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Authors

Bautista-Guerra, Juanita
Calabrese Barton, Angela
Brecklin, Caitlin
[et al.](#)

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JUANITA BAUTISTA GUERRA, ANGELA CALABRESE BARTON,
EDNA TAN, HOSUN KANG AND CAITLIN BRECKLIN

4. KAY'S COAT OF MANY COLORS: OUT-OF-SCHOOL FIGURED WORLDS AND URBAN GIRLS' ENGAGEMENT WITH SCIENCE

INTRODUCTION

Kay's face lit up when she realized that urban heat islands (UHI) were not actual bodies of land surrounded by water somewhere in the middle of a city. When she grasped the notion of "island" as a metaphor, she understood why she had never actually "seen" one, despite having lived all her life and having received all her schooling in urban settings. As she later explained, "An urban island is an island, well not really an island, but it's a place where there is a lot of people so it makes it really hot."

Later, when Kay interviewed people in her city about their knowledge on UHIs (as part of a community ethnography), few could give Kay an answer. For instance, when a hot and sweaty groundskeeper agreed to be interviewed but struggled to answer her question, Kay took it upon herself to restate her question in a way that might connect to his experiences.

Kay: Well, where would you want to go if you were really hot?
Groundskeeper: Uhm.

She then followed up with more detailed responses in which she shared her own ideas, keeping in mind the man she was interviewing and his context. As she pointed to the area grounds that the man was in charge of tending, she said:

Kay: There are trees and there are grass and it helps the heat island effect because, it makes it more shady... and instead of everybody being hot and instead of people being, people not like, being, not to like being downtown, they can kind of enjoy it if they just go in the shade.

Somewhere along the way—at school, at home, watching TV—Kay, who was then 10 years old, had constructed an idea of what an island meant, an idea that was challenged when it was re-signified in an out-of-school setting (i.e., the after-school science club that she has attended for several years). Later, when she took on the role of educating others, she recognized that those pedestrians could have also shared her initial confusion and addressed the metaphor in her dialogues. While Kay admittedly had one of the weaker understandings of UHIs of all of the

students in the program, we believe her actions reveal her efforts to make science accessible to others.

In the same way that this event suggests, most of the interviews, videos, and artifacts that Kay has produced over the past four years capture the words and doings of a sensitive and intelligent girl who has purposefully used her science and technology learnings to transform her own life and her community. Thus, as we delved into the data, we struggled to understand why her school report cards and her participation in school science did not embody the importance of her accomplishments. “It’s like that coat in Dolly Parton’s song,” one of us said, “It’s stitched with love and the girl feels proud to take it to school, but once she gets there, she does not understand why others fail to see its magic.” The fact that Kay has been successful in out-of-school settings but is a mediocre student who merely “deals with” school science hints at the possibility that Kay is able to construct a strong and positive science identity by leveraging and making meaning of non-traditional resources.

In this paper, we share Kay’s narratives to unpack how she crafts an identity with and in science. We focus on the ways in which she understands, describes, and leverages the complex web of resources her family and out-of-school figured worlds provide her in her science journey. We are particularly interested in Kay’s story because, as we highlight in our conceptual framework, the resources that are most powerful in Kay’s recounting of her family figured worlds run counter to what the research literature indicates is powerful in terms of family support for girls in science. We will use Dolly Parton’s song “Coat of Many Colors” (1971) to convey the importance of her narrative.

BACKGROUND: “FRAMING” AFRICAN AMERICAN GIRLS IN SCIENCE

Girls’ Science Trajectories

Despite the increasing success of African American girls in national achievement measures, we are troubled by the continuing trends relative to their identification with, and participation in, science, which receive scant notice. Despite relative equal achievement in science education, African American girls tend to not identify with science (Brickhouse & Potter, 2001; Carlone, 2004), and do not persist in science (National Science Board, 2004; National Science Foundation, Division of Science Resources Statistics, 2004). The problem grows the further the girls progress along their potential science trajectory. In 2007, the National Research Council’s Committee on the Guide to Recruiting and Advancing Women Scientists and Engineers in Academia reported that women in general, but especially African American and Latina women who are interested in science and engineering careers, are lost at *every educational transition*.

In recent years, there has been a more nuanced approach to understanding girls and the science pipeline, as indicated in the aforementioned report. Earlier work in this domain examined whether girls were “in” or “out” of the pipeline. However, recent work has called attention to the fact that there are, in fact, many branches to

the pipeline that operate simultaneously, including achievement, access, attitudes, and activity (Hanson, 1996), and that movement through and in and out of this pipeline looks different for girls from different racial and ethnic groups (Gilmartin, et al., 2006). We concur with the recent work of Aschbacher and colleagues who have further expanded the idea of the pipelines to include not only the “curricular and extracurricular behaviors, attitudes, and choices” that prepare students for a future in the sciences, but also “a broader range of science, engineering, medicine, and related careers” in order to be inclusive of a more diverse student population and the pathways they take towards a variety of career goals (Aschbacher, et al., 2008, p. 4).

Barriers, Support Mechanisms, and Family Influence

The past fifteen years have also revealed insight into the barriers girls face in their quest to express interest in and participate in science-related trajectories despite improvements in achievement (American Association of University Women Educational Foundation, 1999; Brotman & Moore, 2008). These barriers are complex and dynamic. The social, structural, and psychological dimensions held in place by schools and society work together differently for any one girl at any one time, making it difficult for them, their families and the education community to identify and make concrete and lasting changes in support of girls in science. For example, barriers include societal attitudes that portray science as masculine, curricular and pedagogical approaches that value only a limited range of identities and experiences, and a continued lack of equity-minded curricula and professional development tools for teachers (Brickhouse & Potter, 2001). Girls living in low-income urban communities continue to face additional barriers, including limited access to rigorous and high-level science courses, science equipment, appropriate role models, and certified, qualified teachers (Oakes, 2000).

One primary mechanism of support identified in the literature has been that of the family. Parental influence has long been considered an important factor in children's success in school (Berger, 1995). It has been documented in the research literature for several decades that families matter in student success and interest in science learning and careers (Eccles, 2005; Frome & Eccles, 1998; Gilmartin, et al., 2006; Jodl, et al., 2003). Numerous studies have revealed how the attitudes of parents and other family members impact students' career goals and aspirations (Jodl, et al., 2001), and that girls' perceptions of their parents' support to pursue science impacts their career aspirations (Gilmartin, et al., 2007).

Some studies have specifically sought to unpack how families' influences take shape, especially for girls from non-dominant backgrounds. Not only do parental views on career expectations correlate with student aspirations; these effects can be seen fairly early (Eccles, 2005). Noteworthy are those studies that show that stereotypical views of science careers and of gender roles negatively impact girls, and correlate with lower enrolments in higher level math and science classes, diminished views of abilities to do science or math, and lack of persistence in science trajectories (Eccles, 2005; Gilmartin, et al., 2007). Other influential family

factors include parental participation in school science (Dodd & Konzal, 2000), parental beliefs about how they are to help their children and parental efficacy towards their children's schooling (Hoover-Dempsey, Walker, & Sandler, 2005). For example, some studies indicate that girls' parents are more likely than boys' parents to believe that science is difficult (Tenenbaum & Leaper, 2003). Additionally, according to U.S. Department of Education National Center for Education Statistics (2000), studies indicate that parental educational attainment and occupations provide youth with cultural and economic capital. Gilmartin and colleagues (2006) further remind us that "[c]ompared with White and Asian/Asian American students, Black/African American and Latino/a students are more likely to exit the science pipeline because of barriers like familial obligation and financial hardship" (p. 181).

The trends regarding parental influence on their children's—and especially their daughters'—science aspirations noted in the previous section have been both clear and strong over the past three decades. Indeed, studies of familial influence have declined in the last decade because these trends are so well documented. However, we note, that with the exception of the Gilmartin, et al.'s (2006) study noted above, no studies have sought to link girls' identity development with the family figured worlds. What is more, *few of these studies unpack the actual mechanisms of support, grounded in everyday practice, beyond the list of factors that impact girls' development in science trajectories.*

In this paper we highlight the story of one girl, Kay, because her narrative challenges many of the assumptions embedded in the previously discussed literature regarding barriers and supports that families offer to girls in their movement along science trajectories.

CONCEPTUAL FRAMING: RE-FRAMING FAMILY FIGURED WORLDS AND GIRLS' SCIENCE IDENTITY WORK

Drawing strongly upon anti-deficit orientations for understanding how African American girls' author possible selves in science, we build an argument for why one of the girls in our study is interested in science, and the familial-based resources and contexts which support her in developing these interests in ways that matter to her. To do so, we draw on counternarratives, or narratives that make explicit and central the knowledge and experiences of those on the margins.

Counter-storytelling

Scholars from critical race theory have argued that it is important to move outside dominant discourses to understand and act upon the experiences of youth whose experiences have been marginalized. They argue for ways to understand how issues of race and ethnicity intersect with class and gender to frame not only the experiences individuals have but also how these experiences are understood and taken up by others (Ladson Billings & Tate, 1995). For example, we need to find ways to uncover how institutional stories—like those about school achievement,

and who can do science or mathematics—are not neutral or objective. Further, they argue, we need to create new venues for allowing the experiential knowledge of students from marginalized positions to narrate new ways of understanding the challenges and possibilities of urban education (Solorzano & Yasso, 2001).

Counter-storytelling has been defined by Delgado (1995) as the telling of stories of, and by, people whose experiences are not often told, such as low-income African American and Latino youth in urban schools. Counter-storytelling has been utilized within the critical race theory tradition as a tool for accomplishing two related goals. First, as a tool for exposing, analyzing, and challenging the stories of those in power and which are naturally a part of dominant discourse (Delgado, 1995). Second, counter-storytelling has been used as a tool to build community among those at the margins and to challenge the perceived wisdom of those at society's center. Counterstories do this by opening up new windows into the reality of those on the margins allowing new and different possibilities to be showcased, and by combining elements of the story and the current reality, thus constructing another world that is richer than either story or reality alone. Counterstories work against setting up their own master narrative by asking us to “develop multiple and often conflicting models of understanding social and cultural identities in ways that support our ability to hold complexity and broaden our perspective of the possible” (Solorzano & Yasso, 2001, p. 475).

Testimonio

Testimonio has been known as narrative text within the Latin American resistance literature (Harlow, 1987). Beverly (2004) refers to testimonio as story that is told in the “first person” by a “narrator” who is a “witness to the accounts he she recounts, and whose unit of narration is usually a “life or a significant life experience” (p. 30). He argues that testimonio is powerful and persuasive as a form of resistance literature because it is both “protean” and “demotic.”

Historically testimonios, as “edited oral narratives” (Carey-Webb, 2001, p. 133), are written about and for people who are not able to write about their own experiences. While the ability to write one's own experience has been historically related to written literacy, recent work on testimonio calls into question how issues of power and language shape access to discourse communities and how the “ability to write” is just as much about who one writes for as it is the process of actually writing. Therefore, testimonio has gained traction as a mode of discourse that allows the experiences of those outside academia to have a ‘real’ presence within that discourse community.

The experiences of those on the margins continue to be marginalized in academic circles because the discourse and practice of the academy exclude the worldviews of those outside its boundaries. When stories of those outside the boundaries are brought into the discourse, the deeper meaning of the stories is “lost in translation.” Furthermore, testimonios call attention to a *broader pattern of cultural experience*, despite their location in the story of an individual. As Carey-Webb explains,

[Testimonios] differ from traditional oral histories as they emphasize the experience of the group rather than the perspective of the individual...Acts of memory situated in time, testimonials help us to learn about history, revealing connections between personal experience and collective reality. (p. 133)

Counternarratives: Creating Spaces for Impossible Knowledges & Identity Work

Counterstory and testimonio call attention to the experiences of the marginalized, and position those stories as powerful tools for problematizing master narratives. The term “counter” is used to call into perspective dominant or normalizing “master narratives”, or “scripts that specify how social processes are carried out” (Stanley, 2007). Some have referred to these counternarratives as “impossible knowledges.”

Testimonio has the potential to create space for other impossible knowledges that are underrepresented or invisible within conventional academic discourses (Haig-Brown, 2003, p. 416).

We like the term “impossible knowledges” because it reminds us just how much these narratives contain information and understandings that are “beyond our grasp *because of the limits of our language and our lived experience*” (Haig-Brown, p. 416, emphasis ours). Impossible knowledges also contain “frames” for challenging stories of those in power by repudiating stereotypes, giving witness, and uncovering assumptions and normative patters.

Impossible knowledges also call attention to the link between narrative production and identity work. Take, for example, the stories of the Native American women environmental justice advocates (Prindeville & Bretting, 1998). These Native justice workers viewed their community work in terms of their “life purpose, inseparable from identity” (p. 48). They sought to make their own experiences matter by working with others on issues central to the survival of their communities (e.g., environmental degradation, work safety, and pollution); they created collaborations with local media to have their stories aired, to get position statements made public, and to initiate and hold public hearings. Their stories show that part of counter knowledge is not only documenting stories, but also creating pathways or venues for having such stories heard by multiple audiences.

We believe that the relationship between counternarratives and identity work is central to unpacking the patterns of interest and participation in science among school-aged girls as they traverse the different worlds that make up their lives. Counternarratives provide a view of the lives that girls live and to the women they want to become. They also provide insight into the resources that girls might leverage in achieving these goals. They also show us how girls challenge historical, institutional and cultural narratives of what it means to become a woman in science.

How girls craft an interest in science through participation in their out-of-school figured worlds, such as a cooking club, or family science at the local garden can

impact when and how girls seek to pursue participation in their school classroom. Yet, the ways in which girls take up these different forms of participation are deeply tied to culture and context. How girls draw upon their roles as babysitters or soccer players in the home or community, as actresses or group leaders among their peers, can also shape how they choose to pursue science or not. Likewise, how teachers recognize and understand these experiences and their potential connections to science also play a role in whether and how girls choose to pursue science or not. Furthermore, embedded in these stories are likely critiques of normative practices in science, and insight into how these practices constrain and marginalize those for whom the discourses and practices of science do not reflect their own cultural repertoires.

These worlds that exist outside of school science provide girls with a wide variety of resources and positionings that they can and do draw upon to author possible selves in science. We believe investigation into how girls perform this authorship in the ways that they leverage the experiences, resources, and positions of different figured worlds will help us with the individual level patterns that we know are missing from the research literature on how and why girls develop interest and participate in science over time.

KAY'S COAT OF MANY COLORS—A METAPHOR FOR HER POSSIBLE LIFE IN SCIENCE

Inspired in events from her childhood, Dolly Parton's "Coat of Many Colors" (1971) tells the story of a coat sown by her mother out of an assortment of rags and the inability of others to see the love that was stitched into the garment. When the girl proudly wears the coat to school—for her mother has kissed it with hopes of "good luck and happiness"—the "others" (primarily at school) fail to see its richness; contrarily, they read it as evidence of her family's poverty. The last stanza explains how she understands that her family "had no money" but she felt ultimately "rich" because she recognizes that love, rather than poverty, is what transforms the rags into a coat.

We believe that Parton's song is an artistic exemplification of a counternarrative and that the coat in the lyrics serves as a sensible metaphor to explain our findings. In the song, the narrative sown into the coat (i.e. the biblical tale, the kisses and blessings) is evident for Parton and her family; nevertheless, "because of the limits of [...] language and [...] lived experience" (Haig-Brown, p. 416), it embodies information and understandings that are beyond the grasp of those at school, thus, constituting a form of "impossible knowledge." Kay's performances in science might also be incomprehensible if read from the perspective of dominant discourses. Furthermore, the song provides a family referent (i.e., the mother) that helps us in addressing family influence in Kay's science identity work. Kay, like Dolly, takes to school a piece of identity created at home (and at after school club) and then engages in a process of meaning making across these worlds. Thus, we find Parton's song useful to present Kay's counter-storytelling and recognize "multiple and often conflicting models of understanding social and cultural

identities in ways that support our ability to hold complexity and broaden our perspective of the possible” (Solorzano & Yasso, 2001, p. 475).

Therefore, in order to see the love stitched into Kay’s “science identity coat”—rather than seeing her race and socioeconomic status as the poverty of the rags—we have threaded her words and work with the lyrics of the song, presenting them along three narratives: Narratives of navigation, protection, and endurance. After sketching her portrait in “Getting to know Kay,” we present her “Narrative of Navigation.” Making meaning from her mother’s and sister’s trajectories in her family-figured world and drawing resources from other out-of-school figured worlds, Kay (like the girl in Parton’s song) is compelled to negotiate and build upon those resources to navigate her way into becoming a doctor. In the same way that Parton’s mother stitched the coat “way down in the fall” to shelter her daughter from the harsh weather, Kay’s “Narrative of Protection” portray the way in which she creates ways of safeguarding herself and her community from master-narratives that fail to acknowledge her ways of conceiving and doing science. Nevertheless, Kay’s “protection” is not exclusively defensive; she also challenges and transforms hegemonic precepts of what scientific is. Thus, in the final section we present her “Narrative of Endurance”, as science identity work that allows her to bear—while transforming—the challenges within her community **and** within marginalizing science discourses. Overall, like Parton’s coat, Kay’s narratives tell us of the love that was sewn in every stitch of her journey and how she has transformed seemingly disparate “rags” into a purposeful and beautiful coat.

Getting to know Kay¹

We have known Kay since the summer of 2007—the summer before 5th grade when she joined the Green Club (GC) at her local neighborhood community center. Initially, she joined because her friend, Cathy, invited her; later in the year, she also remarked, “I JOINED Green Club work because it is a very responsible group of people and it is very inportant [sic]” (Green Club Survey, Feb. 2008). Even though the first time she remembered personally meeting science professionals was at the afterschool program, Kay (like many other children in the program) already had elements and symbols that she had put together to create a version of what science meant and about what a possible life in science might look like.

Kay is now about to enter 9th grade, and her movement through middle school has not been an easy one. She attends her city’s K-8 magnet school for the performing arts. She opted into this partly because it was just down the street from her grandmother’s house but also because she loves the arts, especially singing and dancing. When we first met Kay at the club in 2007, the club director quickly pointed out Kay’s talent in writing—she had recently won a writing contest for 4th graders at her school. In the same breath, however, she worried for Kay’s future, noting the difficulties her family faced financially and otherwise, and their impact on Kay’s school attendance. Indeed, these two strands of Kay’s life—a desire and effort on her part to make the best of school and to achieve, and an on-going

familial struggle for daily survival—have been present throughout these past four years.

Kay views herself as smart and fun loving, attributes that are not incompatible with her steady interest in science. Ever since we have known Kay she has wanted to be a doctor—a pediatrician or a brain surgeon—or, as she states on the webpage she authored at GC in 5th grade, “a nice career as a doctor.” Through these years, her interest in science has been consistent, both in her descriptions of her desired career and in her indication that “science is fun.” While at times she states that she does not care what people think about her (“*If your friends are not real, they think you a geek, but if they are they will be OK with it. Scientists are really smart, so it’s ok to be scientific in front of your friends.*”), she, like most girls her age, still worries about others’ perceptions (“*I really hate when people talk about me but I don’t care because I am smart enough to know that it isn’t true.*”).

Kay’s performance in school and talk about enjoyment of school has been somewhat erratic. Despite her love of science and her desire to be a doctor, she feels she has to “deal with” school science, rather than fully engage in it and enjoy it. While she views herself as smart and an A student, her grades do not always reflect that. She maintained As and Bs in 5th and 6th grade; however, 7th grade was a difficult year grade-wise, with a fairly consistent low C performance. Kay is defensive of these grades, noting that, “they don’t let you make up things when you miss school” and saying that “when I’m there, I do good.” Kay’s absences appear far beyond her control, given the life responsibilities she assumed with the birth of her little sister, and the shifting “home-base” as her family experienced fairly dramatic economic upheaval.

Kay has stated that the toughest barrier to her desired future as a doctor is economic. Thus, in the same way that her grades prevented her from participating in the dance team (school rules), she recognizes that her low grades may be a hindrance to her “only hope” of getting a scholarship. However, Kay has sought other ways to make up for her grades, particularly by finding opportunities in after school clubs like GC. There, she has learned much of the computer skills and science that, she notes, will help her as a doctor. Most importantly, she expresses that unlike science at school, at GC you don’t get “kick[ed] out” if you fail to attend the sessions; instead, “they catch you up on what they’ve done.” This flexibility and encouragement has allowed for a feeling of belonging to the club, to the extent that she considers she is “technically working there” and hopes to continue doing so until she has to “retire.” Indeed, as we highlight in subsequent narratives, Kay leverages GC to access scholarships for broader and deeper participation in science.

Narrative of Navigation: Following my Mother and Sister into Science

So with patches on my britches
 Holes in both my shoes
 In my coat of many colors
 I hurried off to school

Just to find the others laughing
And making fun of me
And oh I couldn't understand it
For I felt I was rich
And I told them of the love
My momma sewed in every stitch
And I told 'em all the story
Momma told me while she sewed

For the last four years, Kay has insisted that she wants to become a doctor when she grows up. She feels becoming a doctor allows her to help people stay healthy, and she wants to provide care for those who cannot afford it. For Kay, studying medicine seems to be more about helping others than it is about having a career.

Kay seems well aware of the challenges that lay before her in fulfilling her dream. She appears to find great strength to navigate this pathway from the women in her life, although admittedly her relationship with these women is highly complex. Kay speaks passionately about her mother and sister as educated women, for her mom went to college and her sister is currently pursuing a career in technology. However, when she elaborates on their academic tracks, she is uncertain about what her mother studied and tells us that (before she got sick and lost her job) she oversaw "stuff" at a pet store. Her sister, on the other hand, attends a part-time program at a fast-track career center, and aims for a technician degree. She refers to her mom and sister as "role models" who are leading the way with lives in science, and as individuals who are "trying to be their own person."

Kay indicates that her mom would be happy with any career decision that she makes, but is certain that her mother desires a better life for her than she has had for herself, "My mom doesn't want me to end up with a lifestyle like hers." For Kay, her mom's insistence in a better life and her own efforts to work in science are the "major thing that keeps me on track...I want her to be proud of me."

In her pursuit, Kay has inquired about the requirements for an M.D. credential. When one of the instructors at her afterschool program explains the 10-year lengthy process, Kay opens her eyes and says, "That's a long time." Not deterred, she indicates that she is pursuing a track different from her mother and sister, whose college experiences have been much shorter. She makes such note, not out of judgment it seems, but more out of thoughtfulness, expressing that they have set up the way, and she is going to push further.

Another important measure that Kay takes into account when she evaluates the information given by her instructor is the cost of those 10 years. With her family's limited income, she is keenly aware about the financial barriers to accomplish her goals, saying, "the biggest thing I need is money." Nevertheless, it is precisely at home where she receives the necessary elements to break them down, for she acknowledges that her mother's advice and "tough love" on getting good grades is directly related to possibilities of getting a scholarship. Taking her mother's advice to heart, she applied for and won, summer scholarships at [State Tech University], becoming the only youth who has won the award twice. Such strategic navigation

on Kay's part illustrates how she is driven and unapologetic in reaching out for resources that will give her a leg up to reach her goals. Kay is not passively "aspiring" to be a doctor; here is a 12-year old fighting tooth and nail to achieve while facing constant danger of being derailed any moment due to economic instability at home.

With her mother and sister as ever-present role models in science, and her increasing authority as a high performing youth in GC, solidified by authentic, rigorous experiences in science both at the club and during summer internships at a University, Kay has stitched reinforcing patches that position her as someone who has ability and can succeed in science. These elements are especially important navigation devices as they stabilize her identity as someone who can do science even as she struggles with her grades, her participation in school science, and with a tumultuous home-base situation.

Narrative of Protection: Creating a Place in Science

And I didn't have a coat
 And it was way down in the fall
 Momma sewed the rags together
 Sewin every piece with love
 She made my coat of many colors
 That I was so proud of

While carving an inroad towards her science goals, Kay also challenges the boundaries of science both through the process of her engagement and in the science artifacts that she produced at GC. Doing so allowed Kay to draw attention to the strengths and resources she brings to science, resources that are not typically valued in the traditional discourse of science. Through the act of personalizing her science artifacts, Kay also positioned herself as a community expert with the authority to educate those around her about socio-scientific issues. While personalizing artifacts might have been the norm at the club, but how she did so, she continued to push on the boundaries of science. As she explains in a paper she wrote:

My movie made a difference to many people. I know that my sister started to be more green by not littering and picking up trash. She would nag at her boyfriend and yell at others because he would liter and not take care of his trash. [M]y point is that being in Green Club and making movies has made me feel better because I know that I helped change the world. I made movies and people listened (from Kay's paper, March 2011).

As this quote suggests, Kay found opportunities to author multimodal artifacts for broad consumption to be central to her participation in her after school club. In talking about this work she positions herself as someone who is knowledgeable about science and who also has the power to make a difference. She references the power of knowledge in making change and challenges the viewer to consider what

knowledge matters as something that is contested. Kay takes a clear stance to show that scientific knowledge and decision is not cut and dry, that it involves emotions and thinking about the world from other perspectives (the polar bear); that serious messages about the world (global warming) can be shared through humor and wit as at the same time they lay down a sense of urgency.

Take, for example, the PSA that Kay made in 7th grade in GC (“The KCSTJ show”). The youth in the program were charged with crafting a PSA that educated others about “renewable energy.” The youth investigated the role that green energy might play within their location, state and national communities, and its long-term impact on humans and the environment during the time of rising gas prices and intense national discourse on energy independence. Kay was particularly concerned that “getting green energy might not matter if people did not have the money.” She noted that the local electric company charged higher prices for green energy, and that people might not understand that green energy not only saved the earth but really also saved money in the long run.

Thus, she co-authored a “radio call-in show” where they took calls on the listeners’ views on renewable energy. The script positions Kay as the radio station DJ soliciting different views on green energy, as the song *Where is the Love* plays in the background (selected by the girls because it raises awareness on everyday actions in making the world a better place). She highlights the different stances that are likely to be held by her community members and provides a clear explanation for how one might balance these stances. Her attention is to both the community and the science around green energy alternatives, and to how such alternatives can be considered together with economic concerns rather than against them, as she has one of the “callers” in her PSA note. In this one-minute PSA, Kay invoked science, peer culture, caring for other species and suggestions for how to ameliorate the devastating effects of climate change using their content understandings to build a coherent storyline that links everyday actions with climate change. This example reflects many other actions Kay took in the Green Club, where she sought to put different perspectives that are not normally found in scientific discourse side by side. We see this also in her narrative around creating a solar powered teen room at the club, where she hopes more kids will come so they will be “safe” and “off the streets” while keeping the earth “safe” from carbon emissions at the same time.

Kay puts her assumptions and understandings of science to use by enacting them and feeling pride in them, like the girl in Parton’s song. Thus, the “science coat” she creates with her multiple understandings can protect her from a harsh world (i.e., a world with global warming and economic difficulties). Nevertheless, a harsh world can also be embodied in paradigms, norms, and conceptions of expertise that negate non-dominant forms of knowledge. For a girl like Kay, a hegemonic conception of science can be a harsh world as violent as a “rough neighborhood” if it is shaped as something that deems her inadequate, marginal, or even worse, non-existent. Her artifacts and subsequent insights are constructive efforts that give testimony of the way she defends herself and her community from both global warming and disenfranchisement.

Narrative of Endurance: Knowledge and Skills to Make Real Change

But they didn't understand it
And I tried to make them see
That one is only poor
Only if they choose to be
Now I know we had no money
But I was rich as I could be

Throughout the years that Kay has participated in the after-school program, she has become increasingly aware about the role that she plays as a scientific expert and communicator. Indeed, Kay's pursuit for a better world (both as an expert and educator) is directly related to the situations and corresponding tales that emerge from her home and her community.

In an interview that took place when she was in 7th grade, we asked her to tell us about out-of-school places or moments in which she thought about her learnings on green energy. Kay answered,

Sometimes I think about it when I'm going to bed, it just pops up in my mind while I'm not thinking about anything else. And sometimes when I think about death, I think about global warming.

When we asked her about how that made her feel, Kay answered "mad" because she wants people to be more conscious about global warming and engage in activities such as recycling and carpooling. Later on, when we asked her if she wanted to continue attending the club, her answer took the interview in an unanticipated direction. Adhering to the relevance that testimonios give to the experiences of those outside academia and in order to convey the power of Kay's own words, we present the direct transcription of what followed from our question:

Interviewer [Int]: Umhm. K, and uh, looking forward, what do you hope to learn next year? Cuz of course you're gonna be in [Green Club] right?

Kay [K]: Umhm. I was thinking either in the fall or in the summer, it doesn't matter- I was thinking maybe we should talk about all the issues of death and different things that are causing um, people to die, like global warming, and well, I mean, I know that Green Club is about Green Energy Technology, but I think we should do a different subject.

Int: Oh you do? What's that?

K: Like, um, stuff that's causing different things to happen to people, like how people, why people are stalking, and why people are doing drugs and drinking, and a lot of stuff like that.

Int: Other kinds of problems in society?

K: Yea...

Int: Um...any other...?

K: Suicide.

Int: Oh. Wow. I think we'll probably have to stick with Green Energy Technology, but those are all really important issues that you're raising.

- K: Yea, I was also thinking, I was also thinking about maybe asking Ms. T if we could start our own club.
- Int: Oh on what?
- K: Me and some other girls, maybe, if they wanted to.
- Int: What kind of club?
- K: What I just said.
- Int: Suicide?
- K: No, not suicide. A club about problems that's going on and then we should...
- Int: Problems in society?
- K: Yea and then we could make commercials and put them on TV and tell people they need- they just need to stop or...
- Int: Umhm.
- K: Or they could possibly die from it, because my sister um, knew this girl and she got mad at her mom, she went upstairs she took the um, what's that thing called when you go- it goes on your robe to tie it up...
- Int: Oh, um, like a belt?
- K: Yea, like the belt on the robe, and she tied it around her neck and she hung herself and her mom called the police and she was going upstairs, she saw her daughter and she was trying to take it off but it was too late, she died.
- Int: Wow.
- K: So yea
- Int: That's upsetting, oh my goodness.
- K: Umhm. So it was because she was mad at her mom, so I was thinking about starting a club, putting on commercials saying "don't do suicide, don't do drugs, don't drink alcohol, don't stalk. All this stuff could possibly get you in prison or jail, or you could possibly die from all of this." Because if you, I know stalking may seem like, 'oh no, you can't die from that' but you can, because what if that person sees you?' And you stalk them all the time, they might, they could possibly shoot you. Or kill you somehow. So I would like to start a club about that too.

From an early age, Kay has had to deal with figured worlds that have made her aware of the impacts of drug and alcohol abuse. The tales that she hears at home from members of her family include images of girls hanging from robe belts and people skulking in the shadows. She knows that the consequences of certain actions can result in imprisonment or bodily harm. Nevertheless, she is quick to affirm that her knowledge and skills are valuable sources to change those outcomes. In fact, the question that brought about her stories was the one that invited her to inquire into her future (i.e., "what do you hope to do next year?"). Unprompted, Kay brings up an extensive list of "problems in society" precisely because she wants to use her scientific/technological expertise to address matters that have touched her personally and significantly. Kay also feels empowered by her learnings at GC to want to leverage them in taking action for solutions. Just as she positioned herself as a community science expert with her PSAs, Kay wants to

reach out and share in the discourse on such societal issues pertinent to her and her community. Some of the concerns that she raised – drug and alcohol abuse – have strong connections both to science and her ambition to be a medical doctor. Thus, she portrays that her awareness, skills and voice can make a difference.

Kay's narrative conveys that the richness of the storytelling at home does not univocally communicate deficit. On the contrary, she takes those stories and situations as prompts to insert her actions meaningfully in the community to which she belongs. Thus, her present as a scientific expert and her future as a doctor are both functions of her current realities and her concern to change the world. Ignoring or dismissing her realities—whether her family's or her community's—would therefore be significantly detrimental to her (present) authoring and (future) participation in science.

The patches in Kay's coat reflect the many experiences that make up these narratives of protection, navigation and endurance. Kay's coat, which is a careful stitching together of these patches, protects and allows her to act significantly in an otherwise harsh reality that is, in part, the road towards a future in science. In the same way that a coat becomes indispensable when the temperature drops during the fall, recognizing the power in Kay's words allows us to imagine the way in which Kay understands and performs science/ technology as a way to shield herself and others from the “problems in society” she identified. Furthermore, if Parton's coat had the purported powers of “good luck” and “happiness” (precisely because it was created with the mother's love in that hypothetical family-figured world) Kay's coat protects her but also gives her the power to act from her understandings, her knowledge, and her priorities.

WHAT CAN WE LEARN FROM KAY'S COAT? TRANSFORMING THE HARSH WORLD

Country music is music with a lot of class. It's just ordinary stories told by ordinary people in an extraordinary way.

– Dolly Parton

As presented, Kay's life in science does not have a single origin and is certainly not monolithic. Throughout the 4 years in which Kay has shared her journey with us, she has drawn from often seemingly contradictory but nevertheless valuable resources that make her the insightful and promising 8th grader that she is today. Looking into her patchwork of experience allows us to understand the complex nature of constructing and re-constructing herself in science.

In the same way that Parton is an ordinary woman telling ordinary stories in extraordinary ways and speaks to and about a class through her country songs, Kay voice is a testimonio of and to a community of African American girls that she lives, learns and plays with. Kay, and many of her friends come to school – and to possible lives in science – without the traditional set of resources that research and/or society expect (and demand) if girls are to author a life in science. Kay's neighborhood is one of families struggling economically, in a city marked by high

unemployment and severe racial divide. This divide also plays out economically with more families of color experiencing unemployment at a time where state legislators are cutting social support networks. It also plays out in school enrolment patterns across the district.

And yet, the resources Kay gathers from her family, peers and club teachers in her out-of-school figured worlds provide her with resources that often run counter to the normative view of what families provide to support girls in science. Sometimes they run counter because the resources themselves are not themselves normative. Sometimes they run counter because Kay's pathway to the resources (both normative and not) are unexpected and complicated. These resources also provide Kay with the space to navigate and transform a possible life in science. Through her mother's and sister's experiences, Kay has taken on a wide view of "a life in science"—a PetCo worker and technician – being able to find role models whose lives are like hers, while thinking creatively about resources she might bring to succeed in science. Ultimately we see Kay as being able to re-write the narrative of success in science as something that is only for nerds or white people. Not unlike the counternarratives of successful African American achievers in math who resist and rewrite "*hegemonic notions that academic success is white property and cannot be attained by them*" (Carter, 2008, p. 477), Kay resists and rewrites notions of success in science.

Kay's stories should not be sensationalized, but neither should her accomplishments be read as "the myth of the American Dream." We rather understand them as a challenge to the deficit-oriented framing that some might take to understanding Kay's life. The very resources—material, cultural, symbolic—that compose Kay's coat when viewed through hegemonic narratives would be framed through the discourse of deficiency (single parent home, mother in low-wage work, sister not going to college). But such a deficit framing is myopic for it does not reveal how Kay understands these experiences and when and how she draws strength from them. These resources are woven in such a way that they are re/inscribed with powerful and productive meanings that open pathways for her and help her succeed. Such identity trajectory work emphasizes (rather than *deflects*) how race/culture *and* science merge to transform being a "club kid" into a powerful and capable learner and doer of science.

Kay has sewn a coat that she uses to navigate, protect, and endure—and she has crafted it carefully, with love in every stitch. We wonder, however, if as teachers and researchers, we will "laugh" at the coats of our students because we do not understand them, as Parton discusses in her song.

After all, why would one consider a low-wage job at PetCo as a life in science? And, what happens when someone official—a teacher, a school counselor, or peer—informs Kay that her narrative is faulty? We also wonder if we will recognize our students' coats as coats, for if we fail to acknowledge the complexities of a metaphorical coat, we can also divest it of its power. We would rather advocate for classrooms in which girls like Kay's testimonies are seen as their possibilities rather than their rags.

NOTE

- ¹ We have followed Kay for four years (5th-8th grades), and have gathered hundreds of hours of observational notes across the figured worlds that make up her life, conducted multiple interviews each year with Kay, had conversations with family members, and have collected a wide range of artifacts from school and out-of-school spaces. Working with Kay and her data, we sought to trace out her participation in science class and in other figured worlds over time. The family-related out-of-school figured worlds differed for Kay, as they extended from her primary home with her mother and siblings, to her grandmother's, to her sister's. Using science events (within figured worlds) and Kay's identities over time as focal points in our analysis, we worked to discern patterns that mapped onto Kay's identities and her participation in an after-school science club, and to expressed forms of interest and participation in science.

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AFFILIATIONS

*Juanita Bautista Guerra, Angela Calabrese Barton, & Caitlin Brecklin
Department of Teacher Education
Michigan State University*

*Edna Tan
Department of Curriculum and Instruction
University of North Carolina at Greensboro*

*Hosun Kang
Department of Teaching and Learning
University of Washington Seattle*