefly examine an encounter that took place between Ms. T, a White, European American female teacher, and Simon, an African American male second grader.

Ms. T and her class of ethnically and socioeconomically diverse 1st and 2nd graders are investigating plant growth and development. As part of their study, they visited a pumpkin farm, planted pumpkin seeds in a large pot in their classroom, and created and updated a mural of the pumpkin plant's life cycle. They also germinated pumpkin seeds in Petri dishes using moist paper towels. On this morning, Ms. T is reviewing what they have done thus far to investigate seed germination *out of soil*, in order to introduce them to a root chamber, a glass-sided container that makes root growth visible *in soil*. As she is speaking, Simon interjects a question: "Did you put magic beans in there or something?"

We use this event to illustrate some of the potential complexities that can arise as teachers and students navigate interculturality in the science classroom. We note that Ms. T and Simon successfully negotiated this encounter in ways that deepened the subject matter for the entire class. However, in many classrooms and schools, successful negotiation of such moments is not accomplished easily or often. Owing to largely invisible intersections of science, race, culture, and language, these moments can become sites of misunderstanding and struggle. Let's briefly explore how. First, we consider Ms. T's initial reaction to Simon's question. Then we imagine how Simon might have experienced this event had it unfolded differently, more in line with Ms. T's initial reaction than her actual response. We then describe how it in fact unfolded.

We start with Ms. T. Following the lesson, Ms. T reported that she was initially unsettled by Simon's question: "Did you put magic beans in there or something?" Her immediate reaction was shaped in part by the way Simon spoke, without raising his hand and in a spirited manner. From her point of view, he interrupted the flow of her introduction, and by implication, her authority to hold the floor. He played with language, challenging the presumed scientific authority of their germination inquiry from a place generally viewed as antithetical to science: magic. Thus, when Simon first spoke, the deep scientific and intellectual substance of his question was not immediately apparent to Ms. T.

Viewed culturally and historically, Simon's ways with words were neither random nor mysterious. He was speaking from within a powerful intellectual and expressive tradition of African American discourse practices, which includes incisive argumentation, metaphorical invention, counterfactual reasoning, and language play (Lee, 2007; Mitchell-Kernan, 1981; Smitherman, 1977, 2000). These practices attest to deep intellectual and social engagement. However, these practices differ in form and sometimes in function from those of White, European American communities. They are different as well from those conventionally valued in school (Foster, 1983; Gee, 1990; Heath, 1983, 1989; Michaels, 1981). In fact, the language use practices of African American students are frequently misread in school as signs of confusion, off-topic digressions, disengagement or disrespect (Foster, 1983; Michaels, 1981). Like many White teachers, on first hearing Simon's question, Ms. T found herself unsettled, unsure of his meaning and purpose (Lee, 2007, 2008; Lee, Spencer & Harpalani, 2003; Warren et al., 2005).

Now, let's imagine how Simon might have experienced this interaction had Ms. T ignored or dismissed his question. Imagine such responses as routine, daily experiences for Simon, and other students from historically non-dominant communities. How would his development as a scientific thinker or his sense of belonging in academic worlds take shape under those circumstances? By asking this question, we do not mean to minimize the adaptive skills that Simon or other students develop to exercise agency in adverse circumstances (Nasir, et al., 2006; Nasir & Saxe, 2003; Spencer, 2008). However, in an educational system in which 90% of K-12 teachers are White (NCEI, 2005) – and have not been prepared by their professional education to navigate interculturality as an integral part of teaching – such interactions can routinely become sites of struggle across multiple divides. As these struggles accumulate, African American students like Simon can be constructed as “disruptive,” “inattentive,” “unskilled,” or “underachieving,” a pattern of interaction that can consequentially shape their academic trajectory and sense of belonging in school (Lee et al., 2003; Martin, 2009; Nasir & Hand, 2006; Nasir, et al., 2006; Sue, Capodilupo, Torino, Bucceri, Holder, Nadal, & Esquilin, 2007).

The interaction between Ms. T and Simon took a different path. Ms. T's immediate reaction to Simon's question – her feeling of being unsettled by it – served as a signal to her that she and Simon were navigating an intercultural space, the meaning of which she did not yet fully grasp. Recognizing this, she knew that she needed to better understand the *intellectual* space Simon was exploring. In other words, she assumed he was making sense, even if in the moment she was not quite sure of his meaning. What did she do? She asked him to say more, a simple move with large effects. Simon explained that he was wondering how seeds could germinate without soil. This elaboration helped Ms. T see Simon's question in the light of the class's work up to that point, which had highlighted the importance of soil in plant growth, as had her introduction of the root chamber. She now saw that with his question Simon was noticing a contradiction between their experience germinating seeds in Petri dishes without soil and the work they had done to establish soil as a condition necessary for plant growth. Now able to see the astute scientific significance of Simon's question, Ms. T entered more fully into it, exploring it with him, laughing with him, and drawing out the implications of his question for the class's plant study.

By inviting Simon to share and develop his thinking, Ms. T not only supported his learning and that of his classmates, she also opened a space for him to shape an identity as a powerful, engaged, and critical scientific thinker – in his own eyes, her eyes, and the eyes of his

classmates. Indeed, in his question and elaboration, Simon led Ms. T and his classmates to scientifically deeper ground, by bringing their attention to an otherwise unnoticed inconsistency regarding the function of soil in plant life. In navigating this intercultural space together, Simon and Ms. T transformed a potential site of struggle into an expansive learning opportunity about plant science for all concerned. In what follows, we look closely at the work of a small group of teachers and researchers as they analyzed an intercultural encounter in a seventh grade science class.

Unpacking Interculturality in the Science Classroom: “Is the sun alive?”

First, we describe the setting of the group’s work and participants. Next, we contextualize the classroom event. We then briefly describe how the transcript of the event was explored by the group. Lastly, we highlight three insights that emerged through the group’s work and how these illuminated some specific ways in which historically structured inequalities of race, culture and language bear on learning and development in science for African American male students.

The Learning-in-Practice Seminar

The group’s work took place in an afterschool seminar that is part of an ongoing program of research at the Chèche Konnen Center (CKC; <http://chechekonnen.terc.edu/>). *Chèche Konnen* means “search for knowledge” in Haitian Creole. At CKC, researchers and teachers work collaboratively to develop expansive approaches to learning in science, K-8, with a focus on students from non-dominant communities. Participating teachers are mostly White, European American women. Some are K-6 classroom teachers, part of whose responsibility is to teach science; others are middle school science specialists. CKC researchers are from diverse racial, cultural and linguistic communities. They include women and men of African American, American Indian, European American, and Haitian heritage. The authors of this paper, who are co-Directors of CKC, are White, European American women.

In the seminar, among other activities, teachers and researchers examine records of classroom practice (e.g., videotapes and transcripts of classroom discussions) to engage with deep questions of learning and teaching. Specifically, this work weaves together three elements of inquiry into classroom practice: i) learning to see and hear the intellectual power in the meaning-making practices of students from historically non-dominant communities; ii) recognizing how students’ meaning-making practices intersect with and deepen the scientific literacies valued in school and society as important to learning and life; and iii) exploring and experimenting with potentially transformative pedagogical practices that support students, particularly those from non-dominant communities, in developing expansive repertoires for creative and critical participation in scientific literacies and the world.

The work reported here took place in a seminar during 2004-2005. To address explicitly matters of race in everyday classroom practice, we took up conceptual tools from Critical Race Theory (e.g., Cheryl Harris’s *Whiteness as Property*, 1993/1995), visual and literary arts (e.g., Kara Walker’s *New Yorker* cover art, *Post-Katrina – Adrift*, 2007, and Elizabeth Alexander’s essay *Can You Be Black and Look at This? Reading the Rodney King Videos*, 2004), and studies of microaggressions (Sue et al.’s *Racial Microaggressions in Everyday Life*, 2007) to help us analyze race in the world of the classroom, the seminar, and in participants’ lives more generally.

Collectively, we – researchers and teachers – wanted to grapple with how “the settled expectations of whites” (Harris, 1993/1995, p. 1731) operate at both the socio-historical scale of institutionalized, racialized oppression in the U.S. and at the intimate, local scale of everyday classroom life.

The Classroom Event

In early May, 2005, a 7th and 8th grade science teacher, Ms. V, brought to the seminar a videotape and transcript of a classroom event that troubled her. Ms. V is a foreign-born American citizen of Filipino and European American descent. Her classes are diverse along lines of race, class, language, and ethnicity. The example she brought in took place in a 7th grade class. Her students were engaged in an introductory activity from the FOSS *Diversity of Life* curriculum (Lawrence Hall of Science, 2003). In this activity, they are asked to “categorize pictures of *objects and organisms* into living and nonliving groups” at the same time that they develop an operational definition of life. The set of *objects* to be classified is wide-ranging and includes, among others: rain, rocking horse, the sun, robot, fire. The set of *organisms* includes, among others: jellyfish, horse, spider and web, trees.

In the section of transcript of interest to Ms. V, she and the students were discussing where to put the sun, as living or non-living. The first students to speak expressed various points of view on the question. One focused on how the sun, being a star, has a life cycle and changes over time. Another expressed uncertainty, noting that, while new stars are produced, the process is not like sexual reproduction. At this point in the class’s discussion, an African American student we will call Jonathan addressed the question. He reasoned as follows:

Jonathan: If the sun is non-living, then how does it like produce the flowers, if it’s like not real? Cuz like if you think about it, if something’s dead, how does it help another thing out?¹

The essential conundrum posed by Jonathan – how is it that a non-living sun can help living things such as flowering plants – propelled a vigorous and at times tense discussion involving Jonathan, Ms. V, and other students. We take up specific moments in that discussion through the lens of the seminar group’s work on the transcript.

Collectively Working the Classroom Transcript

In seminar, Ms. V contextualized the event for her data group, a subgroup of the larger seminar. Her data group included two other teachers, a 1st-2nd grade teacher (T2, who is also the teacher in the “Magic Beans” event) and a 3rd-4th grade teacher (T3), both of whom are White of European American descent, and three researchers, two of whom are White of European American descent (a learning scientist, CKC1, and a physicist, CKC2) and one of whom (a learning scientist, CKC3) is American Indian. Ms. V started off by sharing some of her concerns. She was concerned, one, with how surprisingly complex this sorting activity turned out to be, and two, with Jonathan’s participation and other students’ responses to it. She described how she worries about striking the right balance with him, of supporting his participation so that he does not lose interest or concentration but also not having him dominate class discussion.

The data group viewed the video of the classroom discussion, and read the transcript aloud. Then over the course of a two-hour session they analyzed the transcript closely, unpacking the scientific meanings and perspectives Jonathan was exploring, considering as well the participation of other students and Ms. V's stated worries about the event within an interpretive framework of structural relations of race.

Three Insights

Here we highlight three key insights at the intersection of subject matter, student sense-making, and historically structured inequalities that emerged during the group's work with the transcript. These insights relate to: a) words and meanings, b) ways of knowing, and c) transformative possibilities for practice. We discuss how the data group's work to develop these insights illuminated the racialized discourse at play in both the classroom event and their unfolding discussion of it. We also discuss how the group's work helped participants, both teachers and researchers, to see Jonathan, other students, themselves, and the subject matter of science in a new light.

Words and Meanings. One major insight to emerge from the data group's work relates to words and meanings, in particular, the extent to which "official" scientific meanings are open to question and critique in the science classroom. In posing his question, Jonathan pointed to a conundrum in the use of the categories living and non-living in relation to the sun, which he conceptualized as a life-producing force. Other students wondered about this as well, invoking ideas such as the *life cycle of stars* to support a view of the sun as living.

The data group worked the transcript to unpack uses of the words *life* and *life cycle* in relation to biological and astrophysical discourses. As they did so, Ms. V noted how the grade 7 FOSS *Diversity of Life* curriculum categorizes the sun and stars as non-living, whereas in the grade 8 astrophysics curriculum students learn about the life cycle of stars, as in statements that take the form: Stars are born, live out their life spans, and die.

Ms. V: Yeah, even in the textbook it talks about a star's life cycle, which is very confusing if just the year before I told them they're not alive [laughing]. It says "the life cycle of stars."

Ms. V realized that the questioning in which Jonathan and other students engaged around the scope of "life" as a categorical description was not random, but grounded in their experience of ways of talking about stars circulating in and out of school, including official sources like science textbooks. Ms. V and others in the group located Jonathan's questioning within an intellectual narrative, in which Jonathan was negotiating meaning across contexts of use, in ways highly attuned to inconsistencies and contradictions: How might these different uses of *life* and *life cycle* function for students, if they know that in one scientific domain they are authorized to talk about stars in relation to life and in another they are not?

The group concluded that the students were on to something deep, namely, that even within scientific disciplines such as biology and astrophysics, the same words may live inside different webs of socially and historically charged meanings (Bakhtin, 1981). This insight speaks to interculturality at the boundary of the disciplinary usage of words and meanings, a boundary of tension between scientific discourses. Both teachers and researchers touched on how life and its meaning has been put into motion in 21st century biology as well as in public

discourse over stem cells, the right to die, genetically modified plants, or extraterrestrial life (Zimmer, 2007). Science education, instead, tends to operate as if words live in neutral, bounded spaces of definition that can then be readily assembled into larger formations such as explanations or classification systems. Thus, as the group came to realize, Jonathan's question included a deep critique of this ideology of language use and meaning in school science. It pointed to the fact that school science often ignores differences in language use and meaning in the fundamentally heteroglossic world in which students, indeed all people, move (Bakhtin, 1981). Most of the time, students are left to sort out these differences on their own.

Seeing Jonathan's question in the light of a richer, more contextualized interpretation of varied scientific uses of *life* and *life cycle* led Ms. V to reframe her initial take on him. When introducing the event, Ms. V stated her concern as a worry about "how he is handling the class discussion," whether his classmates are taking him seriously, and how she is "struggling with helping him to stay focused." Here, Ms. V framed Jonathan as a student who was not able to focus his attention without assistance and whose way of participating was not taken seriously by other students. This account of Jonathan, while particularized in this case in terms of Ms. V's concerns for his learning, also sat within a larger societal narrative in which African American male students are positioned as academically marginal and needing help to participate productively in academic discussions (Martin, 2009; Omi & Winant, 1994). As Martin (2009) has noted, in both research and practice, the dominant conceptualization of learners in our society – those who are academically knowledgeable and those who are not – is ordered according to a racial hierarchy of academic ability.

On this view, everyday science teaching and learning is, as Martin (2009, p. 299) states, a "racialized form of experience" for all participants, although more explicitly experienced as such by African American and other non-dominant students. Indeed, early on in the group's work, right after viewing the videotape, T3 asked Ms. V if she thought "he was just playing Devil's Advocate?" Ms. V returned to this a few minutes later, allowing that she did sometimes think so, but "sometimes I think he's genuinely asking questions...". As the group worked the transcript, developing a new contextualized understanding of Jonathan's thinking, a third possibility emerged, namely, that he was engaged in serious intellectual play, "trying to play to figure out something," as T2 put it. T3, who had posed the Devil's Advocate question, reconsidered her assessment:

T3: I don't think he's doing it to be amusing to the kids. I think he was doing it- It's kind of a good intellectual kind of problem solving (way) of looking at it. Yeah, at first I thought, "Oh, he's just kind of playing," but I think he's doing it to figure it out...this is how he's thinking about science...

Ms. V, too, reframed Jonathan's participation in terms of an intellectually serious intention to make a specific argument and to challenge established categories for sorting things. In this way, Jonathan's move to interrogate settled scientific meaning was now seen as intellectually compelling and instructionally productive for the class as a whole as well as for Ms. V as the teacher. Thus, the work to unpack contextually specific and conflicting meanings of *life* and *life cycle* made visible to data group participants how their assumptions and the curriculum's assumptions about what counts as settled scientific meaning intersected in profound ways with assumptions about what intellectual engagement looks like and who is viewed as doing it capably and who is not.

Ways of Knowing. The second insight to emerge in the data group's work related to differences in ways of seeing and knowing the world. The group came to see that Jonathan was working from a different, arguably deeper, place than the curriculum: He was questioning the coherence of the binary living/non-living classification for a physical object like the sun. More than simply questioning, he was proposing a different, more ecological or relational way of seeing the sun and its dynamic connection to life on Earth. Teachers and researchers commented on this in various ways, noting how Jonathan, as well as other students, seemed to be questioning the binary categorization of living/non-living in generative ways:

CKC3: I think what Jonathan is asking, forget living and non-living...I [Jonathan] want to understand how things relate to each other...he's trying to make ecological sense rather than categorical sense.

Ms. V: And a bit later in the discussion, group participants explored Jonathan's point that the sun "*produces* the flowers":

Ms. V: You have to have that relationship.

CKC2: Yeah, well, to jump from looking at individuals to looking at the system: Is the system living?

T2: And then here he says if something's dead- so if you're putting it in non-living, it means it's dead, which is another

Ms. V: the difference between dead and never alive.

CKC3: ...he's grappling with different frames and different words that index different frames.

Working together, the group co-constructed a view of Jonathan that showed him opening up an alternative, important point of view on life, not as a characteristic of things, but as a dynamic relational field, a synergy of organisms and environments (Bang & Medin, 2010; Ingold, 2000). In this connection, Ms. V observed that in grades 5-6 the students study ecosystems. One of the organizing ideas of the ecosystems curriculum is a systems-relational frame of the sun as the source of energy that sustains life, which was colloquially described in the group's discussion as "*the center of life*". Struck by the irony, she concluded that if her students had recently learned that the sun is a crucial part of that larger system, then it becomes easy to see why Jonathan would question the simple classification of the sun as non-living. Here Ms. V locates Jonathan's question within a larger history of school science, and sees him as intellectually attuned to inconsistencies in curricular representations of the biological world.

As a part of this discussion of ways of knowing, the group took up an exchange involving Ms. V, Jonathan, and Molly, a White student of European American descent. After Jonathan posed his question, Ms. V revoiced it as: "How does something that's not alive create life?...Is it possible for non-living things to help living things?" She asked Jonathan if that was a fair way to put his question, and he agreed it was. Ms. V then opened up the question to the class, asking

what they thought. Some conversation ensued about whether the sun was dead or non-living. At this point, Molly spoke:

Molly: Well I don't know if this makes sense but like for Jonathan's we have to have water even though water is not living...we still need it like plants need the sun.

Jonathan: Wow, does that answer anything?

Ms. V: Well she's saying if water- she's making an analogy.

Jonathan: Well then that's the same thing I just said.

Here Molly made an effort to explain why the sun should be classified as non-living by suggesting an analogy – water to human life – that she thought expressed a similar relationship. Jonathan, expressing some exasperation, challenged the explanatory value of Molly's contribution. Ms. V responded by *explaining* to Jonathan that Molly was making an analogy. As the transcript shows, Jonathan well understood that Molly was reasoning analogically and, moreover, that she was simply repeating his argument by offering another example of the same relationship: the sun is to plants as water is to humans.

The data group took up this exchange as a critical moment – an intercultural struggle structured racially – in the class discussion. The question of Ms. V's in-the-moment reading of the situation became a focus of analysis:

Ms. V: Wait, I don't really understand when he said, "I just said that," I don't think he did. Like where did he say that?

CKC3: Well if water is a non-living thing helping a living thing, it's the same thing- her example is the same thing, and I think, he knew it was an analogy.

Ms. V: But I thought he was saying, "No, it's-" Okay, because before that he said that doesn't answer anything. Because his question was, "How?", going back.

CKC3: How does the sun help a flower?

Ms. V: Right, so she said water is also non-living, it helps the living thing, so she was trying to answer that question.

(...)

CKC1: =can I just say one thing? With regard- so I think that what he's saying is, it doesn't explain it, it's just another example, same structure: sun helps plants, water helps humans, but that doesn't constitute an explanation, just because there are more of these kinds of (relationships)

T2: =in which one is a non-living- it doesn't mean that the sun is non-living, just because this other example

CKC1: =so it doesn't explain anything, he's quite right. It doesn't explain how you can have a "non-living thing" giving life to

Ms. V: =okay. I think I was thinking that he was asking how is it possible, or it's not possible, from his point of view. I thought he meant it was not possible for a non-living thing to help a living thing, so therefore the sun must be alive. So that's why when Molly gave the example that shows it, then he said that doesn't explain it. I thought it kind of does.

(...)

Ms V: Yeah, looking at what he said, "that doesn't answer anything," I get she didn't explain how it works, she just gave another example. To me at the time I thought he was just being argumentative...

CKC3: ...so what I heard, him coming out of it, "Oh I don't quite get this, I went out there, I wasn't being silly..." And then Molly says the same thing and you heard it there. "Why did people hear it when she said it but not when I said it?"

(...)

Ms. V: So he really was like, "No one understands me right now." And I didn't understand him, I was like "Why don't you understand what she said?"

The data group's work around this interaction proved pivotal in everyone's understanding of the connection between Molly's participation, Ms. V's role, and Jonathan's response. Ms. V came to see that Molly's analogy was merely an extension of Jonathan's, not an explanation. The racialized nature of this classroom experience was indexed through discussion of the way in which Jonathan, an African American male, was positioned publicly as not understanding in comparison to Molly, a White female, who was positioned as explaining to Jonathan his "misunderstanding." Ms. V saw Jonathan's participation in a new light, noting how he risked himself intellectually and emotionally by challenging biological and school science orthodoxy with an alternative, relational and ecologically valid way of thinking, and then was judged as not understanding. The group's re-interpretation of the event resonated deeply with the ongoing conversation in seminar to make explicit how socio-historically structured racial hierarchies live in moment-to-moment classroom interactions. Further, it illuminated how these racial hierarchies can shape judgments about the intellectual merit of students' contributions in the science classroom, overvaluing the contributions of White students and undervaluing the contributions of African American students.

Transformative Possibilities for Practice. The data group's consideration of the collision between binary classification of the kind privileged in the curriculum and the ecological-relational way of knowing put forward by Jonathan led to some expansive thinking about practice. The group talked about the difficulty for both teachers and students of using inquiry-based science curricula that are designed to engage students in "discovering right answers." T2

noted that in her experience this school game tended to privilege the out-of-school experiences of children from White, middle class families, for whom discovering right answers or responding to known-answer questions are routine cultural practices (Heath, 1983). These children know how to play the school science game, she argued; they know that the point of this kind of pre-defined inquiry activity is to certify right answers, not to explore, expand, or interrogate meanings. In T2's experience, African American children take up the curriculum in more exploratory, seriously playful, and critical ways: questioning, imagining what-if scenarios, noticing contradictions, and reasoning analogically, all scientifically significant forms of thinking and engagement (Heath, 1986; Root-Bernstein & Root-Bernstein, 1999). Indeed, the focal event with Jonathan reminded her of similar moments in her own classroom, of which one was the "Magic Beans" episode discussed earlier in this article. Seeing connections between "Magic Beans" and this event, she shared what she had learned through her experience with Simon:

T2: I was like, "Where are you going with that?" And I was like beans- the fact they grow in paper towels and things grow in dirt and this whole assumption that kids are going to understand that this paper towel is acting like dirt and that's why they grow. And then I was able to unpack that whole thing for the class because he said that. It's that feeling like, "Here we go with this tangent, it's silly, off the topic."

T2 went on to talk about how these kinds of conversations give rise to many threads of meaning, which can be both exciting and difficult to orchestrate. She explained her way of approaching them, by publicly marking a question like Jonathan's and then using it as a constant reference point in the discussion. Thus, if Jonathan were her student, she might ask him to say more, as she had done with Simon. In response to Molly's analogy, she might ask: "So, Molly, how does what you just said explain this?" In responding in these ways, T2's purpose would be to open up more space for both Jonathan and Molly to elaborate their thinking, without judgments of right and wrong interfering. Building on this, CKC1 suggested listing both Jonathan's and Molly's analogies, engaging the class in discussing their common relational structure (i.e., how they do not fit the living/non-living scheme), and then asking the class to consider a new question: Is there another way they could imagine organizing this space (set of objects) that is not binary?

As this conversation unfolded, the data group focused more and more on how to take up collisions between diverse ways of seeing, knowing and valuing, which represent a complex, deep, and pervasive intercultural space in the science classroom (Ballenger, 1999, 2003; Bang & Medin, 2010; Nasir, et al., 2006; Rosebery et al., 2010; Warren et al., 2001, 2005). Pondering this conundrum of classroom life, they began to imagine a different kind of pedagogical possibility. They thought about the value of engaging students in *explicitly* taking up multiple meaning systems (e.g., binary classification, relational thinking, dynamic systems thinking) as *objects of inquiry*: dwelling inside them to develop a kind of intimacy with how each works to organize the world, unpacking the assumptions each makes about the world (e.g., human-nature-culture relationships), investigating their histories and possible futures in relation to urgent global and local problems bearing on, for example, the Earth's survival. The group thought that this approach would invite students to come to know these systems *as specific ways of conceptualizing, representing, engaging and evaluating the world*, to juxtapose these different systems with each other, and to situate them historically and culturally as powered systems of

knowledge. In such an approach, Jonathan would not have to suppress his scrutiny of “official school science.” Rather, he would have rich opportunities to engage *explicitly* in navigating diverse ways of knowing. And, for her part, Ms. V would have an expanded repertoire to support productive and expansive boundary crossing for Jonathan, Molly, and the class as a whole.

Concluding Thoughts

By investigating teaching and learning as intercultural processes, teachers’ classroom-based inquiries become at once grounded and theorized. That is not to say these inquiries are without struggle. In fact, they are deeply about struggle – “race wrestling” in the words of Mica Pollock (2004): active struggle with “the meanings for race and the consequences of these meanings” (Martin, 2009) as constructed historically and lived in the present of everyday experience as students, teachers, educators, researchers, and human beings. This kind of struggle, as we saw in the case analyzed here, gives rise to more textured, questioning, and expansive understandings of intersections between the sense-making practices of African American male students, scientific subject matter, and historically structured inequalities.

The group’s work on Ms. V’s transcript re-configured racially powered boundaries of human diversity into new ways of seeing Jonathan and Molly, as well as new possibilities for learning and teaching. Along with the other group members, Ms. V expanded her perspective on Jonathan’s intellectual identity in relation to her own practice, the middle school science curriculum, and structural orders of inequality rooted in race, culture and language. Here, as in the earlier example involving Ms. T and Simon, this newly configured way of seeing the intellectual substance of Jonathan’s participation led group members to see the scientific territory in more complex and nuanced ways, from multiple angles. These insights inspired potentially transformative pedagogical thinking informed by a developing understanding of how “settled expectations based on white privilege” (Harris, 1993/1995, p. 277) structure everyday science learning and teaching in ways that are limiting for African American male students and, as it turns out, for all students.

In conclusion, we agree with Danny Bernard Martin’s (2009) recent argument for a critical analysis of race, racism, and racialized inequality in mathematics learning and participation, extending it to science:

(W)hat is needed in mathematics (or science) education are theoretical conceptualizations and research approaches to inequality that move beyond static notions of race to acknowledge that mathematics (or science) learning and participation, like many other areas in life, can be viewed as *racialized forms of experience* – that is, as experiences in which the socially constructed meanings for race in society emerge as highly salient in structuring (1) the ways that mathematical (or scientific) experiences and opportunities to learn unfold and are interpreted and (2) the manner in which mathematics (or scientific) literacy and competency are framed, including who is perceived to be mathematically (or scientifically) literate and who is not. (Martin, 2009, p. 324, references to science added)

We – researchers and teachers at the Chèche Konnen Center – are taking up this call in particular ways in our evolving work, as we struggle together to analyze, understand, and

transform the enduring conundrums of classroom life in the United States, particularly for African American male students and students from other non-dominant communities. We are learning to do so by integrating critical inquiry into historical orders of racialized inequality with critical inquiry into science learning and teaching as lived in everyday classroom practice. This theoretically and empirically grounded approach represents one way, certainly not the only way, to disrupt racialized orders of inequality in education, both in the classroom and in research (see also Gutiérrez, 2008; Ladson-Billings, 2003; Martin, 2009; Nasir et al., 2006; Lee, 2009). And, in disrupting them, to shift how African American students, like Simon and Jonathan, are seen in relation to the intellectual life of the classroom and, importantly, how they experience that life.

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Endnote

1. We use the following transcription conventions: ? indicates rising pitch or intonation that may or may not have the grammatical structure of a question; ! indicates the conclusion of an utterance delivered with emphatic and animated tone; - indicates self interruption; underscore indicates stress on a word or syllable; (word) indicates uncertainty on the transcriber's part but represents a likely possibility; (...) indicates deleted talk; // indicates overlapping speech; = indicates latched utterance.

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