From Peripheral to Central, the Story of Melanie's Metamorphosis in an Urban Middle School Science Class

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Abstract:

Identity formation is a critical dimension of how and why students engage in science to varying degrees. In this paper, we use the lens of identity formation, and in particular identities in practice, to make sense of how and why Melanie, over the course of sixth grade, transformed from a marginalized member of the science class with a failing grade to a highly valued member of the sixth-grade science community with a perfect score of a 100% for the sixth-grade exit project. Our findings reveal that the different figured worlds of the science classroom, such as whole class, small group work, and individual work, offered Melanie different affordances for identity formation that were built upon across such spaces, in both productive and unproductive ways. Our findings also take up the kinds of critical roles that members of her classroom community, in particular teacher and peers, play in supporting and constraining such a transformation. We discuss the implications identity formation has for understanding issues of gender equity and science learning.

Article:

INTRODUCTION

The past 15 years have given birth to a wealth of research around girls' achievement in and motivations for participating in science (i.e., American Association of University Women Educational Foundation [AAUW], 1992,1998,1999; Howes, 1998,2002; Gilbert& Calvert, 2003; Parker & Rennie, 2000; Sadker & Sadker, 1995). This research has provided a detailed portrait of the barriers girls face in their quest to achieve and express interest in school science and offers ideas about the kinds of programs that might support girls in overcoming these barriers. The barriers that girls face in engaging with and succeeding in school science range from school and societal attitudes that portray science as masculine and girls as incapable of meeting its challenges to the lack of equity-minded curricula, pedagogical strategies, and available professional development tools.

Middle school is an especially crucial time to examine how girls, like Melanie, take up science in the classroom in ways that matter to them. Middle school is, after all, a time when girls' choices of peer groups, self-selected mentors, school grades, and after-school programs play a pivotal role in the high school trajectories they pursue and in supporting their efforts to become and remain engaged in science (AAUW, 1992; Lee, 2002; Malcolm, 1997). Middle school is also a time when girls' attitude toward science and achievement in science drop precipitously (Atwater, Wiggins, & Gardner, 1995).

Despite these clear understandings of some of the barriers that girls face in gaining an interest in and succeeding in science, and why some girls *lose* interest in science, we know very little about why or how some girls shift in their engagement to become *more* interested and more successful in science. For us, this raises many questions, but one question in particular that we find compelling is: How do girls identify with and in science, and why might this change over time? Consider the case of Melanie, a student who, in the beginning of sixth grade, was failing science and was often "traded out" of her groups (in exchange for another student from another group) by peers who did not value her contributions. The general sentiment articulated by her peers was that they felt

she was not a good science student and would not contribute much to their groups. Yet, over the course of sixth grade, Melanie evolved from a marginalized member of the science class with a failing grade to finish as a significant member of the sixth-grade science learning community with a perfect score of a 100% for the sixth-grade exit project.

Thus, the research questions that guide this manuscript are the following: (1) Why did Melanie's participation and learning outcomes change so much over the course of sixth grade? (2) What role did Melanie's identity formation during sixth-grade science play in her transformation? (3) How did the science-learning community facilitate and constrain Melanie's transformations?

CONCEPTUAL FRAMEWORK

Identity and Science Learning

Some science education researchers believe that identity formation is a critical dimension of how and why students engage in science (Brickhouse, Lowery, & Schultz, 2000; Kozoll & Osborne, 2004). Some argue that identity formation is especially pertinent for minority students and girls who regularly participate in "cultural border crossing" to gain access to and succeed in school science (Aikenhead, 1996). Costa (1995) has categorized a range of student types, from "potential scientists" who make easy transitions given the congruence of their lifeworlds and science, to "outsiders" for whom science and indigenous lifeworlds are mutually exclusive. It is not surprising that the majority of the students identified as "potential scientists" are White male students.

Yet, identity is not as static or self-imposed a construct as Costa's work might imply. Identities are constructed socially within communities of practice. As Lave and Wenger propose, upon entering a community of practice such as the science classroom, students develop identities through engaging with the practices and tasks of the science class. Learning science becomes "a process of coming to be, of forging identities in activity" (Lave & Wenger, 1991, p. 3). These identities are fluid and dependent on environmental factors inherent to that community of practice. Feminist research on identity formation has also highlighted the protean nature of identity formation, how it is "worked up" from "both available identity resources and the contextual constraints of the use of these resources" (Stapleton, 2001, p. 485). Girls from underrepresented backgrounds have to contend with challenges related to both gender and ethnicity in gaining legitimate membership in the traditional science classroom (Fordham, 1993; Sadker & Sadker, 1995). While surmounting these obstacles may seem formidable, the small cadre of research on minority girls in science tells us that some girls do navigate these challenges with grace and tenacity (Brickhouse et al., 2000).

The science classroom, as a community of practice, offers many different spaces, or figured worlds, where students can author identities. These spaces include whole-class settings, small group work, and individual locations, among others. Drawing from Bakhtin, Vygotsky, and Bourdieu, Holland and her colleagues (2001) posit a framework for the development of an identity in practice carved out in figured worlds. Figured worlds are socially situated, and are "peopled by the figures, characters, and types who carry out its tasks and who also have styles of interacting within, distinguishable perspectives on, and orientations towards it " (p. 51). Individuals have the proclivity to be drawn into certain figured worlds to shape and be shaped by them in authoring an identity. The act of authoring an identity is necessitated via a constant state of dialogism, where "sentient beings exist in a state of being 'addressed' and in the process of 'answering"' (p. 169).

The term "identities in practice" rather than "identities" apply in this study because we believe that the contextual factors of the specific community in practice, in this case, the science classroom, exert significant influence on how novice members, such as students at the start of the school year, adopt or author their in-class identities. The figured worlds (Holland et al., 200 1) of the science classroom are populated by members who are positioned with hierarchically ranked authority. How novice members negotiate their relationships with the official authority, that is, the science teacher, and the more established members of the science class community, for example, the recognized good science students, determine how their identities in practice evolve as they engage in activities in the science classroom. Evolving identities in practice can be inferred from

the way students choose to interact with other members, the decisions they make with regard to the assigned tasks in the science classroom, the opinions and questions they raise and also their reticence and silence should they choose not to participate. However, we are cautious to distinguish between potential identities in practice from random actions in stressing that although there is fluidity and multiplicity in identities in practice, they have to be viable enough such that the student sees a value in repeated temporal and spatial authoring of such identities in practice. In other words, their chosen ways of engaging in science as evinced by their recurring science classroom practices are a reflection of their acting from specific identities in practice.

The concept of "in practice" also delineates the identities students adopt and enact while in the figured worlds of the sixth-grade science community of practice. There are other identities that are salient to individual students based on their simultaneous membership of other figured worlds (e.g., an artist, a gardener, an avid fan of hip hop music), as well as the identities that students have already adopted with regard to science before they become members of the specific science classroom chosen as the site of research. In the context of this study, these refer to the science-related identities that students adopt or author for themselves before they enter the sixth-grade science classroom at The Inquiry School (TIS), which we define as the community in practice.

The identities in practice that are manifested when a student is asked to speak during a whole-class discussion may differ from those manifested when she is inhabiting different figured worlds of school science, such as engaging in a small group activity, which in turn may vary from those adopted when the student is immersed in an individual project. A student may develop a repertoire of identities in practice from which she operates depending on the nature of the figured world she finds herself in at any given context in the science classroom. This repertoire of identities in practice can be referred to as the student's "science classroom identity kit."

A repertoire of identities in practice also speaks to the fluid nature of identities in practice. On the basis of the different spaces a student finds herself in, she may shift identities based on how she positions herself, how she is positioned by others, or by the resources afforded and legitimized within a given context. A student can also expand her identity kit by experimenting and acquiring new identities that have proven useful to her in increasing her agency in the science class. A normally quiet, nonparticipatory girl in the science classroom may have an unexpected positive learning experience on a field trip with the science teacher, which then leads to her acquiring a different identity in the science class, that is, a more interested participant. New opportunities to participate in different ways also present themselves when a new topic that may interest the student is introduced, when a girl is partnered with new small group from whom she can learn, or when the teacher assigns a project that allows the student to leverage on and showcase her unique skills and talents. Thus, a student who is an "outsider" at the beginning of the school year may shift to be a "potential scientist" through such positive experiences.

How students are positioned in the science classroom affects the process of identity development. Students are not only positioned as novices, they are also positioned as the "loud and dramatic girl," the "field-trip girl," or the "generous girl" based on their identities in other worlds that are brought to bear in science class. These positions imbue students with relative power and status in the science classroom. Official student positioning by the science teacher assigning group roles such as "group leader" or "reporter" also accords students power that can transform learning experiences and affect identity formation in science class.

Yet we know that traditionally girls are positioned with less power in the science class-room. They are called on less often to answer content questions and not given as much attention as the boys by the teacher. As a result of this "hidden curriculum," girls are led to believe that a scientific identity is antagonistic with their gendered identity (Sadker & Sadker, 1995). This further illustrates the importance of understanding how girls author their identities in practice while they learn.

For example, Brickhouse and Potter (2001) show us how complex the relationship between identity and success in school and in peer groups can be for urban girls. Their work reveals that through the experiences of marginalization in the science classroom and even in peer groups, urban girls learn that membership in a school

science community is often impossible or undesirable. Having a science or technology-related identity does not mean that one will necessarily succeed in school, if that science-related identity does not also reflect the values of school-mediated engagement or if students do not have access to the resources they need to do science well. However, successful participation in school science or technology, despite a lack of resources in the home environment, can be better facilitated when students have a science-related identity they can draw upon. Brickhouse and Potter's study is important because it raises questions about how to help students retain an identity that is desirable to them in their home communities, yet also allow them cross the boundaries of race, class, and gender, to get access to a science culture that too often resides only in more privileged communities.

Similar to Brickhouse and Potter, Carlone (2004) further argues that someone who has a science identity demonstrates competent performance in relevant scientific practices and deep and meaningful knowledge and understanding of science, and recognizes herself and gets recognized by others as a "science person." In other words, identity construction requires the participation of others. To be a particular kind of person (i.e., to enact a particular identity) requires that we talk, think, use tools, value, act, and interact in ways that render who we are and what we are doing recognizable to others (Gee, 2000).

Carlone's stance is supported by other identity-related work in science education that reveals that there is a subculture of students with out-of-school science identities, who fail to succeed or pursue school science because how they enact their science practices matter little in the school setting (Calabrese Barton & Yang, 2000; Kozoll & Osborne, 2004). For example, in a case study of one young father, Miguel, Calabrese Barton and Yang (2000) showed how, during his teenage years, he resisted the culture of school science while at the same time, as a self-taught herpetologist and businessman, sought to create his own subculture of science in his close-knit neighborhood. For Miguel, resisting school science turned out to be both an act of self-preservation and an act of defiance. Both Miguel's peer culture and the culture of school science were restrictive, demanding conformity to a narrow set of norms that failed to connect his interests and talents to the wide range of possibilities offered by our society and economy. Miguel was placed in a position of having to choose one over the other. Yet, unlike his peer culture, schooling did *not* provide a safety net of support if he chose to conform to schooling over peer culture. What is particularly interesting in this case study is how science itself could have mediated this difference. As a self-taught herpetologist, an occupation highly respected among his peers, Miguel possessed the interest and capacity for a practice of science that could have bridged these two worlds.

These studies on identity and science engagement suggest that science has a higher plausibility of being recruited into a student's sense of self when more than its intrinsic value as a discipline is applicable to the lives of students (Kozoll & Osborne, 2004). They point to the need of providing a more equitable science education grounded in curriculum that encourages more diversity in the ways students can learn and apply science content.

The Role of Discourse and Identity in Science Learning

Integral to science learning are the discourses that youth draw upon in their everyday and academic lives. Discourses, in addition to talking, are ways of knowing, doing, interacting, valuing, thinking, believing, reading, writing, and representing oneself that are "always and everywhere *social*," produced and reproduced in social and cultural practices and interactions (Gee, 1996; Heath, 1983). Drawing on the interconnectedness of youths' cultures and the discourses they draw upon to make sense of their worlds, discourses can also be understood as reflections of youths' identities (Gee, 1999).

If the discourses that youth, or in our case girls, draw upon in their lives can be understood as reflections of their identities, then their knowledges, behaviors, conventions, activities, and beliefs are constantly shaping how and why science is done. A focus on girls' identities, particularly on how and why they draw on particular discourses when interacting with science, is essential to understanding how girls engage in science because it allows for important connections to be made between the contexts of girls' lives and how and why they do science. Girls' identities may change depending on the context within which they are doing science, depending

on who they are with, where they are, and what is motivating them to engage in a certain practice at a particular moment.

Earlier work on discourse and science learning among minority students uncovered the pivotal role that language can play in how students learn to appropriate the cultures and practices of science and to see themselves as scientific (Rosebery, Warren, & Conant, 1992; Warren & Rosebery, 1996). For example, Warren and her colleagues in the *Che Che Konnen* project show us in rich detail how, in bilingual classrooms, students often *imagine themselves a part of science*, and of the scientific phenomenon they are trying to understand, even when they feel marginalized by school science (Ballenger, 2000; Warren, Rosebery, & Conant, 1994). Their work serves as a foundation for a growing tradition in science education to identify the ways in which discourse mediates engagement in science, including not only what one learns but how and why one comes to participate fully or not in science-related communities of practice.

More recently, Brown and his colleagues (Brown, 2004; Brown, Reveles, & Kelly, 2005) have made a compelling case for the relationship between identity, discourse, and science learning. They use the construct of discursive identity, which "reflects an understanding that speakers select genres of discourse with the knowledge (tacit or implicit) that others will use to interpret their discourse as a signal of their cultural membership" (Brown et al., 2005, p. 783). Studies on discursive identities highlight the intrapersonal conflicts ethnic minority students experience as they grapple with cultural politics that motivate the shifting of discourse genres. Brown (2004) identifies four domains of discursive identities, "oppositional status," "maintenance status," "incorporation status, " and "proficiency status" (p. 825). Ethnic minority students code switch within this continuum of discourse identities in response to peer pressure and cultural conflicts, manifesting substantial resistance toward endorsed scientific discourse, which "implicated the value of conceptualizing discourse as an artifact of individual identity" (p. 830).

In a study that focused more on the role of the teacher in supporting links between classroom discourse and identity, Reveles, Cordora, and Kelly (2004) foreground how a teacher fostered students' development in science by acknowledging inherent student identities that were brought into the science classroom. In the classroom discourse, students' personal experiences with the subject matter were explicitly encouraged by the teacher and leveraged upon to delve deeper into the science content at hand. In this manner, deliberate connections were made between school science and the relevant community knowledge students bring with them into the classroom. Toward the end of the study, the "students were speaking, explaining, arguing, and personifying the action of scientists who were capable and literate regarding knowledge and understanding about science" (p. 1140). Students were able to articulate what it was that they did that allowed them to see themselves as scientists, thus "formulating their identities as students, acting as scientists" (p. 1142).

Investigations using identity formation as a lens have advanced our understanding of student engagement in science. They also surface the social and institutional roles that interact with individual agency in widening or constricting the space for identity authoring. Yet, additional research is also needed in this area to question the assumption of homogenizing the identities of minority students and girls. The combinations and permutations of figured worlds within a school science community of practice minority students simultaneously inhabit are diverse and multitudinous, resulting in differing ways of impacting the formation of identities in practice in the science classroom. Research in identity formation needs to be contextualized against these intersecting complexities. We believe this is where our study fits in.

METHODS

This longitudinal case study of Melanie was part of a larger ethnographic study involving African American and Latina students in a high-poverty urban school in a large urban center in the eastern United States. As part of this study, we had conducted longitudinal case studies of 21 girls over the course of 2 years, including Melanie. Toward the end of the school year, we became intrigued by what seemed to us to be a remarkable transformation on the part of Melanie. We thought if we went back to all of the data sources we had that involved her, we might be able to uncover how much she might have really changed and what may have

supported such change. We further felt that we would be better positioned to conjecture about what might support others in making similar transitions.

We believe a single case study is warranted. By focusing closely on Melanie's experiences, we were able to elucidate the factors that mediated the authoring of student identities in practice, such as the role members in the community of practice may play, the effects of being positioned in the different worlds of school science and the possible consequences of transiting between these worlds. Furthermore, the use of a single case study allows us to provide readers with the opportunity "to experience vicariously unique situations and unique individuals" (Donmoyer, 1990, p. 193), thereby transporting readers to places they may not have the chance to go (Yin, 1994). Furthermore, Donmoyer (1990) argues that the value of case study allows the reader to "see through the researcher's eyes" and in the process see things they might otherwise miss (Holland, Blair, & Sheldon, 1995). We believe this is crucial in order for readers to fully comprehend the complexity and nuances inherent in the factors mitigating a students' developmental trajectory.

Melanie's case study was situated in a yearlong ethnography of her science class. Data sources included thrice weekly participant observations for 31 weeks with accompanying fieldnotes, two individual and group videotaped interviews lasting about 1 hour each, one 45-minute content-based think aloud focused on urban ecology, reflection notes, student work, and out-of-science class and out-of-school informal conversations, observations, and hanging out. We used constant comparative analysis (Glaser & Strauss, 1967; Strauss, 1987; Strauss & Corbin, 1990) in the tradition of grounded theory for data analysis, guided by our research questions. Data were first open coded in order to surface themes pertinent to Melanie's authoring of identities in practice. We then close coded the data within a set of themes such as the role of the community of practice, Melanie's science practice, and the dialectic relationship between Melanie and her community of practice.

Overview of Research Context

The Inquiry School. The Inquiry School (TIS), where the study was conducted, is situated in a poor neighborhood in a high-poverty community of a large urban center on the eastern coast of the United States. TIS is a new school housed within a much larger K-8 school. This K-8 school has 910 students, 45% of whom are African American, and 55% are Hispanic. A telling indicator of the socioeconomic status of these children is the fact that 90% of the students are on the school's free lunch program. Each class in TIS has between 28 and 32 students, with the distribution of boys and girls being roughly equal. As the school has a science focus, each class of students gets five periods of science each week, with each period lasting 45 minutes. While the school had a science focus, it is a zoned neighborhood school with no special selection process. The school was chosen both for the demographics of the students it serves (high poverty and minority ethnicities) as well as for its focus on science.

Mr. M., the Sixth-Grade Science Teacher. Mr. M. had 5 years of experience teaching urban students at the inception of the study and is committed to teaching science for social justice. He is a firm advocate of student-centered science learning and uses different student-empowering pedagogical strategies such as group discussions, projects, student presentations, and role play. Students in his class thus have access to different "spaces" for science learning. He also set up his classroom to be inviting to students with a menagerie of class pets. These included dwarf hamsters, frogs, fish, snakes, and a praying mantis. Many students asked for permission to care for these animals before school and during the lunch hour. Mr. M. also had clearly defined rules in his classroom. Most of the time, he enforced his rules strictly. Of Irish and Italian descent, Mr. M. was the only Euro-American in his classroom. He had tremendous rapport with the majority of students, many of whom regarded him as their favorite teacher. Because of his admirable classroom management and relational ties with many of his students, Mr. M. was the resident "expert-teacher" other teachers looked up to and consulted with.

Neighborhood of TIS. The neighborhood in which the school is located is a harsh one marked by high poverty. It is a predominantly African American and Hispanic neighbor-hood. From the windows of the sixth-grade science classroom, corroded overhead subway railings are in clear sight. On route to the school from the

subway station, one passes a funeral house, a dollar store, an auto-repair shop, and a few small eateries including a fried chicken and pizza place, a deli, and a Chinese take-out restaurant. The walls of the apartment blocks as well as the metal grills of shops are liberally scrawled with graffiti. Gritty apartment buildings, many with broken or badly repaired windows, surround the school. There is a small grocery stall across the school where students like to frequent for snacks and a gospel church known for its service to the needy in the neighborhood with free gifts of groceries, household essentials and clothing made available on different days of the week. The church opens its doors at noon, and a long line of minority folk can often be seen quietly queuing for aid from early morning.

MELANIE'S STORY

Getting to Know Melanie at the Beginning of the School Year (September 2004)

Melanie was a cheerful 12-year-old Dominican girl. Tall and thin, she had long dark hair, usually worn in a tight braid down her back, and friendly eyes framed with black-rimmed glasses she mostly preferred to do without because she felt they made her look "nerdy." Despite having less than perfect vision, she stated she would rather squint or copy notes from her friends. While the rest of the girls tended to accessorize with necklaces, bracelets, and earrings, Melanie dressed casually, usually in T-shirt and jeans, and was regarded as more of a tomboy by her friends.

Melanie was one of the few students we knew in TIS who lived with both parents. Neither of her parents spoke English at the time of this study and were not actively involved in her school life in the sense that her science teacher could not recall ever having met Melanie's parents during any schoolparent meetings or field trips. However, this by no means implies that Melanie's parents were not interested in her education. Since Spanish was the language spoken at home, Melanie tended to converse with her friends in school largely in Spanish. Socially, Melanie was close to a group of girls who affectionately called her "Cookie" because of her constant cravings for a cookie snack.

In the beginning of the school year, Melanie was extremely shy in science class. We often got the feeling that she was self-conscious of her height as she tried to shrink her body by hunching her shoulders. She almost always sat in a corner, and during the first two semesters of sixth- grade almost never volunteered to answer any questions or give any sort of response. Since the teacher had a strict rule of students raising their hands while waiting to be called on so as to participate, Melanie almost always kept her hands down. She would sit and grin at the more enthusiastic classmates around her, who would have not just one but both hands waving high up in the air to get the teacher's attention. Her lack of confidence in speaking English may have been a contributing factor to her being taciturn in science class.

Melanie did not imagine herself as someone who was smart in science. She told us in an interview that she did not know enough content knowledge to answer the teacher's questions and she did not want to invite criticism from her peers. Curiously, she was very open with her status as a low-achieving student in science. The science teacher had also deemed her a "very weak student." Within the first month of being in her classroom, she shared with us voluntarily her failing grade on her first science test. Sitting at her end of the table, she called out to us when science class concluded, "Look! I got a 23 out of a 100!" and proceeded to let out a loud sigh. This proclamation came in the wake of her close girl friends sharing their higher marks ranging from Ginny's 88 to Tricia's 105, including bonus points.

While she had firm friends in a specific group of girls, Melanie was also often teased and called unkind names by a few other students in class. On the basis of Costa's (1995) work, Melanie was either an "outsider" or an "I don't know" student to school science in the beginning of the sixth- grade school year. Interestingly, although Melanie would not participate in the official epistemic arena of science class, she did not shy away from engaging in casual, social conversations with those at her table during science class. She described herself as "a regular student ... you do everything that another person does. Let's say, you talk a lot of course, um, you pay attention, not that much... but I pay attention... ." While she might not have contributed in terms of explicitly adding to the science content at her group, Melanie did engage in school tasks by asking the teacher for more

supplies such as colored markers or poster paper for the group. Melanie interacted actively with her peers in the school cafeteria during lunch and also in the hallways, chatting with friends like any other teenager.

Melanie's Different Identities in Practice in the Different Figured Worlds of Sixth-Grade Science

In this section, we describe Melanie's participation in the two different figured worlds of sixth-grade science: *whole class*, where students participated as audience members or as presenters, and *small groups*, where students engaged in group tasks or projects. These different figured worlds in sixth-grade science were identified because these are the traditional spaces of student engagement where students negotiate their participation and identity in school science. In what follows, we present an analysis of Melanie's participation in these sixth-grade science spaces, showing how Melanie's participation in one space affected her subsequent participation in other spaces. To do so, we first present a series of critical episodes that show how Melanie's participation changed over time. These episodes were chosen across the school year from Melanie's participation across the figured worlds. We also chose these episodes to reflect the range of science topics explored in the sixth-grade classroom since we believe that how students engage in science is related to the specific content under investigation. We wanted to ensure that we examined Melanie's participation across the content domains of sixth-grade science. The episodes were also chosen to reflect the varied figured worlds Melanie was positioned in as she was teamed up with different classmates. Since the viability of one's authored identity in practice is contingent on its reception by the members in the figured world, we posit that member-to-member interactions are integral to one's identity in practice authoring. Finally, several of the girls who were Melanie's group members in these episodes were also case study students in the larger study thus we are more confident in our conjectures about the possible roles they may play in influencing Melanie's engagement with science. We analyzed these episodes to make sense of how Melanie was supported in crafting a broader repertoire of identities in practice upon which to draw and become successful in science class. Episodes were selected across the school year in an effort to understand Melanie's engagement throughout space and time. Table 1 summarizes the episodes.

Melanie the Shy, Passing Girl: September–December 2004

Whole Class. In the beginning of the school year, Melanie quickly co-opted a game rule allowed by the science teacher to minimize her participation and increase her invisibility. The science teacher, Mr. M., liked to use games such as Jeopardy-style quizzes to test the students' content knowledge as a form of revision before administering a science test. Since he had arranged his classroom into six groups of students, he often pitted the groups against one another and would go in sequence asking each group member a question, implying the mandatory participation of every student. Many game shows on television have a rule where a contestant can "pass" on a question. When it came her turn to answer a question posed by the teacher, Melanie asked to "pass" and surprisingly, the teacher allowed it. Although "passing" meant losing her team a potential point, there was safety in exchange from not risking a wrong answer. Melanie co-opted this rule as her regular practice whenever she was asked to answer a question, even when not playing these knowledge games. She soon earned the reputation as "the girl who passes" as was evidenced by talk among her peers. "Passing girl" became one of her identities in practice in the beginning of the school year.

Even during the times when the teacher gave the students reading material with questions to work on before he checked the answers with the class, Melanie chose to "pass." In one particular class, the students were working on questions on fungus as a decomposer. All the answers to each of the questions were found in the reading material. However, when the teacher called on Melanie for the function of the rhizoid, in spite of the fact that she had written her answer down in her notebook, Melanie said "Pass?" instead of answering the question. The teacher accepted her "pass" and directed the question to Delia, who answered it correctly. Delia and Melanie had the same answer written in their notebooks.

Small Groups. Melanie's reputation as the "passing girl" had a significant impact in her participation in small groups in differing ways. We describe three narratives where Melanie was teamed with different group members.

TABLE 1
Melanie's indentities in practice (IdPs) through sixth-grade school science

Date	Episode	Figured World	Description	IdPs Authored
Sept. 2004	Co-opts game rule to "pass" when called upon	Whole class	Sought for invisibility in sixth-grade science—shunned active participation	IdP: "Girl who passes"
Oct. 28 and 29	Seven ingredients of nature group poster and presentation	Small group and whole class	Reluctant participant of small group work, wanted to pass	IdP: "Marginal group member," "shy presenter"
Nov. 12	Farming and weather group work	Small group	Not allowed to "pass" by supportive friends—experienced initial success with science content	IdP: "Group time keeper," "valuable group member"
Dec. 12	Amelia and the boys—no work was done due to conflict	Small group	Deemed a liability to small group that members want to trade off	IdP: "Girl who does not know anything about science"
Jan. 8, 2005	Animal Project presentation—invoking Jane Godall	Individual project/whole class	Gave her presentation as Jane Goodall with "gorillas" —received 100 marks for the project	IdP: "Jane Goodall the primatologist"
Jan. 27	Save the giraffes poster with Katherine	Group work/whole class	Role played the mother and baby giraffe to enthusiastic applause	IdP: "Confident presenter, funny presenter"
Feb. 3	Lesson on skin	Whole class	Sought for participation by telling stories, "shouting out" answers to epistemic questions	IdP: "Science talker, science storyteller"
April 15	Drawing of self in science class	Small group	Saw her identity in science class as someone who has friends rally around her to support her learning	IdP: "Member of core group of supportive friends"
June 3	Weather chart with Nick and Chantelle	Small group	Able to render help and encouragement to another group member as coleader of the group	IdP: "Helpful coleader of group," "encouraging peer"

Seven Ingredients of Nature (October 28 and 29, 2004). In this first narrative, Melanie was assigned to a group with two of her good friends, Ginny and Pat. Each group was to design a poster illustrating the "seven ingredients of nature" (air, water, soil, producer, consumer, sun, and decomposers) and to show how they interact in the recycling of nutrients. Melanie contributed a drawing of "soil" where she had colored in a patch of paper with different shades of brown. The other girls were busy arranging the pictures while Melanie sat quietly watching. The teacher approached the table and said that he wanted the group to act out the parts in their presentation. He gave an example with the sun. "So if you are the sun, you say, I am the sun, and then you say what your role is in nature." Melanie looked petrified. She turned to the teacher and asked him if she could not

take part. “Can I pass? Mr. M.? Can I be excused?” The teacher said everyone had to take part and walked to another table.

After Mr. M. left, Melanie started cutting up the scrap paper left over from the others’ trimmings (of their drawings). She busied herself with cutting scrap paper into tiny pieces, saying to her teammates, “Give me all our scrap paper, I’m going to cut them up.” While the others were trying to assemble the poster, Melanie chose to engage in an unproductive activity. Pat, who had unofficially taken on the role of group leader soon chastised her: “Will you stop cutting up scrap paper? Help us! You can help us Melanie! Think about what you’re gonna say!” Melanie replied, “I’m the soil, I’ll say that.” Pat responded with, “You’ve got to say what it DOES.” Melanie said she did not know, while continuing to cut up scrap paper. Pat urged her to think about it, before turning her attention back to the poster.

Mr. M. came and stood next to Melanie at which point she ceased shredding paper. He reprimanded Melanie for shredding paper and asked her to “write down what you are going to say in your life log!” Melanie took out her life log (their science note book) and started to write. She did not get any further than the sentence “I’m the soil” before pleading with her group members for help. Ginny and Pat immediately responded and gave their suggestions while Melanie copied down what they said into her notebook.

When it was time to present the poster, Melanie read her lines that the rest had helped her write, although she was the most soft spoken amongst her group mates. She kept her eyes on her slip of paper and read out her lines in a very quiet voice, “I am the soil, and I give nutrients to the plant.” The teacher commended them on their beautiful poster. Each group had to answer a few questions from the audience. While Ginny and Pat took turns in answering audience questions, Melanie stood quietly at the end of the group.

Farming and weather (November 12, 2004). The lesson in this second narrative was focused on weather and farming. The teacher instructed the class that they were to work at their tables in groups to answer questions using information from a reading packet on how farmers are reliant on the weather. At Melanie’s table (table 5), Ginny was assigned the role of facilitator. It is important to note that the girls at table 5, including Melanie, formed a very tight social network, and were often supportive of each other in and out of the classroom.

As facilitator, Ginny instructed her group that everyone had to answer every question and assigned the order in which each would answer, “first Melanie, then Pat, then me, then Katherine.” Upon hearing that she was to be the first one up, Melanie asked if she could pass and not answer. Ginny looked at Edna since she was the adult sitting at their table. Edna suggested that all members should try to answer the questions, even if they were not sure. Ginny nodded her head in agreement, turned to Melanie and got ready to start. She read the first question from the list. “Ok, first question. Can farmers grow plants all year round in the United States? Where and why? There are 2 questions so I’m gonna read it again.” She repeated the question aloud and turned to Melanie for her response. Katherine, the recorder, had meanwhile turned to a fresh page in her life log, pencil poised, ready to take down what Melanie would say. The group waited expectantly for Melanie to give an answer.

Melanie answered with a tentative “Yes?” sounding completely unsure. Katherine wrote down her answer and immediately demanded that Melanie substantiate it. “Why? Say WHY?” Melanie ventured for a guess with her answer of “because... there are many farmers?” Pat objected, saying, “No. My answer is no because in Alaska it’s really cold and it is connected to the US.” Ginny concurred with Pat, agreeing that “there are places that are too cold in the US.”

Ginny read Questions 2 out loud. “Question two. Where can plants grow all year?” She turned to Melanie who promptly replied “In Texas, all the hot places, like Hawaii.” This was the first time we observed Melanie reply to a content question so quickly. Ginny did not get a chance to respond before the teacher came over to check on their progress. The teacher then pulled out one of the girls’ school-given academic diary where, on the back page, there was a map of the United States. He explained to them that the equator was the hottest, and thus the southern states would be hotter than the northern states. When the teacher left their table, Pat suggested that the

group should change their answer to “any states in the south.” Meanwhile, the rest of the tables were progressing at a faster rate than table 5 most likely because they did not require each member to come up with an answer. One member usually gave an opinion that was then taken as the group answer. Ginny had established a more democratic system at table 5, hence their slower progress.

Ginny read the next question: “Is it different to be a farmer in Minnesota and Florida?” Melanie uttered aloud “What?” in response, at which point all three girls, Ginny, Pat, and Katherine repeated the question to her in unison. Melanie looked bewildered and said she did not know. Edna suggested to the girls to look for Minnesota and Florida on the map. All four girls then pored over the map on Ginny’s academic diary. Katherine found Minnesota and Florida, and the girls examined their location with relation to the equator. Melanie was enlightened and said, “Oh! Ok, so Minnesota is colder and Florida is hotter,” Pat continued her sentence, “So you can grow more plants in Florida!” Ginny asked if everyone agreed and Katherine then recorded the answer in her life log.

When Ginny read the next question, “Kansas is known as the wheat state because it grows wheat and Florida is known as the orange state. What can be grown in your state?” Katherine was excited and started to verbalize her thoughts. “My opinion is that... ” She was cut off by Ginny who reminded her that Melanie has to answer first and Katherine should wait her turn. Ginny explained to Katherine, “You have to wait. I’m explaining to Melanie.” Ginny then repeated the question to Melanie, who replied, “I want to pass.” The girls encouraged her to try but she protested, saying she did not know the answer. Trying to help, Edna then asked Melanie which state she lived in to which she replied “New York.” Edna followed up with another question, “So what can you grow *in* New York?” Melanie tentatively answered, “grapes?” Pat immediately chimed in with “Apples! There are always apple trees in New York.” Katherine also concurred. She stated her opinion was apples “because New York is called the Big Apple.” Ginny then told the group a story about her apple picking outing with her stepfather and the different apples she picked, including empire apples and sour apples. Melanie seemed disappointed that everyone else had said apples instead of grapes. Pat apologized to her.

Ginny then read question 5, “Why will the plants be affected if there is too much rain?” Ginny then turned to Melanie and scolded her for not listening, calling her name sternly and telling her that she had to try harder at paying attention. Melanie ventured an answer of “too much water.” Pat then suggested that the excess water might drown the plants, and Katherine and Ginny agreed. Melanie then grinned broadly and proclaimed, “Hey! I got it! People agree with me!” The other girls laughed and concurred, “Yes, Melanie!”

Ginny then read the final question aloud. “If a farmer’s crops are ruined, how will it affect the money?” Melanie immediately answered “Not enough food for harvest.” Pat suggested that there would be not enough money if the crops were ruined. Katherine empathized with the farmers, since “They grow the plants and fruits to sell it, and they are doing the hard work and if the hard work is destroyed, it will not get them money.” She then wrote the answer down. Table 5 was the last group to complete the seven questions.

Group work with Amelia and three boys (December 12, 2004). In this third narrative, Melanie was grouped with four other students at a table. One of her teammates was Amelia, a girl with a very strong personality, who was often referred to by the teacher as the class “bully.” The students were to brainstorm the positive and negative aspects (in terms of environmental impact, cost of production, etc.) of industrial and regional farming as a group and then write up their points in a T-chart to share with the rest of the class. Amelia immediately assumed leadership and the first thing she wanted to do was to “trade” Melanie with another table because she felt that Melanie was “stupid and she don’t know anything about science,” an impression possibly fuelled by Melanie’s “passing” practice. Throughout Amelia’s diatribe on the “flaws” of Melanie as a group member, Melanie kept silent in her seat, fighting back tears. None of the other group members sought to defend her or deter Amelia. Melanie erupted into tears, bringing Mr. M. to their table. Melanie could not be consoled and Mr. M. left the room to solicit the help of Mr. R., Melanie’s homeroom teacher. Melanie’s table did not get any work done in that period. When the bell rang to signal the end of class, Melanie’s girl friends who were sitting at different tables, crowded around her to offer hugs and words of comfort. After this episode, Mr. M. took care

not to group Melanie with Amelia again. While Ginny and Pat, students with more epistemic and positional authority than Melanie facilitated and encouraged her participation in their group work, Amelia used her positional authority to deter Melanie's participation.

Crafting Identities for Participation: January 2005

Whole Class. The next two episodes, The Animal Project and Save the Animals, reveal how Melanie drew upon new resources and identities to craft a new way of participating in her whole-class community.

For the Animal Project, students were assigned an individual project to do over winter break. The Animal Project required each student to research and report on a chosen animal. The project consisted of two sections, a written report and a presentation. Students could utilize the material resources in the science classroom library as well as the school library. The teacher also arranged a session with the school librarian where the students were taught how to use specific search engines to look for information online.

Most of the students researched on big cats since information on these animals were readily available in the classroom library. Initially, Melanie was tempted to do the same. "Oh I wanted to do the cheetah but everyone was doing the cheetah and I wanted to do something different so I choose the gorilla." She completed both the report and a poster board on the gorilla. During her presentation, which took place during the first week of January 2005, Melanie took on the role of gorilla expert, the female scientist Jane Goodall. Apart from meeting the requirements reporting on biological information such as the habitat, food, and life cycle of the animal, she also enlisted the help of two friends, Pat and Chantelle, to act as gorillas while she "taught" them sign language while pretending to be Jane Goodall. What was remarkable about this episode was both the confidence and animation that marked Melanie's whole-class participation, something not visible in the first half of the school year. The teacher and her peers gave Melanie riotous applause, and she earned 100% on her report and the presentation.

The Save the Animals episode occurred on January 27, 2005. Melanie had been working on a "Save the animals" poster with Katherine. This poster was an extension to the Animal Project the students did. Students were grouped in pairs to work on this poster. Melanie and her partner, Katherine, decided to focus on giraffes. During the presentation, Katherine and Melanie both took turns explaining their poster, where they had drawn a mother giraffe with her baby and a tree with the recycling symbol. Melanie also held up a separate piece of paper with the words "WE ARE RESPONSIBLE." After Katherine explained about deforestation affecting giraffes, Melanie impersonated both the mother giraffe and her baby.

> We drew a tree because not only the giraffes need it but we need it too cause, erm, of the air.... Plus the giraffes will starve. We drew the giraffes saying " I'm hungry! Help us! Help my family! We need trees to eat the leaves!" and the little one, the baby is saying "Help me! And my mummy! I'm starving!"

The class was amused with her speaking as the giraffes, especially when she used a squeaky baby voice for the young giraffe. They laughed and clapped loudly for Melanie and Katherine.

Talking Science: Crafting an Identity as a Full Participant in Science Class

Whole Class. Melanie's whole-class participation shifted remarkably during the immediate time frame right after the extended Animal Project, the two earlier episodes described. For example, in a lesson on skin (February 3, 2005), the teacher introduced the functions of the skin to the students. He started off having the students think of the functions of fruit peel since the last unit was on nutrition. Melanie was very attentive during this lesson and raised her hand several times to volunteer to answer questions posed by the teacher to the class. He called on her frequently in this lesson, and she answered his questions correctly each time.

> Teacher:Besides protecting it, what do you think its protecting it from? What does the skin of the tangerine or the potato protect them from? What do you think is trying to get into the fruit but is held out by that peel? Take a guess, its okay, that's why you're here ...

A student answered “insects.” Melanie had her hand up with several other classmates

Teacher:Okay! Insects, they want to eat it, what’s another Melanie?

Melanie:Bacteria!

Teacher:Bacteria! Definitely!

The teacher also asked the class what the singer Michael Jackson always has above his head all the time when he is outside. Melanie chimed in immediately with “an umbrella!” The class then discussed Michael Jackson’s skin bleaching and his risk for contracting skin cancer. At the end of the lesson, the teacher gave Melanie an opportunity to share a personal story about skin.

Teacher:Melanie’s got the last word.

Melanie:Okay ... When you go to the D.R, you are one color ...

Teacher:Listen to her please! *The class was starting to chat*

Melanie:When you go to the D.R. from the United States, you are one color, but when you come back from the D.R, you are another color, a darker color like Kate ...

Mr. M. then concluded the lesson, using Melanie’s example to link exposure to the sun with increased production of melanin leading to a darker skin tone.

Small Groups. Likewise, Melanie’s participation in small group shifted remarkably. To-ward the end of the school year (April 15, 2005), students were asked to draw a picture of themselves in science class. Melanie drew herself at her current assigned table with three other girlfriends (Figure 1).

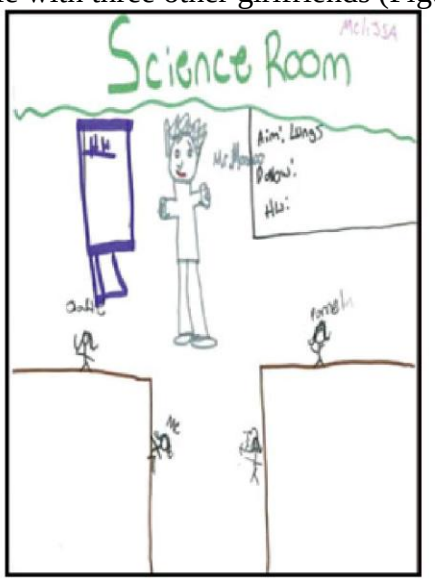

Figure 1. Melanie’s drawing of herself in science class. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

Melanie’s vision of herself in science is also framed through positive group collaboration. She explained her picture as follows:

Melanie:Me, is right here, at the edge, at the table, and I’m trying to listen to Mr. M. teaching me. And, Jackie sits across, no, next to me, trying to do the same thing. And Pat sits across from Katherine ...

Researcher: And why is it that you drew 3 of your friends? Why did you draw those three girls?

Melanie:'Cause, they are my best friends ... and they support me, and they help me.

From being the one who had to rely on her friends for help, Melanie was able to switch roles and begin help to her teammates in a small group by the end of the year. In this narrative, which takes place on June 3, 2005, Melanie was paired up with Chantelle and Nick. Nick was a challenging student with a complicated family background who was often suspended for truancy and other misdemeanors such as fights with other boys. He was a student with a very short temper such that Mr. M. usually left him alone. Each table had to work as a team to produce a weather chart of 15 cities from the forecasts listed on the day's newspapers. Mr. M. wanted to incorporate elements of mathematics in this lesson such as graphing bar charts to scale. Each student was to do a rough draft in their notebooks, choosing five cities for the individual draft before combining all their work on large poster paper.

Melanie started to copy the teacher's example of both axes (*Y* axis for temperature and *X* axis for cities) in her notebook. Chantelle was doing the same while Nick started to talk to the two girls about wanting to join the army so he could use all the guns and canons. Seeing that Nick had not brought his science note book, Melanie ripped a piece of blank note paper from hers and gave it to Nick, urging him to get on with the work, telling him, "You're smart! Look, you don't do any work but you're smart! So do your work now!" Nick looked rather embarrassed, smiled a little and actually started to draw a graph to the surprise and pleasure of Mr. M. who commended the group on how he "really like[d] the team work that is going on at Table 3!" Melanie then cooperated with Chantelle in deciding on the layout and title of their poster, sharing her opinions and making decisions with Chantelle throughout the activity while encouraging Nick to keep at his work.

DISCUSSION

Melanie's story highlights just how fluid a student's identities in practice can be across the school year. In following Gee's (2000) tenet, identity is defined as the "kind of person" (p. 99) one is being viewed as by the people around one in any given context. Hence, identities are largely context dependent. Melanie's identities in science class are termed as her identities in practice to both recognize and acknowledge the relevance of her sixth-grade science community for whom her identities in sixth-grade science were ultimately authored.

In the whole class, Melanie went from seeking nonparticipation with her "passing rule" practice to eagerly seeking participation as a full-fledged member, one who is recognized and validated by the authority figure in the classroom, Mr. M. the science teacher. In the beginning of the school year, an observer might have felt that Melanie could not even be said to be participating on the periphery. She could not accurately be described as being marginalized because she purposefully sought not to participate and self-censored by authoring a "passing girl" identity in practice. If this had been the only snapshot of Melanie's participation in sixth-grade science, she would most likely have been labeled a student who had little interest in science, as evinced by her first 23/100 test score. Melanie would fall neatly in Costa's (1995) "outsider" category.

However, by the end of the school year, Melanie was actively participating, and was volunteering regularly to answer science content-specific questions posed by the teacher. Most of the time, she would follow his rules and raise her hand while waiting to be called on, sometimes she shouted out the answer or what she thought was the answer even as he chose another student. During these "shout out" moments, Melanie was always enthusiastic about having the answer to a question. Melanie began to tackle the more scientifically factual questions posed by the teacher, the kind that she would request to "pass" in the beginning of the year. For example, in the lesson where the students were learning about the digestive system as well as good and bad cholesterol, Melanie volunteered and correctly answered the liver as the organ where bile is secreted when the teacher posed the question. In terms of more traditional outcomes of learning such as test scores, Melanie scored 100% for her animal project and managed to maintain her subsequent test scores above 80%, a vast improvement from her initial 23% for the first test.

In small groups, Melanie evolved from participating vicariously through shredding waste paper (Seven ingredients of nature) to displaying commitment and ownership in subsequent group projects (Save the giraffes and Weather Chart). This shift reflected a gradual change from being someone who shied away from participation, with identities in practices as an "outsider," an "unproductive group member," someone with "no ideas," a group member to be "traded" because she apparently adds no value to her group. Melanie ended the school year with a firm pivotal hold in the center of participation, with dramatically different identities in practices as a "good presenter," "coleader," and "encourager," someone who could command the attention of her peers, make decisions, and facilitate the participation of a fellow, less engaged teammate.

While her progress may seem dramatic, as with most students, Melanie had both better and less fruitful days in science class throughout the year but we could see the overall move she made from the periphery toward a more centered participation as the year progressed, in tandem with her increasing agency in school science, quality of work produced, and test scores. Melanie's identities in practice and thus her participation in her sixth-grade community of practice were anything but static.

While studies have described the incompatibility of minority students and girls with school science (e.g., Aikenhead & Jegede, 1999; Brickhouse & Potter, 2001), Melanie's sixth-grade science trajectory paints a more hopeful picture. As Melanie's case study has shown, students are not necessarily bound to just one school science identity.

The fluidity of Melanie's identities in practices illustrates that identities in practices are deeply contextualized and dependent on particular power dynamics of the specific figured world in time. Melanie exhibited personal agency in the authoring of these identities in practice. She was also empowered and supported by key members of her science community of practice as discussed below. In the following section, we unpack two key points.

First, we explore the role of the community of practice, which is Melanie's sixth-grade science class. In particular, we examine the critical and supporting role of Melanie's authority figure, Mr. M. in Melanie's transformation, which includes his endorsement of Melanie's practices in his classroom, his role in "converting" Melanie's narrative authority to epistemic authority, and his creation of new and different figured worlds that helped to legitimize the kinds of capital Melanie brought to bear in science class. We explore the gatekeeping and gate-opening roles that peers who are higher in the hierarchy of power, especially in the small groups, play in Melanie's participation trajectory.

Second, we examine the role of discourse in Melanie's participation. In particular, we look at how Mr. M. allowed Melanie to disrupt the standard discourse for his classroom by using opinions and then stories as entry points into the dominant classroom discourse. We note that Melanie's stories supported her in shifting the authority in the classroom from text-driven to experience-driven, and from abstract science to personal authorship, allowing her to draw upon her gendered identity in support of being a central science participant.

Role of the Community of Practice and Mr. M.

In this section, we describe key figures in Melanie's sixth-grade science community of practice who played principal roles in shaping and partnering with her in her efforts to author new identities in practice for herself in school science. In this study, the community of practice is largely defined as the students as well as the teacher Mr. M. in her sixth-grade science class.

Mr. M. himself was instrumental in Melanie's development as a science student. As the authority figure in the classroom, Mr. M.'s endorsement of Melanie's practices in science class was of paramount importance. First, he allowed her unorthodox use of the "pass" game rule in regular classroom discourse. While he could have certainly viewed it as an act of resistance that should be discouraged, Mr. M. was sensitive to Melanie's discomfort and lack of confidence and so, rather uncharacteristically (given his strict, no-nonsense classroom management style), allowed Melanie the "immunity" from mandatory participation that she sought with her "passing" practice. The fact that Melanie had not been publicly embarrassed by Mr. M., even if it was indirectly

by his insistence on her answering one of his posed questions, could be the reason why she enjoyed science as her favorite subject and counted Mr. M. her "favorite and best teacher" even in the beginning of the school year when she was not doing well in his class.

This affinity for both the subject and Mr. M. is probably instrumental in her decision to share stories later on in the school year. Mr. M. also drew upon Melanie's stories about her lived experiences to make important content connections, helping her acquire some epistemic authority in the classroom. Mr. M. was very encouraging when Melanie shared her stories, allowing her the floor time, expanding on her narratives and therefore acknowledging the importance of her contributions, to link it with the science content being learned, and often choosing her to share her story when time is limited such as during the lesson on "Skin." When Melanie, excited about sharing answers to factual science questions, shouted them out loud without waiting to be called on, instead of reprimanding her and reminding her of his class rules, Mr. M. validated her answers (e.g., during the "Skin" lesson) and used them to continue his lesson.

After the hurtful episode with Amelia, Mr. M. was careful not to group Melanie and Amelia together, keeping Melanie with her friends for the rest of the year. This was another indirect but significant form of support Mr. M. rendered Melanie—to consciously team her up with one of her closer girlfriends upon recognition of the positive influences the other girls like Ginny and Pat have on Melanie's participation (e.g., during "Seven ingredients of nature" group work and "Weather & farmer" group work). More importantly, these pairings opened up different kinds of figured worlds because they supported Melanie in drawing upon the capital she brought to the science class in positive ways. When Melanie was paired with Katherine on Save the Animals poster, Katherine agreed to support Melanie's idea to impersonate the giraffes during their presentation, an important contribution to the project. When Melanie involved Pat and Chantelle in her gorilla project, she was supported in taking on Jane Goodall's persona in sharing with the class what she learned about gorillas.

Other important key figures in the community of practice were Melanie's friends Ginny and Pat. Ginny especially was nurturing in her collaborations with Melanie whenever they were grouped together. Not only did Ginny take the time to explain the questions to Melanie, she also made sure Melanie had time to think and articulate an answer when other group members tried to dominate. These displays of peer care and concern not only aided Melanie in gaining confidence to take small risks in answering science questions, they also showed Melanie that her friends believed in her ability. In group interviews, Melanie's friends reminded us that Melanie was a good student who gave herself too little credit:

Researcher: So let's say you were given a project to do, like just now, when you were given the pyramid of exercise, so let's say Mr. M. says, you're gonna do this project, as a table. What do you do, yourself, when you're in a group, and you're given a project. Are you a follower? Are you a leader? The artist? What do you usually do?

Melanie:Wait. *whispers to Pat, what is a follower? Pat whispers back* Ok, I am a follower....

Researcher: Ok, can you give me an example of how you are a follower?

Melanie: Like for example, Tricia's the leader and she tells me what to do, like cut out pictures that are good for the poster, I'll do it ... I'll follow my leader.

Ginny: But say like right here, its Pat, Melanie, Tricia, Katherine and then me and we were the best of friends, all of us, so basically, basically Melanie is not always a follower, sometimes she's a follower but sometimes she's a leader, 'cause she gets good ideas in her brain.

Researcher: Melanie, how good are you in science, rate from 1 to 7, compared to the rest of your class?

Melanie:*long pause* I think I give myself a 4 ...

Ginny:*interrupts* I give her, I give her a 6. She got excellent team-work.

Tricia: I agree.

Melanie's experiences in her science class illustrate the influence the community of practice can have on the development trajectory of any particular individual member. Melanie's story illustrates that it is not only the teacher who has the capacity to act as a gatekeeper, but also peers who are higher in the hierarchy of power, especially in the small group. When Melanie was in Amelia's group, she was not just barred from any potential participation. Amelia, acting in the capacity of self-appointed group leader, was eager to trade Melanie off to another group because she deemed her a liability. As a member with more power in the small group, even though she was a student, Amelia was acting as a gatekeeper of Melanie's participation. In contrast, Ginny used her power as the officially appointed group leader to safeguard and promote Melanie's participation with encouragement. While the boys were apathetic to Amelia's criticisms of Melanie, Pat and Katherine allied themselves with Ginny's efforts to motivate Melanie and affirm her participation. While Amelia acted as gatekeeper, Ginny acted as a "gate opener." The support rendered by gate openers Mr. M. and Ginny provided opportunities for Melanie to establish her voice in science class. Melanie's ties and social relational authority with this group of friends became resources she could draw from in helping her participation in science class, such as during her Jane Goodall presentation.

Role of Discourses

The school science discourse in this sixth-grade community of practice is flagged with signifiers such as being "technical," "content-specific," and "protocol driven." Mr. M., being the only White male in a classroom full of minority students, may also signify a certain way of being and talking in the science classroom. As alluded to earlier in the Introduction, Melanie spoke only Spanish at home and thus may have been uncomfortable in verbalizing in English given her reticence in the beginning of the school year. Moreover, Mr. M. had a practice of introducing new "key terms" in each lesson, a strategy he used to help the students acquire the scientific vocabulary. Students copied the key terms into their notebooks with their definitions, and key terms feature largely in classroom assessments. Mr. M. was vigilant in insisting that the students use the key terms in their sentences. He often halted students midsentence in their answers, insisting that they "use the correct terms. Don't say I think, say I hypothesize. . . ." Key terms therefore functioned as a signifier of a specific dominant discourse that is privileged in the sixth-grade science by its being incorporated into the daily routines of the classroom.

With the support of Mr. M. and her friends, Melanie inserted herself into the text of science classroom discourse by engaging in "science talk" that sat outside these normative discourse patterns of Mr. M.'s classroom. We purposefully use the phrase "science talk" to refer to the kinds of talk that was initiated by students in response to the science content being discussed. "Science talk" often drew directly from students' funds of knowledge that are not explicitly sanctioned in Mr. M.'s science classroom. The science talk that we witnessed in Mr. M.'s classroom was strongly infused with the various aspects of youth genre (Varelas, Becker, Luster, & Wenzel, 2002) such as playfulness, student banter, exaggeration, and teasing. While science talk was not an official practice in Mr. M.'s classroom discourse in that he rarely solicited student opinions or stories during classroom discussions especially in the beginning of the school year, he supported Melanie's participation in science talk, helping her to take the first steps toward crossing the threshold into an otherwise more masculine school science discourse. Melanie started to articulate her opinions in the class on issues that were not directly content related, in situations where the context is more casual, friendly, and student directed.

In using opinions and then stories as entry points into the dominant classroom discourse, Melanie managed to shift the official discourse from answering teacher-specific questions that are usually content heavy and therefore risky (to her) to a personal discourse in which she is the expert (and therefore sure of all the "answers"). Before she was confident in answering science content-specific questions, Melanie was acknowledged and validated by Mr. M. first by giving relatively risk-free peer comments during class presentations as an audience member, she was an "involved audience member," then via her sharing of stories

from her personal experience in front of the whole class. Judging from how she consistently sought for invisibility in the whole-class context by literally "passing" up all chances of participation, Melanie was probably not too comfortable at the prospect of having to voice an opinion with everyone else in the classroom listening to her. Therefore, to arrive at being willing to share a story, taking the initiative to ask Mr. M. for the floor in sharing a story with her peers is a significant breakthrough for her. Her story on how one gets darker after a holiday in the Dominican Republic during the lesson on skin was skillfully woven by the teacher into the scientific discourse of sun exposure and melanin production. While Melanie's story was shared in simple vernacular, Mr. M. was able to use her story to expand on the science content with the appropriate science vocabulary. In another lesson after the class had presented their "Save the Animals" poster, Melanie's sharing of another story about how she witnessed puppies being ill-treated in the Dominican Republic led to other students sharing similar stories and a discussion on animal rights activists and ethical issues surrounding animal husbandry facilitated by Mr. M.

In so doing, not only did Melanie secure a "safer" participative space for herself, but also she widened the boundaries of what is considered acceptable talk and validated answers in Mr. M.'s key term heavy science classroom discourse. Science talk and storytelling became legitimate points of entry for Melanie into school science discourse. With the positive affirmations she received from the teacher, Melanie gained the confidence to start tackling science content-specific questions by relinquishing her "passing girl" identity in practice and volunteering to answer content-specific questions in addition to sharing stories. While Melanie was able to utilize student friendly science talk and storytelling as scaffolds to engage in scientific discourse, the nature of science discourse in Mr. M.'s classroom was also being transformed. Other students also began to share narrative stories in science class. While Melanie could not be credited with being the one responsible for introducing science talk and storytelling, she certainly contributed to it being an accepted science class practice in Mr. M.'s classroom.

Having her opinions and stories validated as part of the school science discourse also meant that Mr. M. acknowledged and valued Melanie's out-of-school funds of knowledge drawn from her travels to visit family in the Dominican Republic. Researchers (Moje et al., 2004) have speculated about the competition of discourses as a significant barrier hindering minority students from identifying with school science. Particularly with regard to scientific discourse, everyday knowledge is preferably relinquished since school science "is typically not about experiencing the world or one's relationship with it, but about analyzing and changing it" (Moje et al., 2004, p. 45). With Mr. M. supporting Melanie's stories, Melanie's personal discourse began to merge with the dominant and more privileged science classroom discourse in the whole-class discussions, producing "a third, different or alternative, space of knowledges and discourses" (Moje et al., 2004, p. 41). Melanie's everyday knowledge with science translated into legitimate resources for her to engage in deeper meaning making in Mr. M.'s science class.

It was interesting to note that in these science talks, Melanie also chose to invoke female authorities that were seldom featured in student presentations in science class. For her animal project, she took on the role of the female zoologist Jane Goodall, acting as Jane Goodall teaching sign language to her volunteer "gorillas" as her presentation to the class. While studies show that most students, including girls, still regard the quintessential scientist as an Einstein-like White male in a white lab-coat mixing chemicals or inventing gadgets (e.g., Chambers, 1983), it is significant that Melanie should choose to present herself as Jane Goodall, a female zoologist who not only is a highly regarded scientist, but one who advocates gorilla welfare because of her obvious love for these animals. By invoking Jane Goodall, replete with her nurturing acts toward her "experimental subjects" the gorillas, Melanie tacitly forced recognition not just for herself as a student giving an engaging presentation, but also for the often overlooked female scientist and zoologist. This particular space of "classroom presentations" also lent itself to such spotlighting since the audience is bound by the official classroom discourse to pay attention to the student presenting.

Melanie also chose the empowering feminine roles of mother and child during her "Save the giraffe" presentation. She voice-acted both the mother and baby giraffes in her presentation, using maternal bonds to

give authority and urgency to her environmental conservation message. Melanie not only merged her gendered identity with her science student identity in these presentations, she also strategically positioned herself with more authority through the role-playing of strong, feminine personalities such as Jane Goodall.

In authoring this science talker/storyteller identity in practice, Melanie displayed "discursive agency" (Butler, 1997, p. 127), where she acted tacitly and unknowingly as an agent for social and political change in her classroom. Through science talk and storytelling, Melanie helped push for the sharing of personal accounts, a practice normally eschewed by traditional science classroom discourse to "function in contexts where it has not belonged" (p. 161). Science talk and storytelling took on a different meaning in Mr. M.'s science class; they became legitimate elements of classroom science discourse. While the success of her science talker/storyteller identity in practice was not guaranteed during the authoring, the attempt itself showed her desire to reposition herself in a more centralized location in this sixth-grade science community of practice. Melanie herself became a product of her discourse, the science storyteller with narrative authority who was readily becoming more visible in the science classroom.

CONCLUSIONS

Melanie's case study reveals the complexity of their interactions that influence the developmental trajectory of an individual student in science class. It was a long, drawn out process with Melanie authoring multiple identities in practice within the figured worlds of her sixth-grade science class. There were certain "critical instances" for Melanie. When she was teamed with friends who supported her like Ginny, the affirmation and encouragement she received aided in her slowly developing a science identity in practice that supported her success. Her science teacher, Mr. M., played an important role in allowing and fostering the creation of transient hybrid spaces that helped foster a deeper participation for Melanie. Melanie herself displayed agency in engaging in the science practices of student-directed science talk and playing with identities. At the end of sixth grade, Melanie was one of Mr. M.'s target science students and the one student he remembered with pride. Mr. M. was instrumental for helping Melanie succeed in school science. While he may have paid more attention to Melanie because of our presence in his classroom, Mr. M. has good relationships with many of his students and a repertoire of pedagogical skills that gives him the rare ability to support the learning of individual students in specific ways (see Calabrese Barton, Tan, & Rivet, in press). For example, teacher decisions in seemingly mundane issues such as sitting arrangements can therefore be crucial for supporting or hindering student learning and development. This has implications for how figured worlds in school science are set up to encourage and nurture student authoring of science-positive identities in practice. Teacher interactions with the student in the different figured worlds determined the kind of identities in practice that the girls ended up authoring. Mapping out such interactions with the identities in practice precipitated can aid in pedagogical strategies that will facilitate science-positive identities in practice.

Melanie's developmental trajectory in sixth-grade science was pushed along by what can perhaps be described as an interplay between her personal agency and the responses of her community of practice. This dialogic interplay shaped the creation of transient but vital hybrid spaces where Melanie was supported in her efforts to establish her voice in science class, contributing to her growing confidence and authority. With each dialogic interaction, she was "propelled" into a space where she was exposed to an increased amount of risk while authoring her participation. The elevated risk, however, also presented her with a larger platform to establish her authority in the science classroom.

Melanie's case study highlights the disservice potentially inflicted onto students when we make sense of their experiences with single snapshots in time. Melanie's case study shows the importance of taking a longitudinal lens in research when one is focused on issues of identity and participation, especially since these issues are highly fluid and context dependent. Context and figured worlds in a science classroom are dynamic and kaleidoscopic in nature, subject to many factors one of which is the crucial temporal element. In following Melanie through one complete school year, we were better equipped and positioned to understand her learning process, the unique challenges she faced and to appreciate the many hurdles she surmounted. More importantly, we were able to witness her blossoming agency and share, as adult authority figures, in her triumphs. By

engaging in a yearlong participatory observation, we were also afforded more perspectives from different members in the community of practice, which helped us gain insight into power dynamic issues and the complexities involved in minority students' efforts in authoring new identities in practice in school science.

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