

*Examining the Impact of Classroom Group Identity Development in
an Urban Chemistry Classroom*

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Abstract

In this grounded theory study, we follow the cases of two marginalized female students in their Regents High School Chemistry class. Both traditionally and historically, chemistry has been viewed as a challenging field of study, one promoting elite status stereotypes that often alienate and hamper students' capacity for achievement in science. Especially now that we live in an era where collaborative group learning is emphasized, particularly in urban classroom settings, it is critical to determine the effect group identity development has on students' perceptions of themselves, their social groups, and the implications when learning science content. This research expands the current work in group memberships and social identity by utilizing an emergent model we are calling Classroom Group Identity or CGI, which stems from theories of social identity, interaction ritual chains, and communities of practice. Using the conceptual lens of classroom group identity, class surveys, interview transcripts, classroom observations, and classroom transcripts, a positive change in emotions was observed in the values, perceptions, and behaviors of these two students. In turn, CGI development, described as a micro scale collective or social identity, influenced the construction of classroom leadership and trust in both marginalized female students and provided a means to encourage and support the learning of chemistry topics.

Keywords: Classroom Group Identity, Collective Identity, Urban Science Education, Chemistry, Gender, STEM Education

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Introduction

Although little research has documented group identity development, this study looks at classroom group identities or CGI in one high school science classroom. We define CGI as the classroom group membership of the teacher and students in which solidarity building interaction rituals, (interactions between two or more individuals that generate symbols of group membership), positive emotional energy (feelings of motivation and enthusiasm when engaging in successful interaction rituals), and classroom discourse (classroom discussions that exchange and share information) are cultivated in a collaborative learning environment to develop a sense of belonging to science. Like other social identities, CGI is a temporary identity because it is dependent on continuous interactions that occur within the classroom. In this case, the interactions are focused on those between the chemistry teacher and two of his female students, and these interactions occur within a small and collaborative chemistry classroom environment. Over the course of the academic school year, CGI occurs in four stages (a) establishing collaborative classroom group dynamics and shared emotions; (b) establishing teacher roles and student roles; (c) developing sacred objects, content knowledge and/or science discourse; and (d) developing a sense of belonging to science. This sense of belonging references both a strong affiliation to the learning of science and serves as the potential point of entry for students to later develop long-term science identities.

To understand the development of CGI, we followed a grounded theory case study approach, where theory emerges and is grounded in the context of the case under study. We used ethnography as the predominate methodology for observation, grounded theory in our analysis, and case study to look specifically at the development of CGI in the chemistry classroom. Robert Yin (1994) suggests that case studies provide holistic and enlightening perspectives of true to life situations. As both process and product are of interest and grounded theory is a subjective process that relies on the careful gathering and analysis of data, the case study approach expands the limitations of grounded theory. Here, the teacher-student interaction within the chemistry class composed a bounded system to better identify the shared behaviors, attitudes and language of a social group.

We specifically looked at the development of classroom group identities of the chemistry teacher, Michael, and of the 18 classroom participants, two female students, Ariel and Simone (all names are pseudonyms) were identified as in-depth case study participants due to their attendance and availability.

Michael, in his late twenties, was a native New Yorker. He had attended undergraduate and graduate school in the state. As a second year teacher at Urban Chemistry High School, Michael taught the class we observed as researchers, as well as four other chemistry classes. All his students called him Mr. Michael. He taught two classes of grade 10 chemistry (Regents and non-Regents) and two classes of grade 11 chemistry (Regents and non-Regents). Michael often built his own chemistry models for classroom use, incorporated classroom sing-a-longs, small group work, short lectures, chemistry demonstrations in class and in the lab, and utilized education technology and media like remote clickers, films, or video clips to supplement his Power Point presentations. Michael was interviewed three separate times in the course of the academic year: October, December, and June.

From the data collection and analysis, a classroom group identity model is constructed as introduced in Figure 1.1 and further elaborated in the following four stages: (a) Stage One: Establishing Collaborative Classroom Group Dynamics and Shared Emotions; (b) Stage

Two: Power Dynamics Establishing Teacher Roles and Student Roles; (c) Stage Three: Developing Sacred Objects, Content Knowledge and Science Discourse; and (d) Stage Four: Sense of Belonging to Science and Completing the Model.

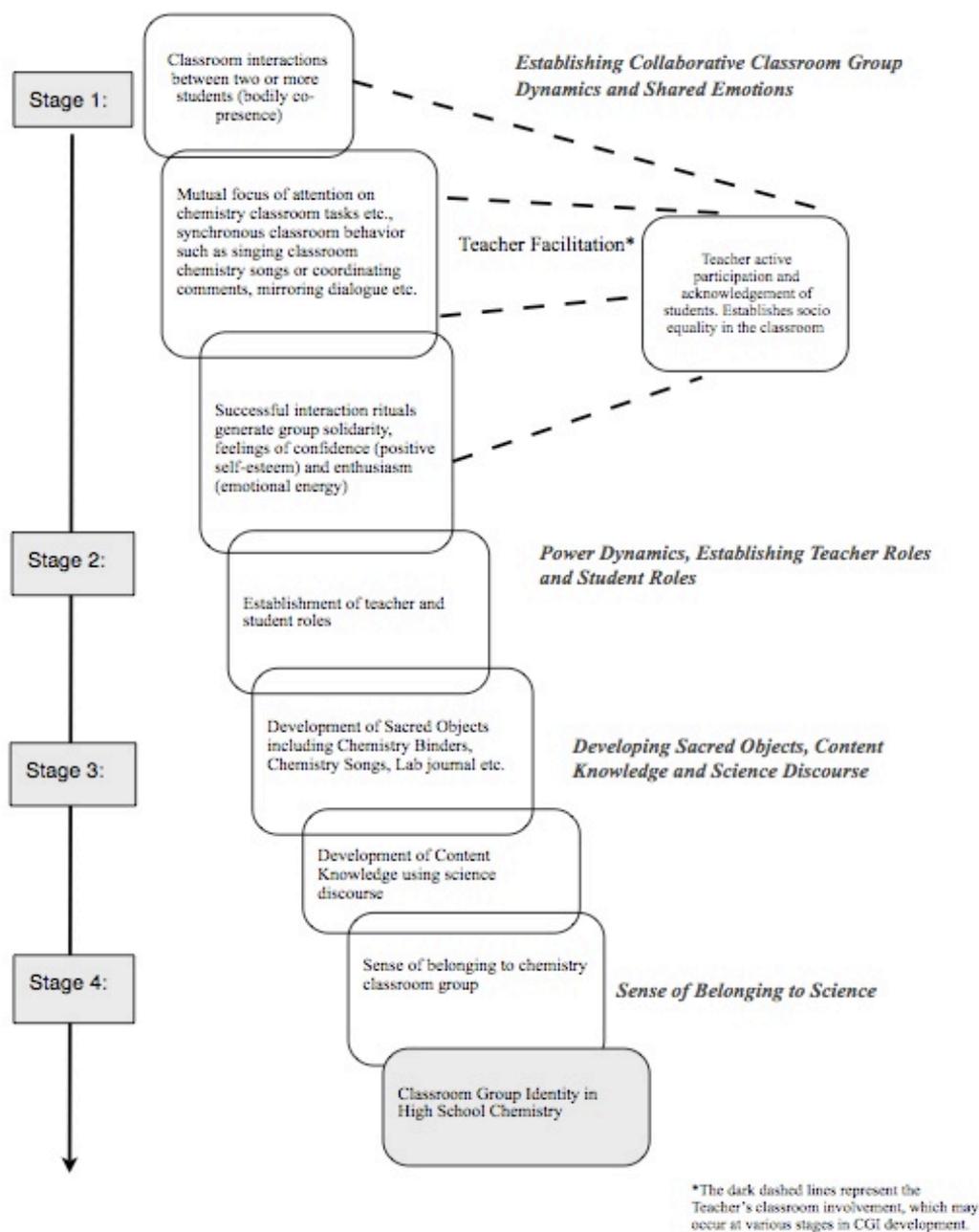


Figure 1.1 The mechanisms that construct classroom group identity in high school chemistry

Stage One: Establishing Collaborative Classroom Group Dynamics and Shared Emotions

The first step was to construct a collective classroom group. Here teacher and students interact, share, and exchange knowledge, information, and ideas amongst its members. This was determined by the students' participation and willingness to work in groups and share answers during class.

Stage Two: Power Dynamics Establishing Teacher Roles and Student Roles

Even though these students are cooperative and participatory as shown by raised hands bidding for the floor to ask/answer questions, Michael's role as the chemistry teacher was neither static nor permanent. Throughout the academic year, Michael reminded students of procedures, how to develop their ideas, deliver instructions by providing directives, which are typical commands of classroom teachers, such as asking for a response from students, calling on specific students to encourage those that did not participate in class, encouraging discussion, and repeatedly circling the classroom when students worked on chemistry activities or problems in their groups. Michael also rarely fumbles or stutters, so this displays his articulate powerful position, yet also remaining aware of his position as a teacher and also aware of his limitations.

Stage Three: Developing Sacred Objects, Content Knowledge and Science Discourse

Third, by engaging in collective and synchronous behavior, the students are organically building membership not only to each other as a class, but also with their teacher. The relationship building is significant in building a classroom group identity. Within the classroom, acts of membership and solidarity also deliver new meanings to the objects used in these rituals. For instance, initially the student binders, orange review books, scrub top uniforms, and reference tables may appear to be nothing but class materials, yet over the academic year, the students came to rely on these classroom objects as important artifacts in the science classroom.

Stage Four: Sense of Belonging to Science and Completing the Model

The fourth component of the classroom group identity model is having a sense of belonging. This component completes the CGI model. In this classroom's case, the bonds of social interaction strengthen over time if there is constant participation and collaboration taking place. Still, it all depends on the frequency that these interactions occur to generate rituals, roles, norms, symbols, etc.

Ariel

At only 15 years old, Ariel was a very mature teenager who presented characteristics of poise and care. Having emigrated from Puerto Rico to the United States, she lived in the Bronx with her family. She automatically stood out in class not because of her very light complexion or long brown hair but due to her relatively quiet and timid demeanor. This appeared rare for the lively chemistry classroom. In fact, she was only one of six students who began attending her chemistry class at 7:30am, a half an hour earlier than the start of school. This pre-class time was spent asking Michael questions about the previous night's homework or reviewing topics from earlier lessons. While most of the other early attendees asked each other questions and reviewed in small groups together, Ariel sat alone and did not participate in the conversation unless Michael asked her to contribute. At these times, Ariel was attentive to the teacher's detailed descriptions of the homework problems and watched her peers interact in the center of the classroom while she copied down notes Michael wrote on the board.

During the initial two months of observations, we noticed a sort of ritual in how Ariel came to class. Ariel appeared to be quite shy with her classmates, rarely talking to any of the

students seated next to her either before or after the start of class. She often entered the classroom only greeting Michael, then taking a seat at her desk and getting up only to grab the chemistry review books located at the front of the classroom, then returning to her desk with her face held down.

Separately, an interesting aspect of her classroom behavior was her level of participation during the actual class period. From the very first observation of the class, Ariel was the only student who raised her hand to every question Michael posed. Although it seemed she preferred to work alone, the fact that she attended class early and was involved in classroom discussions, though most of them directed toward the teacher, suggested that there was a desire to join and participate with her classmates. Since she was arriving early and often volunteered to help Michael co-teach. This required Ariel going to the board, writing down, and describing her reasoning in detail for answers to questions. Early in the school year, we were unsure if this was merely an aspect of her personality, being timid and reserved, yet wanting to “show-off” her knowledge, or was she deeply interested in learning chemistry and desired to help her peers learn chemistry.

When asked about helping her classmates both in and out of class, Ariel stated, “Yea, if someone asks for help and I understand the topic greatly I will help.” Even though Ariel would readily help her peers, she first had to feel confident in actually knowing the content before providing the help. Having science content knowledge was crucial for Ariel to be able to help her peers, in the chemistry classroom and in the laboratory setting. She did not see helping her students as competition, unless it was with an assignment. For instance, she stated: “Unless there is a competition assignment Mr. Michael may have assigned, I try to help my classmates.” The competition assignment that Ariel was referring to was simply homework questions assigned as chemistry homework free passes. These may also be used as points for the weekly Friday exams. Every student had a chance to win these passes, which were considered honorable class prizes. The value placed on them was viewed as a sacred classroom object. Ariel restricted the degree to which she was willing to help her classmates in an effort to remain a top student and be recognized as such.

During the first several weeks of observations in the chemistry classroom, Ariel was a floater group member, collaborating and participating in group work only when Michael requested it. This type of interaction further developed Ariel’s own personal identity of isolation rather than a member of the collective as a group. She did not resist helping her peers unless she felt unable, unqualified, or not knowledgeable to help; still, this depended upon the circumstances. By only participating when she was confident, this ritual limited her involvement to further herself academically or as a collective member of the classroom community. As a borderline, marginal collaborator, who helped her peers but only on select occasions, Ariel was not well integrated in the classroom community.

By mid-October, Michael gave Ariel a great deal of classroom responsibility as co-teacher, which promoted her within the classroom. Ariel was made a co-teacher in the chemistry classroom. Although Michael was guiding the lesson, Ariel was there to assist him and to ask questions to her peers. Co-teaching became a common occurrence in the chemistry classroom with Ariel. This role served as a great form of motivation for her, and it offered her a space in the classroom community to share her knowledge and to feel more integrated into the class. Michael shared the reason for selecting Ariel as co-teacher was to promote student leaders in the science classroom and for students to help other students gain confidence and interest in chemistry. In Ariel’s case, Michael, as well as the entire class, accepted Ariel in the role as

co-teacher. The “golf clap” or quiet applause represented a collective ritual in which all students were encouraged to engage in praise and acknowledge Ariel’s class participation. It was vital that Ariel felt included and Michael as the teacher made it a point to further support Ariel’s inclusion and leadership in the chemistry classroom. Michael too developed higher expectations of Ariel as the co-teacher.

Consequently, Ariel began to feel socially accountable to the classroom community. Ariel increasingly provided extra support to her peers more regularly or consistently over the academic year. In return, she was publically praised by Michael and her classmates within the classroom community, either by golf clap applause when answering a question correctly or verbal thank you’s from Michael and the class. Following these moments, and increasingly over the academic year, Ariel would smile more in class and became far more sociable, especially with the other members of the focus group. Rather than sit alone during the pre-class time period, when she arrived to class, Ariel joined others at their desks. She would sit with two other female focus group members as they sat, ate breakfast together, and sang pop culture songs. Ariel also at times “allowed” the girls to comb her long dark hair.

As a student in her chemistry class, Ariel often viewed herself as smart but also lazy. She stated that school came easily to her; thus, she needed to find inspiration and excitement to entice her to attend school. Although Ariel said it was “weird” that she actually liked chemistry, she described her enjoyment with chemistry as a “great bond towards chemistry.” Over the course of the year, her thoughts on chemistry intensified directly relating her success as the co-teacher and being accepted by her peers in the chemistry classroom. Moreover, Ariel attributed her interest in chemistry to Michael. She could relate to him, and she found him to be teacher who stood out among her other teachers. Michael used solidarity building rituals in the chemistry classroom which Ariel found to be culturally relevant. Although she thought one of the rituals-- class sing-a-longs –was “corny”, she still appreciated Michael for not being like her other teachers. His difference made him “stand out” and this also made him an effective and relatable teacher.

By December, Ariel no longer mentioned classroom competition as a means to block her fellow class members from excelling. Instead she stated that although she might feel competitive about grades, “the competition is good sometimes but like when it comes to the bottom of it, we are all here for each other.” Ariel, as part of the classroom group identity, no longer felt isolated or excluded from the classroom group. She was no longer confined to a role as student learner, student floater, sitting quietly alone. She instead referred to her classmates as being “there for each other.” By becoming an integral part of the classroom community, Ariel changed her level of classroom participation and also made it a point to state she was there to help her friends and class members learn and understand the content of chemistry.

At the mid-year interview (December), Ariel shared more of her interest in chemistry and her future aspirations. She started watching Grey’s Anatomy television show and became interested in being a specific kind of doctor: “Ever since I was like 5 or 6, I’ve always said I wanted to be a doctor and then I was probably about 9, 10 [years old] when I started saying I want to be this specific doctor [childhood trauma general surgeon].” Ariel also shared her identity as a chemist:

Stefania: Do you think of yourself as a chemist when you are in chemistry class or chem lab?

Ariel: Not really but given the name I would consider myself more of a student chemist.

Although Ariel had interests in becoming a doctor since the age of five, she felt a sense of belonging to science due to her chemistry class interactions. She did not admit to feeling a sense of belonging in her past science classes, like anatomy and biology, though she liked those sciences too. Regardless, in her current role as chemistry co-teacher, she did not primarily feel like a chemist-- but a "student chemist." This identity was enough to maintain her interest in chemistry for the year.

Simone

Simone moved from Jamaica to the Bronx at the start of 9th grade. She described the move from the Caribbean to the United States and her new school, The Urban Chemistry High School, as a "migration." Simone found herself in a period of a transition during her freshman year, having missed over three months of school and not only being thrust into a new school culture but a new culture altogether. Unlike her freshman year, Simone anticipated starting her sophomore year with a strong ambition toward reaching her future goals. Her cultural background played an important role in how she viewed herself. In an early interview where she discussed her family background, gender, and ethnicity, she noted the love and attention she receives from her family:

I grew up around my large family consisting of old and young and they've had a major impact on the student and person I am today. My parents are loving and encouraging in everything I do and always want to be involved in my life. ... I think your race and gender does have an impact on who you are but not how far you can go or achieve in life. Being Jamaican, I am proud of my ethnicity and ancestors and unconsciously my ethnicity does round out who I am and how I behave.

Simone specifically stated the following about her future interests and education: "I love learning different languages and how people with these languages interpret different things and would like to major in many languages in the future." Because of her passion for learning and studying, the need to fulfill a hunger was built from a foundation rooted in her family's culture and from family support, which enhanced her ability to embrace her own individual sense of self. Simone did not place any limits on her potential to achieve her dreams. She stated that even though she was female, a minority, and an immigrant, these identities did not determine her future capabilities, nor should it for anyone else. Simone was determined to achieve her goals and her strong sense of self was her personal identity.

Others also recognized Simone as a student who "loved" science. Simone was often referred to by Michael as an individual that was "really good at helping out" and even "tutoring" one of the students in Michael's third period class. Because of Simone's tutoring, Michael stated that "the student's grade had "sky-rocketed." Michael had established an incentive program in which students of varying abilities were paired with other students needing assistance. The student tutors would help others who needed more assistance in learning and understanding chemistry. Simone showed leadership skills as a chemistry tutor, and her efforts were acknowledged, appreciated, and applauded by Michael. The acknowledgements that Simone

received from Michael were reciprocated. Like Ariel, Simone attributed a great deal of her interest in chemistry to Michael:

I think he stands out compared to all our teachers. He's really effective. He's a really good teacher. ...Not saying that the others are bad but I don't know like how he approaches it. It's like you actually understand what you are doing.

Simone described Michael's teaching methods as creative and effective in his approach to teaching chemistry. Simone appreciated his methods, particularly his introduction of chemistry songs. She shared:

Yeah and he's the only teacher I know that can associate chemistry with songs.... I was very shocked. I was very shocked. He was like, 'Oh I have a song for you,' and I was like, 'What song. Is it about chemistry?' Of course it is about chemistry. (laughter)... I was like oh, 'Ok.' ...Then he tried to sing. (laughter)

Simone said Michael's inclusion of song was as an "effective" tool that she had never been previously exposed to in school. Michael's use of chemistry songs was especially appreciated, since Simone was an avid singer.

At mid-academic year in a December interview with Simone, she stated that she had not always loved science. She explained that in grade 5 she started to understand science when she "got really deeply introduced to biology." She understood biology and how to relate the many concepts in biology. She found biology "easy" and "started liking it. It just got easy... and it was like ohhh cool. Pretty awesome." Thus, her first remembered experience of liking science was in elementary school and learning biology. In addition, as Simone was able to see "how this relates to that," learning and understanding science became exciting and "awesome" to learn. With continual observations of Simone over the second half of the academic school year, she interacted with more students in both the classroom and laboratory spaces. Her classmates often asked her to join their groups and help them conduct their experiments. The call for assistance was not one-sided, because Simone often asked her classmates for help as well. This also supported her earlier comment that having a group structure in class helped in learning from multiple perspectives and learning new course material. She had the respect of her peers, and she also learned from them.

By the end of the school year, Simone was asked about responses she gave on the Science Is Me Survey. Although her final perceptions largely remained the same, she no longer thought scientists worked by themselves. In fact, she strongly disagreed with her previous choice and also changed her opinion about friendships she made in the class. Rather than stating none of her closest friends were in chemistry, which she responded on the early survey, she responded now having met and made many of her closest friends in her chemistry class. Simone also summarized her chemistry class experience:

This year was my first time doing chemistry and honestly I'd do it all over again. My chemistry class was fun, informative, crazy, and definitely interactive. My teacher's teaching method was very effective and made chemistry seem easier than I thought... Chemistry class sort of forced me to interact with classmates I didn't normally speak with and made me more comfortable with my peers. The atmosphere was fun and sometimes too noisy but mostly interesting... Chemistry gave me a chance to understand how to help my classmates and figure out more about them and they about

me. I think many of them learned who I really am and we got a chance to rely on each other.”

Therefore, the collaborative and supportive learning environment that made up Simone’s chemistry class was a place where overtime she continually developed an identity in chemistry as a tutor and made close friendships. Simone participated in pre-class and during class as a means to help her classmates also connect to chemistry concepts. In the process, relationships of classroom community were made. Thus, her chemistry class gave Simone an academic platform to explore her multiple identities—that of student, group member, and scientist.

Conclusions

From observations and interviews, it was determined that Michael’s practices as the chemistry teacher deeply influenced both Ariel and Simone’s engagement, participation, and their pursuit of classroom leadership. Both of these females were also able to develop classroom group identities as student chemists. Based on their responses and involvement in the chemistry classroom and laboratory setting, Ariel and Simone, as well as their peers, helped to unearth the processes that influenced the development of a classroom group identity in their urban chemistry classroom. This meant that the two focal students and their chemistry cohort, the entire class, underwent a multi-stage process in which they formed memberships, roles, rituals, symbols, and solidarity, comprising all four segments of CGI. Specifically, Ariel and Simone started out merely as classmates, but by the end of the year, both had changed their perceptions of science and each other. Based on interactions within the micro scale collective identity of the chemistry classroom, Ariel and Simone demonstrated increased levels of student engagement, participation, power, and development of identities in chemistry.

Upon analyzing the cases of Ariel and Simone, two distinct themes arise: first, students and teachers benefit from classroom group identity development because there is reciprocated trust and values tied to leadership that is demonstrated between students and their teacher. In this manner, competition is limited even amongst peers. In its place students encourage and support each other in understanding topics in their chemistry class, and concurrently strong friendships are formed. Second, students’ perceptions of chemistry as a field of study improve, and they begin to feel stronger attachments to learning chemistry. Classroom group identity allows for interaction rituals as the fundamental ingredient to generate group solidarity and a sense of *belonging* to high school chemistry as the end of the identity process.

Ariel and Simone also took on new roles, such as co-teacher and tutor, which support their development of classroom group identity. Both participants are designated as leaders because they are active learners and attain teacher roles in the classroom. This is particularly salient because in the beginning of the school year, Ariel is shy, reserved, and keeps to herself; and though Simone is funny and happy, she gains respect from both Michael and her peers as a chemistry tutor. Since CGI feeds off of synchrony, and positive emotional energy to develop a sense of belonging, even more roles that are assigned to Ariel and Simone, and others within the classrooms, is likely. In a CGI community, roles are generated, supported, and appreciated to support learning.

The value of interaction ritual development and collaborative community environments that everyday activities, like homework review or classroom sing-a-longs in the classroom are shown to potentially encourage positive emotional energy and produce classroom group identities that align to science. Thus, CGI has the potential of being an avenue of research that moves towards promoting positive science experiences and science identities, especially in more male dominated fields like the physical sciences. Much like Lave and Wenger's (1991) views of legitimate peripheral learning, Ariel seems to designate herself as an active participant but at an apprentice level. When she is in this learning environment, it not only gives rise to her feeling of community but also allows her to be recognized as a class leader.

By the end of the year, Ariel and Simone both feel they either know more chemistry than their peers or possess an equal level of content knowledge. Ariel and Simone also relied on each other for help in order to better understand the topics from their chemistry class. These students develop a collective sense of self that includes interdependence on their classmates and teacher, which in turn provided them with a sense of security in their learning, sharing, and understanding of chemistry. In October, Simone indicates that although she strongly enjoys science and views her chemistry classroom as a social field, her portrayal of professional scientists is not as defined or so positive. She considers scientists as men and women who do not work in teams, did not collaborate, and often worked alone. Yet by June, all these negative perceptions changed.

Simone also begins to communicate more and share personal aspects of herself to both her teacher and classmates. At the start of the academic year Simone is more reserved and did not dispel her emotions or ideas, much like Ariel's early behavior. Again, by the end of the academic year both girls are able to open up to more modes of communication, that is speaking to their teacher and to fellow student members, including those they at first did not know.

Michael entrusted Ariel and Simone with leadership positions and by working together with him as a guide, the entire class benefited from the sharing of their knowledge. Ariel in particular felt a sense of accomplishment and confidence once she taught the material to others. Both girls also recognize their own strengths and limitations when in their leadership roles in class. In the CGI process both students also gained the inner confidence and acquired sufficient content knowledge to be classroom leaders. Here, the full class of participants is sharing and developing relationships amongst members of the community that positively influence the community as a whole. Again, the more that people want to engage in such positive interactions, the greater the production of emotional energy. Specifically, the more emotional energy an individual can foster, the greater the chances that the individual will engage in the same action in the future, especially if emotions or feelings arose that inspired positive feelings like happiness or confidence.

The cases of Ariel and Simone also suggest moving toward developing positive attitudes toward chemistry, not just science. Ariel and Simone "liked" science starting from childhood, but found many benefits of learning chemistry in high school to support their early interests and future careers in science. This element of building from positive experiences in science is critical to help encourage and attract young women to the sciences. Michael serves as a facilitator in Ariel and Simone's development as classroom leaders. But in order to be a facilitator for leadership, Michael relinquishes authority and power as the teacher in the classroom. Lisa Hobson and Lynn Moss (2010, p. 30) state "leadership should be shared and performed in strategic ways and synergizing efforts should be employed for making learning

connections”; thus, Michael’s role does not need to be limited as the sole authority of leadership in the chemistry classroom. Individuals may be powerful in one respect and powerless in another. Therefore, in the science classroom the teacher and their students alike can be both powerful and powerless.

Although Michael’s race, upbringing and culture are different from that of his students, the dynamics that we observe in the class do not infer a cultural divide or resistance to learn by his students. Based on classroom group dynamics, a symmetrical relationship is seen: Michael’s role as a teacher exists because students exist. Thereby teacher and students must negotiate the interplay of power and solidarity occurring in groups. In the classroom, the teacher has the opportunity to influence, to make the ultimate decisions and to relinquish or share that power with other group members. Leadership for example, as shown in Michael’s incentive program demonstrates his flexibility as an instructor, his cultural awareness, and his dedication to academic and professional excellence. Students like Ariel and Simone are matched to his struggling students and are able to demonstrate their strengths and more importantly share their knowledge with other chemistry students to collectively form a classroom group identity.

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