

*Research Article***Agency Amidst Formidable Structures:
How Girls Perform Gender in Science Class**Heidi B. Carlone,¹ Angela Johnson,² and Catherine M. Scott³¹*The University of North Carolina at Greensboro, North Carolina*²*Saint Mary's College of Maryland, Maryland*³*Coastal Carolina University, South Carolina**Received 6 March 2013; Accepted 31 December 2014*

Abstract: Larger social structures such as race, class, gender, and sexuality and classroom structures like narrowly defined participation practices constrain individuals' agency to engage in untroubled and sustained science identity work. This article explores the central dilemma of attending to structure and agency in settings where inequities are blindingly pronounced. Using a framework that highlights gender as discursive performance, we examine a data set of 13 girls' engagement with school science from fourth to seventh grade (ages 9–13) that shows how structures of gender, race, and class became more salient for girls' trajectories over time. The gender performances that became most pronounced were: minimizing one's differences/fitting in, pleasing adults, and making oneself submissive or invisible. "Helping others" became a subversive, rather than celebrated, practice over time. To illustrate the themes with more depth, we present a longitudinal case study of Mirabel, an academically gifted and scientifically interested first generation immigrant to the US, whose science trajectory became increasingly precarious and entangled with larger social structures. A focus on structures pointed to the narrowly constructed classroom subject positions that left virtually no room to be simultaneously "girly" and "scientific" and the prominence of heteronormative versions of femininity. A focus on agency made evident that girls were less engaged with how to become scientific and more concerned with figuring out what kind of girl to be, given what was acceptable in the setting. We end with an account of Mirabel that highlights her resourcefulness and agency that make possible a hopeful shift in her trajectory. © 2015 Wiley Periodicals, Inc. *J Res Sci Teach* 52:474–488, 2015

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This special issue on the structure/agency dialectic provides us an opportunity to reflect on the utility of the constructs (structure and agency) for understanding and foregrounding (in) equity in science education and for working toward more just science educations. For the past 15 years, our work has highlighted the ways structures and individuals' agency are mutually constitutive. To understand what we mean by structures, we draw on the work of Patricia Hill Collins (2009). In her domains-of-power framework, she argues that racism is "a system of power with four domains" (p. 53): institutional, disciplinary, cultural and interpersonal. We expanded this framework to include other systems of power as well (sexism, classism, heterosexism, and language dominance). The institutional domain is concerned with *institutional structures* like educational

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Correspondence to: Heidi B. Carlone; E-mail: hbcarlon@uncg.edu

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policies, school science traditions, and reform initiatives.¹ The disciplinary domain includes *organizational structures*, “the rules and regulations of everyday life” (p. 53), a category that includes classroom structures like normative scientific practices (Carlone, Haun-Frank, & Webb, 2011). The cultural domain is the *structure of ideas and ideologies*; in this category we place ideas about how good science students act and how girls should behave. *Interpersonal structures* consist of “ordinary social interactions” between individuals and in communities; e.g., how students interact with one another and their teachers. Within these four kinds of structures, then, individuals (in our case, girls in science class) exercise *agency* in their actions and meaning-making; e.g., when they perform certain identities, make decisions and value judgments, and decide future courses of action. In this framing, the setting’s structures provide guidance, but not prescriptions, about possible and acceptable actions and meanings. Actors craft identity performances that conform to and/or resist the prevailing structures, sometimes intentionally, but sometimes unconsciously. By identity performances, we mean behaviors, not reflections of some sort of individual essence. As Judith Butler (1990) describes this,

[a]cts, gestures, and desire produce the effect of an internal core or substance, but produce this *on the surface* of the body, through the play of signifying absences that suggest, but never reveal, the organizing principle of identity as a cause. Such acts, gestures, enactments, generally construed, are *performative* in the sense that the essence or identity that they otherwise purport to express are *fabrications* manufactured and sustained through corporeal signs and other discursive means. (p. 136; italics in original)

This process is repetitive and habitual; an individual’s identity performance settles into recognizable patterns over time. Note also that the same individual can craft a different performance based on setting; the same performance can also be interpreted differently in different settings.

Thus, people’s choices are not free; their agency is influenced and guided by structures, though those structures and their influence may be implicit or hidden. The structures are themselves also the result of agency—of the actions of others. Some of those actions (as in the case of institutional structures) are taken by people far removed in time and space from the immediate setting. Others (organizational structures like classroom rules and norms) result from actions closer at hand. Interpersonal structures result from actions in the immediate vicinity. All of these actions at all levels are influenced by the structure of ideas and ideologies.

Thus, structure and agency mutually constitute one another (Carlone, Johnson, & Eisenhart, 2014a); structures change as a result of the choices and actions of individuals and groups, whose choices and actions are constrained by structures. We are particularly interested in the extent to which individuals can affect and/or work against structures. Are most structures monolithic and enduring, resistant to change, even though they were created by individual and collective action? Or are structures more mutable than that? If so, which kinds of structures are most amenable to change, and how does that change take place? In particular, we are interested in how likely it is that individuals from non-dominant groups (e.g., girls in science class) are able to work against the structural status quo.

We have been thinking about this question of structural resistance and change using the metaphor of *cracks and fissures* through the structures (Shumar, 2010). Others have worked with similar concepts. Robert Moses and Charles Cobb (2001) write about *crawl spaces* “created in the larger political and social world that we can use to our advantage” (p. 94). Collins (1999), examining the experiences of Black women in academia, writes about “social locations or border

spaces occupied by groups of unequal power,” who she calls “the *outsider[s] within*” (p. 86, our emphasis). Optimistically, she asserts that “the insights gained via outsider-within status can be a stimulus to creativity that helps both African American women and their new organizational homes” (p. 88) and, writing specifically about sociologists, “[a]t its best, outsider within status seems to offer its occupants a powerful balance between the strengths of their sociological training and the offerings of their personal and cultural experiences” (1986, p. 11). Holland, Lachicotte, Skinner, and Cain (1998) remind us that, “even with grossly asymmetrical power relations, the powerful participants rarely control the weaker so completely that the latter’s ability to *improvise resistance* becomes irrelevant” (p. 277, our emphasis).

All of these framings—crawl spaces, outsiders within, improvisers—are powerful and useful. In this paper, however, we use the metaphor of cracks and fissures, because it helps us explore our central interest: What is the nature of these cracks? Are they like slot canyons?—narrow, stable cracks through seemingly impenetrable rock faces, of a set width, through which only a set number of people can pass? Or, are they like cracks in the foundation of a building, cracks that could widen and eventually bring down the whole structure?

We examine this question through a longitudinal data set of 13 girls’ engagement with school science from fourth to seventh grade (ages 9–13) and a deeper dive into the case of Mirabel, an academically talented girl who moved from a Central American country to the US in third grade. The girls in the data set were recruited into the study because, in fourth grade, they were all in classes judged to have excellent science teachers (see selection procedures in Carlone, Haun-Frank, & Kimmel, 2010) and all viewed themselves and/or were viewed by others as excellent science students. They all, we argue, spent a year in a crack in the structure, in a classroom where their *classroom organizational and interpersonal structures* of highly engaged and participatory science ran counter to the more typical *institutional structures and structures of ideas and ideology* about science education, what it means to be a good science student, and who excels in school science.

This study’s *central research question* is: Once girls have participated in and studied science within a crack in the science education structure (during fourth grade), what happens to their performances of femininity in science class over time? In fourth grade, these girls performed themselves as competent, interested science students in ways that did not conflict with structures of ideas and ideologies about gender (or race, class, and English fluency). The focus of femininity in our study lets us not only consider girls’ trajectories through science, but also, at a more abstract level, the dialectic between structure and agency. Girls perform different versions of femininity (agency), and their performances shape and are shaped by ideological, organizational, institutional, and interpersonal structures of “proper” femininity, i.e., proper ways of being a girl in school science class.

The Gender Problem: Why it (Still) Matters

Many girls in our study who were so engaged during 4th grade are exactly the kinds of students who are not performing well in science. On the 2011 National Assessment for Educational Progress 8th grade science test, girls on average scored 4 points lower than boys; children eligible for free lunch scored 27 points lower than those not eligible; Latino students scored 27 points lower than White students; African American students scored 35 points lower than White students; and students classified as English language learners scored 48 points lower than non-ELLs. Each of these differences was statistically significant. Fourth-grade science scores from the 2009 NAEP showed comparable gaps (U.S. Department of Education, 2014). U.S. Department of Education data indicate that Black and Latino students attend schools with higher concentrations of first-year teachers at three times the rate of White students. Among the high

schools with the highest concentration of Black and Latino students, a quarter do not offer Algebra II and a third do not offer chemistry (Rich, 2014). Further, among 2012 college graduates, 24% of White men majored in STEM, along with 15% of Black men and 21% of Latinos. In comparison, 11% of White women, 8% of Black women, and 9% of Latinas majored in STEM (National Science Foundation, 2013). In 2010, although women constituted almost half of the college-educated work force in the United States, only 28% of people employed in science and engineering fields were women. Although African Americans constitute 15% of the adult population age 25–65, and 6% hold science and engineering degrees, they make up only 4.6% of the people in science and engineering jobs. Comparable figures exist for Hispanics: 21% of the US population, 6.7% of science and engineering degree holders, and 5.2% employed as scientists and engineers (National Science Foundation, 2013, 2014).

Structure, Agency, and Gender

The statistics above speak to science education's enduring equity and access problems for girls and all students of color, despite popular literature touting the urgency of schools' new "boy problem" (Hoff Sommers, 2013). Previous gender literature focuses predominantly on either structure or agency. Brotman and Moore (2008) provide a synthesis of themes in gender and science education research from 1995 to 2006 and identified four foci: (1) equity and access (institutional and organizational structures); (2) curriculum and pedagogy (classroom organizational structures); (3) the nature and culture of science (structures of ideas and ideology); and (4) identity (p. 974). Only the fourth focus (identity) attends to both structure and agency (Brickhouse, Lowery, & Schultz, 2000). However, as Shanahan (2009) argued, identity studies in science education often emphasize "aspects related to the individual and especially to individual agency" (p. 44), rather than the dynamic interplay between structure and agency. In this paper, we focus on the girls' discursive performances of gender (i.e., a form of agency) within the structures of school science. Our understanding is informed by Butler's (1990) work and applications of her work in the sociology of education (Francis, 2000) and science education literature (Archer et al., 2012). This view of gender emphasizes the contingent, ongoing, and situated nature of gender identity work. Louise Archer and colleagues (2012) summarize Butler's (1990) argument well:

[G]ender is not the 'result' of a person's sex—it does not emanate 'naturally' from particular (sexed, racialized, classed) bodies—but it is produced through discursive and bodily 'acts.' Gender (and thus identity) is, therefore, not something you 'are' or 'have' but rather is something that you 'do' (perform) and continually redo. (p. 970)

Ways of "doing gender" (or "being a girl") that become normative often involve heterosexualized versions of femininity (Skelton, Francis, & Read, 2010). These ways of doing gender are hegemonic in that they are not self-reproducing; their authority arises from everyday, sanctioned practices (interpersonal structures) that create "the illusion of a 'proper', 'natural', or 'fixed' gender" (Archer et al., 2012, p. 970). Focusing on performances of gender draws attention to the structures that govern and police "appropriate" gendering and the choices (i.e., agency) girls make and actions they take (consciously and subconsciously) to position themselves in relation to normative versions of femininity in a setting. Previous literature about girls in school and school science demonstrate the ways gender, a "powerful illusion" (Butler, 1990, p. 185) and, we would argue, an ideological structure, shapes girls' science agency and performance. For example, compliance and submissiveness (Carlone et al., 2014a) and "restrained" heteronormative femininity (Skeggs, 2004) become more valued than girls' actual science interests and

competencies (Tan, Calabrese Barton, Kang, & O'Neill, 2013). Valued gender performances for school, science, and school science are often raced and classed (shaped by the structure of ideas and ideology), making them unattainable or undesirable for girls and women of color (Ong, Wright, Espinosa, & Orfield, 2011) and girls from lower socioeconomic backgrounds (Bettie, 2003).

Archer and colleagues' (2012) large-scale study of girls' science interests and aspirations demonstrates the intricate negotiations of gender performance by "science-keen" girls (p. 973). The girls' negotiations in the study resemble our ideas about cracks and fissures; they had limited options about how to perform in the context of conflicting structures of ideas and ideologies; ideas about how to be a girl that were in conflict with ideas about how to be a good science student. One group of girls, "feminine scientists," engaged in "girling" science, by balancing their performances of science interest with performances of "appropriate. . . heteronormative femininity" (p. 974). Another group of girls de-emphasized their "girliness" to perform a "blue-stocking femininity" that was asexualized and celebrated cleverness and academic achievement. Both versions of femininity brought complications and precariousness related to the girls' science trajectories. We found similar negotiations in our study.

Methods

This study is part of a larger project that identified the short- and long-term affordances of one year of strong elementary science instruction on students' science-related identity work. The larger study involved ethnographic studies of fourth, fifth, and sixth grade classrooms (e.g., Carlone, Haun-Frank, & Webb, 2011) and longitudinal case studies of students' science-related identity work (Carlone, Scott, & Lowder, 2014b; Carlone, Webb, Archer, & Taylor, in press), and included videotaped and audiotaped observations, fieldnotes, audiotaped interviews with students, teachers, and parents, and student work samples. Our initial foray into the data was guided by this question: What are the patterns of girls' discursive performances of femininity in school science from fourth to seventh grade? We analyzed those performances in light of their entanglements with science-related identity work.

We chose approximately three to five video excerpts (10–45 minutes/each) of each girl's participation in science class in fourth, sixth, and seventh grades for ten of the 13 girls and in fourth, fifth, and sixth grades for the three remaining girls (See Table S1 "Summary data collection", supplementary document online).² Where possible, we privileged videotapes that featured girls working in small groups, but included at least one whole-group session (e.g., discussion, lecture) for initial analysis. Our goal was to identify her primary academic/scientific performances (i.e., performing oneself as "good student", as aligned with classroom norms or not), along with the versions of femininity she displayed. Fairly early in the analysis, we began to see patterns across girls' performances and honed in on the following performances of femininity: pleasing adults, belonging (minimizing "otherness"), nurturing (helping others), standing up for others, making self submissive or invisible, leader/dominance/superiority, outsider (emphasizing "otherness"). When we did not have enough evidence on any given research participant for an emerging theme, we examined more video footage and fieldnotes and closely examined transcripts from mid-year and end-of-year interviews we conducted with each girl and her teacher each year of the study. We developed a preliminary profile of each student using the performances of femininity we identified as patterns across the participants. We then examined at least two additional video excerpts per year (some whole-group and some small-group settings, from 10–40 minutes each), where available, in addition to examining fieldnotes, audiorecordings and/or student surveys focused on girls' science interests, goal orientations, and self-efficacy. We also re-

visited the interview transcripts to support and refute the initial assertions about each girl's patterned performances of femininity in science class each year.

Our mid-year interview protocol was roughly the same each year, aimed at eliciting girls' descriptions of themselves and school science with an open-ended approach (15–30 minutes long). In end-of-year interviews, we used a semi-structured protocol that took 35–60 minutes each. For example, we asked them about their: descriptions of themselves as “science students” and as “students”; meanings of the normative scientific practices promoted in their classroom and perceptions of their abilities to perform those practices well; perceptions of the three smartest science students in their class and descriptions of “smart science students”; out-of-school interests and use of leisure time; moments in and out of school when they felt particularly scientific and proud; future academic and career goals. The teachers' interviews focused on their perceptions of the normative scientific practices in their classroom and the nature of each girl's participation, performance, and potential in science that year and in the future (80–100 minutes each). All names and locations mentioned in this study are pseudonyms.

Overview of Results

In fourth grade, most girls made regular bids to be recognized for their scientific performances; all were “pleasers.” Being a “pleaser” in these settings meant performing scientifically. Table S2 (Supplementary document online) summarizes girls' performances of femininity in science class over time. After fourth grade, many girls continued to perform as pleasers, but did not make overt bids to get recognized as performing scientifically. Only two girls consistently performed as scientifically and academically competent and interested over time.³ However, some girls of color unevenly performed as “resistant” or “rebellious,” which may have indicated frustration with norms (which is to say, structures of ideas and ideology) that were undesirable or unattainable (e.g., Aaliyah's case in Carlone et al., 2014b). Belonging, or minimizing “otherness,” became more prominent across time for nearly all girls. More girls, especially Latinas from poor or working class backgrounds, performed as submissive or invisible by seventh grade. Bids for leadership or dominance, rare in fourth grade, became even rarer in seventh. All girls, except for Yazmin and Luisa (two, very academically strong Latina girls from working class backgrounds) changed their performances based on classroom norms (which is to say, organizational structures). The structure of ideas and ideology in terms of gender and race became increasingly important in the classroom cultures; interpersonal structures within classrooms became more closely aligned with more common ideas and ideologies about race and gender over time, regardless of these students' settings; structural cracks where girls could do science without cultural constraints seemed to close. One interesting instance of agency, one crack which did persist, was that many girls of color continued their practices of helping others, though their classroom cultures did not encourage those practices. In other words, nurturing could be viewed as a subversive practice to make the independent, competitive work of school science more enjoyable.

Mirabel: A Sample Case

To better understand the interactions among larger structural ideas about race and gender, classroom organizational and interpersonal structures, student agency and performances of femininity in science class, we introduce the case of Mirabel. Mirabel comes from a two-parent home with a younger sibling. Her parents, who managed a local restaurant at the time of the study, encouraged Mirabel to achieve academically. They supported her academic endeavors, allowing her to set up a garden outside their apartment and bring home crabs from the beach for

long-term observation. Mirabel lived in a Central American country until age eight, when she moved to the United States and managed to quickly pick up English and excel academically. By the end of the fourth grade, she was among her class's top scorers on end-of-grade standardized tests in literacy and mathematics. By fifth grade, she was recommended for the academically gifted program.

Fourth grade: science in a structural crack. In fourth grade, Mirabel had an award-winning science teacher, Ms. Wolfe, who was recognized in her district for innovative, hands-on/minds-on teaching, using live animals in her classroom, and for promoting giant growth on standardized test scores, especially for English Language Learners. Her approach was very child-centered; veering from the curriculum to follow youths' questions and curiosities was a regular practice. Ms. Wolfe recognized Mirabel as a high achiever and earnest student: "the girl who makes a four [the highest score on the state standardized assessment] and grows 20-some points, wanted to come to summer school" just because she liked school so much (Teacher Interview, 8/13/08). Mirabel nominated herself as one of the class's smartest science students in the end-of-year interview, and others did, also. In class, Mirabel was recognized for her scientific reasoning, her observation skills, and especially her keen linguistic skills. For her age, she had a good grasp of scientific vocabulary, even in English, her second language:

Ms. Wolfe: Help me make a list of what the word "insight" might mean.

Students: [Share various ideas, none of which are completely correct.]

Ms. Wolfe: There's a science word I was hoping somebody would be able to think of.

Mirabel: Observation!

Ms. Wolfe: Yeah, observations would be a good one! *The teacher writes "observations" on the board.* (12/06/07)

Mirabel consistently positioned herself as a "good student" in fourth grade and was recognized as such. In this class, being a "good student" meant performing oneself scientifically — being a good question-asker, group member, problem solver, and sharing one's scientific ideas. Mirabel was an active participant in whole-group discussions, frequently made bids to "hold the floor," and often raised her hand to answer questions even before the teacher finished presenting the question to the class. During a particular lesson on observing animal behavior, Mirabel shared insightful comments and relevant observations eight times with the class during a forty-minute period. For instance, she pointed out that the millipedes she observed "preferred the humid side of their tank" (12/06/07). Mirabel's body language frequently showed her active science engagement; leaning forward in her seat during investigations, nodding her head in agreement during discussions, and writing ideas in her science notebook (5/07/08). Her science notebook was wrought with detailed drawings and accompanying descriptions. She was nearly always on task in small group work.

Because the class's celebrated subject positions valued many different social identities, Mirabel's social identity work was an important resource leveraged in support of her scientific identity work. Though a newcomer to the US entering a classroom where students had been together as a dual language immersion cohort since kindergarten, she seemed undaunted,

frequently making social bids to her peers and easily fitting in. For example, while the class was exploring which materials were magnetic, Mirabel discovered her own unique method of pre-testing objects before using a magnet on them: “you can tell something is metal by tapping it on your teeth” (4/9/08). After modeling this technique for the camera, she showed her partner, then got up to demonstrate it at neighboring tables, while laughing and giggling. Mirabel’s bids for recognition revealed a desire to fit in. She charmed her peers and the adults in the room.

As illustrated in Table S2, Mirabel’s gender performances in fourth grade were typical of most girls in the study, as she performed herself as a pleaser and nurturer. However, unlike all but one other girl in the study (Celeste), her *primary* performances made evident a desire to minimize her otherness and belong. She performed herself as socially savvy, quickly assessing the norms of this tightly-formed class group and figuring out ways to “fit in,” which meant performing oneself scientifically (i.e., asking good questions, making insightful observations, contributing to others’ learning). In many ways, her performances aligned with the “feminine scientists” portrayed in Archer et al.’s (2012) study mentioned above. Mirabel’s agency to successfully perform herself as both “smart” and “girly” were supported, even pushed, by this classroom’s organizational and interpersonal structures. She was social, dyed and styled her hair in fashionable ways, and wore jewelry and conventionally feminine clothes; according to the structure of ideas and ideologies in her classroom, these actions were not in conflict with her high-achiever, motivated side.

Fifth grade: The crack narrows. In fifth grade, Mirabel had a teacher, Ms. Campanel, who valued and celebrated youths’ cultural backgrounds. Ms. Campanel, who was trilingual and had lived in different countries and urban areas on the east and west coasts of the US, was adept at meeting students’ social needs and was a passionate and seasoned teacher of social studies and literacy, with advanced degrees in these areas of education. However, science was not her favorite subject, and she felt constrained by the fifth-grade curriculum that stressed vocabulary memorization in preparation for standardized tests. She peppered the curriculum with some innovative activities (e.g., creating and studying eco-columns; creating Rube Goldberg machines; go-carts), but a lot of the science instruction was literacy-based.

Mirabel’s academic and scientific performances were inconsistent in fifth grade. Unlike in fourth-grade, when Mirabel was viewed as a “language expert,” Ms. Campanel was a native Spanish speaker and did not need students’ help with language. Ms. Campanel positioned Mirabel as smart, nominating her for the academically gifted program. However, she described Mirabel’s performances as uneven, attributing this, in part, to her own difficulty in teaching science in a way that was meaningful to Mirabel: “If I had to do it over again with her, I think that she could be a science student who excels, and I don’t think that she excelled this year in science” (6/3/09). Mirabel’s gender performances and others’ meanings of them distanced her from more scientific positionings; she found it much more difficult to craft a performance which was both scientific and in keeping with larger structures of ideas about gender. Ms. Campanel characterized Mirabel as “flighty” and a “social butterfly” whose interest in “girly stuff took [her] away from intellectual engagements” (6/3/09). She explained that Mirabel was “into boys” rather than school for half of the year. Mirabel indicated at the end of the year that she still enjoyed science and still wanted to become a doctor, but she also found it “boring” at the beginning of the year and did not nominate herself as a “smart science student” (6/3/09).

Mirabel found normative masculine topics like forces and motion and go-carts “boring,” but she engaged with more enthusiasm during the ecology unit. Ms. Campanel attributed this to Mirabel’s heavy identification with heteronormative Latina femininity. “She’s doing gender in a real mainstream way for her background.”

As a girl, she's a girly girl and [the forces and motion and weather units] were totally just disinteresting to her. . . . If I were older Mirabel talking to younger Mirabel, I would say, 'I needed something girlier than weather or the [go-cart] cars.' [For those units], she just went through the motions and it didn't really sink in. (6/3/09)

Gender performances congruent with larger structural ideas about heteronormativity became increasingly prominent in Mirabel's trajectory, making the space for agency in putting together a solid scientific performance much smaller. In our observations, she seemed to over-perform "social girl" and underperform her academic identity, especially when we compared her school science performances to the previous year and compared to all other girls but one (Celeste) in the study. Mirabel's gender performances in fifth-grade point out the very precariousness that Archer et al. (2012) predicted of the feminine scientist's identity work. They explained girls' "identifications [with science] as potentially precarious in light of inherent tensions between heterosexual attractiveness and academic success within wider public discourse. . . . which we would anticipate may increase as they enter adolescence" (p. 977).

We suspect that Mirabel's identity work was inextricably tied to larger heteronormative ideas and ideologies about femininity and, coupled with her strong desire to fit in among peers as a recently arrived US immigrant, it was more important to her to perform "girl" than it was to perform "scientist" or "academic." Skelton et al. (2010) suggest:

being an 'acceptable girl' is not in harmony with being a successful academic achiever: the former involves passivity, accommodation, a concern with social relations and projecting feminine 'desirability' whilst the latter demands hard-nosed determination, singularity and concern with mental/intellectual (rather than social) pursuits. (p.187)

Maintaining the "scientist" part of her identity became somewhat of a liability in light of the high-stakes nature of fitting into the classroom's interpersonal structures. However, Mirabel's academic identity was not in peril to the point that she was in danger of failing school. She still cared enough about her school performance that, when the teacher explained that her academic performance was putting her in jeopardy in the long-term, she began being more conscientious in school and in science.

Sixth grade: The crack has disappeared. Mirabel's sixth- (and seventh-) grade teacher was Mr. Campbell, whose classroom work was dominated by short lectures, lots of bookwork, assessments that required memorization, and the very occasional cookbook laboratory. Much more so than in fourth or fifth grade, Mr. Campbell strongly enforced prototypical gender norms in his interactions with students; classroom organizational and interpersonal structures became strongly aligned with the larger structures of ideas and ideologies about gender and heteronormativity. His teacher performances fluctuated from the "cool", "funny" teacher who sang songs, played guitar, joked with, and teased certain students to the strict, authoritative teacher who called out publicly and scolded behavior he deemed unacceptable. In this setting, where the space for agency was even more constrained than it had been in her fifth grade class, Mirabel's scientific performances were less frequent and dramatically less robust. Mirabel occasionally spoke up during class to answer a question, but her contributions were not recognized as substantive or insightful. She completed the work required, but she often performed as helpless, asking the teacher for the answers to the worksheets or copying peers:

Mirabel: Mr. Campbell, I need help.

Mr. C: Con? [*With?*] What, these three? It's one of these. Lo siento. [Sorry.] [He watches over her shoulder as she reads.]⁴

Mirabel: Your breath smells like peanuts.

Mr. C: Comically breathes on her. Mirabel: [*Leaning away.*] Oh, don't do that, please!

Mr. C: I can't hold your hand through the sixth grade.

Mirabel: Yeah, but I can't cross the street by myself. I really can't. (5/27/10)

In this interaction and others like it, Mirabel seemed to be playing with a more heterosexualized identity with the teacher and then backed away from it by claiming a “little girl” identity, explaining that she cannot cross the street by herself. In her bids of helplessness, with which Mirabel positioned herself as a student who could not find the answers on her own, she used a good deal of social savvy to get Mr. Campbell's attention and help. She often performed somewhat flirtatiously, for example seating herself next to him at the front of the room and tapping on his arm repetitively with her pencil and asking for the answer to every multiple choice question on the worksheet, all of which he provided to her (4/13/10). In another instance she resorted to flattery, suggesting that Mr. Campbell should be on American Idol, and making other comments unrelated to school, for which she received positive recognition. Despite the fact that these performances required social savvy, her identity work failed to get her any *scientific* recognition from the teacher, and instead positioned her as a “sassy”, “gum-chewing” girl, and sometimes an “interruption” to the class (Teacher Interview, 6/7/10). Mr. Campbell would occasionally have to remind her to stay in her seat and be quiet. However, her performances were in keeping with interpersonal structures in the classroom; they brought her positive social recognition from peers, who would sometimes laugh with her, and her teacher, who would joke with her and give her attention.

By sixth grade, Mirabel did not affiliate with school science, was no longer recognized for robust scientific thinking, and was being positioned in ways that thwarted her scientific trajectory. Rather than positioning Mirabel as a budding scientist who needed opportunities to use and get recognition for the scientific skills she had developed in fourth grade, Mr. Campbell positioned her as a potential “good student” who just needed to work harder: “Just work as hard in school as your parents do at their job, and I think you'll be amazed at how bright you are” (6/7/10). In this framing, Mr. Campbell also invoked, perhaps unintentionally, structural ideas about the meritocratic myth that immigrants who work hard get rewarded. He also failed to realize that Mirabel did, in fact, recognize herself as a bright, achievement-oriented student in other settings.

None of Mirabel's peers, by the end of sixth grade, nominated her as one of the “smartest” science students, nor did they mention her as part of an “all star science team” they would put together if they could (Student Surveys, 2010). Mirabel distanced herself from the “smart science students” because “I don't want to use scientific vocabulary or get the right answer all of the time” (6/1/10). We discuss elsewhere that the “perfect performer” was a celebrated subject position in this class (Carlone et al., 2014b), and Mirabel recognized this. Being unwilling or finding it difficult to align herself with that narrow subject position, Mirabel also disaffiliated from science, explaining that, although she got good grades in science and considered it important for her chosen future career as a doctor, “I'm not really into it. . . Science is not really my thing. I don't find it that interesting” (4/12/10). It was especially striking that the student who, in fourth grade, demonstrated such a natural aptitude for language, and even in sixth grade named Language Arts as her favorite class (6/1/10), now resisted using scientific vocabulary, claiming that it was something only “the smart students” did. Like her fifth grade teacher, Mr. Campbell labeled her as “flighty”:

It drives me crazy. I'm like, 'You are smart and you know it.' . . . It's hard to get her serious too. She doesn't get serious very often. Everything is too light-hearted. It's hard to get down

to like, 'Stop for a second and talk to me. No silly talk. . . You're smarter than this.' 'No I'm not.' (6/7/10).

By sixth grade, Mirabel played up heteronormative sexual performances more than most girls in the study, but she seemed wary of going too far with those performances. She wore make-up and dressed in fashionable clothes, often used a sing-song voice with Mr. Campbell, and brought up popular culture references with him and her peers. She downplayed her academic side, blowing bubbles dramatically with her gum, sighing loudly, and closely examining her nail polish in class. She often seemed to be on the "lookout" for the next exciting social interaction—scanning the entire classroom, looking around to see what her peers were up to.

It was hard to bear witness to these interactions, knowing what we knew about Mirabel's happy, confident, helper performances in fourth grade. In the organizational and interpersonal structures of this class, celebrated academic subject positions were only easily inhabitable for the "perfect performer" types, which were only available to a couple of White and Asian girls. Often, "narrow discursive spaces leave little possibility for other girls (e.g., working-class and/or other minority ethnic girls who may engage in more 'glamorous' performances of working-class femininity. . .) to imagine future science careers as 'for me'" (Archer et al., 2012 p. 983). What made Mirabel's trajectory even more perilous is that Mr. Campbell was also her seventh grade teacher, which left her little room to shift identity performances. It is important to note that heteronormativity, in Mirabel's case, was an ideological structure that shaped her possible, acceptable performances, and also a resource that she creatively leveraged, enacting agency, to enable her social belonging.

What the Structure and Agency Framework Revealed to Us

At the end of this study, as with many of our other studies, we are left frustrated by the power of structures. Mirabel, formally identified at the end of fifth grade as an academically gifted student with an aptitude for language, literacy, and life science and with a goal of becoming a doctor, was increasingly in peril of giving up on science, especially when she found herself in a 6th grade science class where the classroom structures were closely aligned with larger structures of ideas about gender and race. The system failed her in many ways. The fifth grade teacher admitted that, had she been a stronger science teacher and/or been more rigid with her expectations, "flighty Mirabel", who "interfered so much with her learning persona" could have been minimized and "scientist Mirabel" could have flourished. "I think that person (flighty Mirabel) needs to not be in class" (6/3/09). The sixth and seventh grade teacher's classroom structures promoted narrowly constructed celebrated subject positions, whereby only the "perfect performers" were celebrated as "great" science students. This put severe constraints on Mirabel's agency; she was left with no viable academic/scientific subject position to occupy while still feeling like she "fit in", so she chose to be more social and girly, a social position that made her feel successful with her peers and brought positive social recognition from the teacher.

When we viewed girls' agency in light of what they cared about, how they responded to others' positioning of them, what caused them struggle and conflict—we rarely, if ever, saw the performances as attempts to "become scientific." They were much more concerned with figuring out what kind of girl to be, given what was deemed acceptable in the setting. The normative gender role of "good girl", of pleasing adults, was consistent across time for nearly all girls, with the exception of one African American girl (Aaliyah) and two Latina girls (Yazmin and Celeste). All but two girls (Yazmin and Luisa, Latinas from working class families) significantly changed their performances based on classroom organizational, ideological and interpersonal structures. Even after experiencing interesting, hands-on/minds-on science in fourth grade, if the classroom's

normative practices in the next grade called for doing bookwork, note-taking, and memorization, they easily, without complaint, conformed. This raises the question: if the classroom structures were altered to hold students accountable to more robust scientific practices, would the presence of larger ideological structures around gender, race and become less prominent and relevant? Or, are these larger structures so entrenched and enmeshed by middle school that there is no escaping the ever-more-precarious and complex identity work that all adolescent, science-interested girls confront?

Structure loomed large for all girls' performances and positioning in relation to science. Even Amy, a White girl from a socioeconomically privileged background, had to do complicated classroom performances to get recognized as "smart" but not "too smart", as "scientific", but not "geeky". The performances of femininity that became most pronounced across the data set—e.g., minimizing differences, pleasing adults, helping others—aligned with coping mechanisms of girls and women of color in science as seen through the lens of poststructuralist feminist theory (Collins, 2000; Johnson, Brown, Carlone, & Cuevas, 2011; Ong, 2005). Even the contestations of ideological structures about gender were somewhat predictable based on previous literature. For example, displays of leadership, dominance, and/or superiority are forms of contestation that inadvertently position girls (and especially African American girls) as rebellious, "loud", "bossy", and "not well behaved" (Fordham, 1993; Morris, 2007). It seems to us that for the most part, the cracks in the structure that Mirabel found in her fourth grade science class had more or less closed off by sixth grade, and there was little room for her to use agency in ways that widened those cracks. The conflicts between structures about being an acceptable girl and being a good science student severely constrained Mirabel and her classmates.

Conclusion

Mirabel's story viewed through our lens of structure, agency and cracks and fissures is not hopeful. At the end of sixth grade, she seemed to be using her agency to walk away from her possibilities in science in favor of her primary social goal to fit in with peers. We used the structure/agency lens to look for cracks and crawl spaces in existing social structures, locations where Mirabel (and girls like her) could more easily leverage existing resources from self, home, and school to challenge the status quo of larger structures, and maybe even become a good scientist while she was at it. For example, even though Mirabel's sixth- and seventh-grade classroom organizational structures promoted individual achievement over collaborative endeavors, some of the girls helped one another with their school science work, despite their teachers' rules to work quietly and individually. In other words, nurturing and helping others became a subversive activity, leveraged to create a crack in classroom structures that promoted achievement as an individual accomplishment. Mirabel, however, used heteronormativity, an ideological structure that serves the status quo, to be the kind of girl she hoped to be—someone who fit in socially. Unfortunately, this meant being shunted farther away from a science-bound trajectory. Mirabel's case, during the snapshot of time we studied, tended toward the structural (reproductive) side of the structure/agency dialectic. We question whether our use of the structure/agency dialectic was somehow overlooking moments of possibility, making it difficult to detect the cracks. This seems to us an open question; however, we see three possibilities:

1. The situation may be as dire as Mirabel's story makes it seem. Larger social structures almost always win, and the rare cracks, when they appear, are like slot canyons: they are stable (can't be widened) and grow narrower over time until they are seemingly impossible for students to work satisfyingly within.

2. The problem is the way we deployed the structure/agency framework; by looking for social reproduction, one will find it, even when agency is put into the mix.
3. The cracks might be like cracks in a foundation, leading eventually to structural change and collapse; we just did not see the whole story in the four years we followed Mirabel.

Let us look at Mirabel's story through this third possibility. If we assume that her story is not over, then we can see her as a girl who is skillful at reading the structures shaping a social setting and figuring out who to be in that setting—how to perform herself—so that she will be a recognized, celebrated member of the setting. While we may wish that her settings had not pushed her towards rejecting science and almost-flirting with her teacher, we can admire her resilience, persistence and perspicacity in crafting a performance (i.e., exerting agency) that kept her from being marginalized. In previous work, we found that women of color in science and engineering professions have used this ability to “read” a social setting (Johnson et al., 2011). We borrow the term *la facultad* from Gloria Anzaldúa (1999), described as “the capacity to see in surface phenomena the meaning of deeper realities, to see the deep structure below the surface. . . . It's a kind of survival tactic that people, caught between the worlds, unknowingly cultivate” (pp. 60–61). Mirabel, we could contend, has become an expert at reading social situations and finding ways to fit in. Let us hope that Mirabel, like the women we have studied, can continue to keep herself relevant and recognized and maybe, just maybe, even finding her way back to science.

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Notes

¹Note that Collins (2009) also calls this domain the structural domain; we refer to it as institutional to avoid confusion with the way we are using the word structure.

²We had difficulty obtaining enough parent consent forms to videotape in two cohorts' fifth grade classes and similar difficulty with another cohort's seventh grade class. This is to be expected of longitudinal ethnographic data sets in school settings.

³These girls may have been similar to Archer et al.'s (2012) “blue-stocking scientists.”

⁴Though he was a native English speaker and not completely fluent in Spanish, Mr. Campbell would often use Spanish words and phrases when speaking with students whose native language was Spanish.

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