Chapter 7
Collaborative Research Models for Transforming Teaching and Learning Experiences

Rowhea Elmesky

As I reflect back on my first few months of teaching at CHS, I recall some fleeting moments that gave me the satisfaction of being a teacher. Sadly, many days …I came home and wondered: "Am I a failure as a teacher?" … The greatest challenge that I faced was to be accepted by them as their teacher. I wanted my students to know and understand that I was there to help them and not to punish them with detentions and suspensions. … Their academic level was well below grade level, and the word "science" was enough to repel them from doing any productive work in the classroom. In my entire life, I always tried to do the "right" things, but here I was sitting in a high school classroom without knowing how to do anything right. I was frustrated, but I promised myself that I would work to make things better. (p. 49)

Apparent in this quote from an autobiographical reflection in Anita Abraham's dissertation, satisfaction and feelings of worth as a science teacher are connected to the type of classroom community that forms and to the nature of the interrelationships arising among students and with their teacher (Abraham 2007). For many teachers in urban schools, it is a daily struggle to teach science. They often experience frustration or failure in building classroom communities where they are able to successfully connect with or be "accepted by" their students. In fact, Anita's experiences of dissatisfaction and frustration as a new science teacher in an inner city school are indicative of the experiences of many new (and experienced) teachers in urban schools.

In studies by researchers such as Richard Ingersoll (2000), analyses of the Schools and Staffing Survey (SASS) and the Teacher Follow-up Survey (TFS) reveal that the retention of teachers, and particularly mathematics and science teachers, is directly linked to factors which include dissatisfaction. In fact, 40% of mathematics and science teachers who depart from the field cite their dissatisfaction as stemming from sources that cause them to feel disempowered. Specifically, two of

R. Elmesky (✉)
Faculty of Arts and Sciences, Washington University in St. Louis,
St. Louis, MO 63130, USA
e-mail: relmesky@wustl.edu

B.J. Fraser et al. (eds.), *Second International Handbook of Science Education*,
Springer International Handbooks of Education 24, DOI 10.1007/978-1-4020-9041-7_7,

the major causes of displeasure for teachers who decide to eventually leave the profession are student discipline problems and perceptions of minimal student motivation. I suggest that these teachers, similar to Anita, may feel stripped of *agency*. According to William Sewell (1992), agency infers that one has the power or capability to shape the social relations in which one is embedded, "which in turn implies the ability to transform those social relations to some degree" (p. 20). Teachers wish to experience a sense of empowerment within the classroom and specifically in their interactions with students, thus, pointing to the fact that addressing the challenges of teacher retention and satisfaction requires attention to classroom dynamics, and specifically to the strengthening of social relationships with students.

This chapter shares a narrative of one immigrant science teacher's (Anita Abraham) experiences while working in a comprehensive neighborhood school with students from different social, cultural and economical backgrounds than herself. Further, the chapter provides images of how classroom experiences can become better understood from multiple vantage points when collaborative research is incorporated into the classroom, during and outside of class time, as occurred during the critical ethnographic study that Anita was conducting, with me, under an NSF-funded grant. The grant invoked a model of collaborative research (utilizing a "research with" rather than "research on" methodology), and teams were created at every school site to consist of two teacher-researchers from each participating urban school, at least two student-researchers from each focal class, and university researchers such as myself. Specifically, the chapter emphasizes how introducing researcher roles into the classroom helps to strengthen weak relationships between teacher and students, encourages the development of new teaching and learning roles, and improves the critical consciousness of both teacher and students.

Anita's Story

Although she held a bachelor's degree in Chemical Engineering from India, Anita decided to go back to school to become a teacher when she immigrated to the USA. Even before she finished student teaching, she was offered her first teaching job at City High School (CHS), a large Northeastern urban school with a nearly 99% African-American population, the majority of whom were from the surrounding low socioeconomic neighborhoods. CHS lacked human and material resources; with its concrete walls and heavy metal double doors, it looked more like a correctional school than a high school. During her first year, teaching at CHS was overwhelming. Anita found that many CHS students had lost hope and interest in school as a means to acquiring a viable education. Many students did not have access to resources like pens or paper. In general, students did not express interest in doing class work, and questioned the relevance of Anita's teaching by asking questions such as "Why do I need to learn this?" or "Where am I going to use it?" For the majority of the time, Anita felt that her primary job as a teacher was to work on

classroom management issues rather than to teach. In an autobiographical reflective piece, she wrote: "I had no clue how to respond or what to do, and my inability to control the class and influence their attitudes haunted me day and night; I went to bed late thinking about the unpleasant events that I had experienced in the classroom." Anita felt that the students did not respect or acknowledge her as their teacher, and instead, were considering her as an outsider or someone who did not belong in their community because of her ethnicity and accent. Questions such as "Why are you here?" or "Why is everybody coming to our country?" made Anita feel disempowered. She wondered how to respond or what to do. The students' statements seemed to communicate that she was an intruder, making her first year of teaching painful and disappointing.

Even beyond that first year of teaching, the social, cultural, racial, and economic divide between Anita and her students was complex and daunting. As stated in the quote opening the chapter, Anita believed that "her greatest challenge was to be accepted by them as their teacher." Year after year, she tried an array of "quick fix" strategies, yet eventually she realized that she needed to develop meaningful relationships with the students. Becoming a teacher-researcher helped pave such a pathway, and Anita's case provides support for advocating the use of collaborative research models in science classrooms.

Collaborative Research in the Science Classroom

Anita: As a science teacher at City High School, I had seen university researchers walking down the halls, in classrooms and also in the principal's office. Most of the teachers were suspicious about the university researchers. They tried to avoid them, were apprehensive about being interviewed by them, and afraid that they might accidentally say something that might put them in "trouble." In those days, I wasn't sure what the ongoing research was about, and I didn't make any effort to know either. Things started to change when our vice principal, a former science department head, asked me to join the Master's in Chemistry Education (MCE) program offered at the same nearby university. At the same time, Dr. Kenneth Tobin, the main university researcher from the Graduate School of Education, asked me if I would be interested in joining the research group already working at City High School. He further explained to me that, as a part of the research team, university researchers would have access to my classroom and I also would be participating in the research as a teacher-researcher. As a regular classroom teacher, I didn't consider myself a researcher and didn't know what qualifications were expected for a researcher. Moreover I wasn't comfortable letting a university researcher into my classroom. I was worried that, if things went out of control, those events would become the focus of their research findings. When I shared this information with one of my coworkers, Ms. Cloud, a 30-year veteran teacher, her reactions were negative, mainly because in her opinion educational researchers always concluded their findings without any input from the classroom teacher or students. However, I anticipated that my situation would be different because I would act as a teacher-researcher and my students would also become a part of the research team as student-researchers. Although I was still slightly apprehensive, I agreed to be a part of the research team, excited that my voice and my students' voices would also be heard during the research process.

These reflections shared by Anita, following the completion of the study, illuminate the mixture of emotion arising when teachers are asked to incorporate *research* into the classroom context. The remainder of the chapter describes some aspects of the research process in which Anita, student-researchers, and I collaborated during 2002 in her 11th grade Chemistry class and supplementary laboratory at City High School.

Critical Collaborative Research as a Tool for Daily Classroom Change

Urban schools, such as City High School where Anita taught, are marked by inequalities – visible in school staffing, funding, courses offered, and the resources available. The schools are often oppressive to students who are labeled as "resistant" or "unmotivated" and classrooms become grounds for conflict, disconnect, and struggle. However, critical ethnographic methodology and methods are tools for shifting classroom dynamics from "control over" to "collaboration with." That is, when participatory critique is encouraged, transformation in the classroom occurs and schooling can become a less oppressive experience and more rewarding for both the students and their teachers.

When Angela Calabrese Barton (2001) discusses critical ethnography, she describes the research process as a "dialectical theory- and practice-building process in which practice and research shape each other in an endless cycle" (p. 907). Thus, critical ethnography calls for identifying the problems and asks for transformation by connecting theory and practice. This dialectical relationship between practice, theory, and research triggers local transformation of the structure by providing tools for all participants to act in new ways as the findings from the research constantly inform participants of their practices and vice versa. Moreover, critical ethnographic methods increase the agency of the participants through methods that are inclusive of all of the stakeholders involved. Collaboration is key and necessitates that teachers and students take on researcher roles that allow them to draw strength from the research findings. Thus, both the research process and the associated findings serve as catalysts for growth and transformation.

Students as Researchers

Kenneth Tobin (2006) has conducted educational research that involves students as researchers and found that this type of model "provides a way to obtain their [the students'] perspectives on what is salient in terms of school, teaching, learning, and myriad other issues" (p. 27). That is, when student-researchers are included in salient ways in research studies, teachers are afforded greater opportunity to understand their perspectives on what is occurring in the school or neighborhood fields and, importantly, "why." Through the new role of "researcher," they significantly

contribute to identifying patterns of coherence (as well as contradictions) within their classrooms, in relation to the teaching and learning they experience.

In Anita's classroom study, student-researchers engaged in activities such as the review and analysis of videotapes, interviewing each other and fellow classmates, transcribing such interviews, writing reflective journal entries, and developing video ethnographies that captured salient aspects of their lifeworlds outside of school. Weekly, the researchers ate lunch together, during which time they watched videotapes from class time and from within the laboratory. They were asked to identify video vignettes of salient events that were taking place, and these video vignettes then became focal points for discussion. In addition, a selection of video vignettes was shared with students who were participants within a captured video clip, in order to obtain their perspectives and to preserve and privilege their voices.

When Students Speak

With the introduction of a research design in Anita's classroom that employed students as researchers, the students quickly learned that their perspectives were valued and that it was acceptable to be critical of classroom practices. For example, in the following entry from one student-researcher's (Deidre's) journal, she highlighted a major issue present in schools like CHS where there is a culture of distrust of students in laboratory settings.

> I think Mrs Abraham should trust us and plus the burner, she gotta go to group to group, lightning it and its gonna take a long time and we wanna do our lab real quick and by her keep goin to group to group she just need to give us like some matches or a lighter so we can [light the] burner our own? Burner is easy to use. (2/02)

These types of reflections were useful in helping Anita to identify how her teaching practices afforded and truncated students' performance within the laboratory setting in a school where deficit perspectives of the students were the norm. In fact, for years, most students at CHS did not receive opportunities to participate in a science laboratory setting and, specifically, Biology students had been prevented from performing dissections due to the teachers and administration's fear that they would harm each other with scalpel blades. Accordingly, although some teachers like Anita eventually decided to incorporate a lab section into their science classes, there was still a tendency to enact control tactics that truncated student agency. Therefore, laboratory equipment like the Bunsen burner could only be lit by Anita, and this was not received well by students who found themselves waiting on one teacher during the tight slot of time designated for laboratory completion. Through the avenue of research, students like Deidre were able to bring to the surface how such teaching practices could be experienced as inefficient ("she gotta go to group to group") and as disrespectful of their abilities ("burner is easy to use"). Moreover, Deidre was able to represent student interests in having access to a greater range of resources; she was also able to provide concrete suggestions of how the students could experience greater autonomy ("she just need to give us like some matches or a lighter").

Contradictions are a normal part of social realms and to be expected within classroom cultures. Research designs that privilege multiple voices encourage the study of such contradictions rather than the search for patterns of coherence alone. In Anita's classroom, the involvement of multiple student-researchers allowed for various perspectives to emerge. For instance, while Deidre was quick to point out that the students in her class were quite capable (e.g., of lighting a Bunsen burner), another student-researcher (Maria) held a different view. Since the majority of the students in the class lacked previous experience in a science laboratory setting, Maria felt that Anita's assistance was necessary and perhaps even insufficient to meet all of the students' needs. In a conversation with me, she expressed:

> This is our first time for doing something. This is our first time being in the lab. It is our first time all this stuff. It is the first time. But I think she can get more help somewhere else too. She needs to find some more help. (2/02)

Maria's remarks and associated suggestions communicate frustration with schooling structures that have limited her and her peers' modes of participation in science. In the previous science class that Maria and her peers had completed at CHS, the curriculum had consisted of bookwork and lacked any laboratory component. Hence, when the students were in the chemistry laboratory, it was the first time for most of them and there were constant requests for Anita's assistance. She continuously circled the classroom throughout the duration of the laboratory activity, moving from group to group. The demands became strenuous for Anita and a source of negative emotion for both her and the students. Maria noted this in another research meeting:

> She [Anita] teaches but she still needs to be a little more patient with us also. … I think our group was asking for something. She was doing something else and she got like real mad like "I WILL BE THERE IN ONE SECOND!" And I understand that you [Anita] are only one person but we need help also.

Through the student-researchers' perspectives, it is evident that Anita's decision to simply add a laboratory component to her chemistry class did not magically rectify the years of inequitable science learning environments that students like Deidre and Maria had been experiencing. Instead, Anita needed opportunities to consider what resources afforded her students to experience success. Such considerations are fostered through incorporating a research worldview into the classroom where students (i.e., student-researchers) can take a proactive role to support their learning. While it is natural that the students may initially focus mainly on recognizing aspects of the environment that are unfavorable and engage in a process of sharing their frustrations, they will also come to simultaneously recognize teaching practices that foster success, respect, and autonomy. These occurred in Anita's classroom, as the student-researchers evaluated their classroom experiences. For example, although Deidre had been quick to point out that Anita did not allow the students to light the Bunsen burner, she recognized that Anita promoted student autonomy in other ways. For example, Deidre spoke about Anita's practice of encouraging the students to select their own laboratory groups – contrary to other teachers at CHS, stating:

> When we are in the laboratory [in Anita's classroom] and we have to pick who we are in the group with, and you work with people you are already familiar with – some teachers just put you with anybody. If you don't like that person and you are not familiar with that person, you are not going to work because you don't know anything about them. So [in Anita's classroom] you work with your friends and like we have the lab [Rate of Reaction], and we had to mix the chemicals, look at the color change, and time it for one second or two second. It was fun.

Students like Deidre viewed this opportunity for group self-selection as beneficial on multiple levels. Evident in her comments, Deidre recognized that working with familiar peers assisted in the process of carrying out experiments smoothly and in an enjoyable manner ("it was fun"). She also pointed out that rapport and comfort level with one's peers assisted in the completion of lab requirements such as the mixing of reactants, timing the experiment, and recording observations.

In fact, over the course of the semester, video data of the lab showed how the students often took responsibility for their own and each other's practices in the lab. That is, students kept an eye on their group members and on other groups to make sure that they were following procedures correctly. They often provided information by answering questions, sharing techniques, talking through the process and modeling for each other. For example, during a laboratory activity on physical and chemical changes, one group wanted to finish the activity quickly and decided to put the baking powder directly into the vinegar without first wrapping the powder inside a paper towel, as the procedure required them to do. However, this did not go unnoticed by a member in a different group who reacted quickly, by shouting, "Stevenson you wrong! Don't take it out! You wrong." Such interactions indicate that the students were acting with independence and as resources for each other within the laboratory, illustrating a spirit of collective responsibility.

Thus, throughout the research process, students had the opportunity to become more conscious of how their peers were functioning as science learners and to recognize shifts in their peers' practices and identities. That is, the student-researchers seemed to develop insights into what was needed to become successful science learners. In a written entry that was recorded in response to watching videotapes of the students in the chemistry laboratory, another student-researcher, Sasin, wrote:

> I think that the labs are the best part of this chemistry class. We have fun with it. I think we get a better explanation by seeing and doing these labs instead of a lecture. … I think we have grown as little scientist[s]. We look more familiar within videos with the equipment. Everyone seems to enjoy the lab. We all like to work in groups.

On a different occasion, as the student-researchers watched some video footage of their chemistry laboratory, they observed and discussed different students' practices and related aspects of the learning environment. For example, while watching a videotape of the students engaged in the Flame Test Laboratory Activity, Maria provided understandings regarding one student's engagement in the classroom. She commented:

> But at 11:07 [AM] we seem like we all were writing down our observation and getting along well. Look at Earl. Earl the type of person that doesn't do any work. He the one that copy and stuff like that. But he not dumb! Earl ain't dumb! He smart he just don't wanna do it … He don't wanna seem like he smart.

Earl was considered to be a troublesome student by many of his teachers, including Anita. During classroom instruction, instead of paying attention and writing notes, he usually put his head down. However, during the laboratory component of Anita's class, Earl began engaging in different practices as a science learner, and this attracted Maria's attention while viewing the video footage. Maria recognized a shift in his practices from someone who "doesn't do any work" and "copy and stuff like that" to someone who was writing down scientific observations and "getting along well." Her summative perspective (i.e., "He don't wanna seem like he smart") was insightful and catalytic. Anita became interested in understanding him better, for example, making efforts to learn more about his home life and experiences in other classrooms. Through her researcher role, Maria helped Anita to focus upon a student whom she had previously somewhat ignored. Thus, I argue, incorporating a collaborative research model into the science classroom assists in deeply interrogating how it may become a space where all students are central and have the opportunity to associate positive emotions and respect with the doing of science.

Sharing Responsibility for Success

> I learned a lot from research. We sit in groups and talk about class an[d] stuff. [Before] I never thought about the other kids and how they feel. I learned how Ms. A [Anita] cares about us. She taught us to help other people in class. I get good grades. Class is just a big group of helpers for everybody.

This chapter does not intend to set up an argument for linear, causal relationships between research and improved social relationships in the classroom; however, I do maintain that collaborative research models introduce dynamic and transformative structures into the classroom that encourage the building of a caring community where shared responsibility is key ("just a big group of helpers for everybody"). Structures, as discussed by Sewell in his article on agency, can be both material resources as well as virtual ones like rules, ideology and schema. For example, evident in Nisha's journal entry above, in Anita's class, becoming involved in research encouraged schema that valued nontraditional teaching and learning roles – where students take responsibility for their own and their peers' learning and where the teacher is someone who genuinely "cares." That is, collaborating in the doing of research encouraged the emergence of a community where students began to think about one another's perspectives ("how they feel"). The students were also able to see Anita as someone who was concerned about their well-being. Moreover, the introduction of research into the classroom helped to create spaces for authentic conversation, for instance, through the use of resources like group "talk." In a school where the students are silenced on a regular basis, the opportunity to *speak* is essential to promoting positive emotional energy in the classroom. In fact, the students in Anita's classroom were quick to share their experiences with research with other teachers. Maria related: "We told Ms Morris [the English teacher] about the research in your [Anita's] class and how we talk about what we like and what we don't and all. She liked it. She said that she might try it."

Reflection in Isolation No More

Many times, teachers make sincere efforts to engage in successful practices and to regularly reflect upon their teaching. As stated by Anita: "Everyday I tried to spend a couple of minutes reflecting on my actions, and at times asking the following question to myself – if I were a student, would I want me as a teacher?" However, arguably, when reflection occurs in an isolated context where the teacher is alone in developing her perceptions, it is difficult to identify and determine why particular practices are successful or not in promoting a positive classroom environment.

There is, however, much to be learned from students' contributions as researchers. The student-researchers' perspectives provide important dimensions for better understanding the classroom than would have been achieved if Anita reflected alone. The students provided important information about how responsibility and respect are aligned, helping Anita to recognize a wide spectrum of student perceptions of her actions; for example, her "helpful" practice of lighting Bunsen burners communicated distrust to some students, and for others, she was not be perceived as being "helpful" enough. She also was able to learn that an unpopular teaching practice (at CHS) of allowing students to work with "your friends" could help students generate positive feelings about science as an enjoyable subject area. The student-researchers additionally helped Anita to perceive the generation of positive emotional energy as central to encouraging a positive atmosphere for learning, where students can grow as "little scientist[s]."

School and classroom structures can be transformed to afford the learning of students in the classroom. Sonya Martin (2004) posits that "only by *collectively* [emphasis added] seeking to expose and examine the structures associated with the process of teaching and learning can contradictions be resolved to afford greater agency for all classroom participants" (p. 203). I suggest that teachers should jointly and regularly reflect with students on classroom practices, and collaborative research models pave out a space for hearing the students' voices. In the case of Anita, working with coresearchers enabled her to become more aware of how her practices were being interpreted and shaping the emotional status of the classroom. Although educational research findings are intended to improve teaching and learning in a classroom, the reality is that traditional research dynamics do not afford the immediate participants of a study with opportunities to reap the benefits; rather the implications of the research findings are for future classrooms. A research "with" methodology empowers students and teachers during the research process. That is, the model of critical research discussed in this chapter introduces a view where research is utilized as a tool that is immediately effective and designed to encourage a sense of empowerment. In this manner, teams of university teacher- and student-researchers become integrated and natural parts of a classroom routine where the learning environment is characterized by an openness to examining practices and taking responsibility for one's own actions.

Acknowledgment The research in this chapter was supported in part by the National Science Foundation under Grant No. REC-0107022. Any opinions, findings, and conclusions or recommendations expressed herein are those of the author and do not necessarily reflect the views of the National Science Foundation.

References

Abraham, A. (2007). *Sociocultural perspectives on teacher-student relationships in an urban chemistry classroom*. Unpublished doctoral thesis, Curtin University of Technology, Perth, Australia.

Barton, A. C. (2001). Science education in urban settings: Seeking new ways of praxis through critical ethnography. *Journal of Research in Science Teaching*, *38*, 899–917.

Ingersoll, R. (2000). *Turnover among mathematics and science teachers in the U.S.* Paper prepared for the National Commission on Mathematics and Science Teaching for the 21st Century, Chaired by John Glenn. Retrieved June 15, 2008, from http://www.ed.gov/inits/Math/glenn/compapers.html

Martin, S. (2004). *The cultural and social dimensions of successful teaching and learning in an urban classroom.* Unpublished doctoral thesis, Curtin University of Technology, Perth, Australia.

Sewell, W. H. (1992). A theory of structure: Duality, agency, and transformation. *American Journal of Sociology*, *98*, 1–29.

Tobin, K. (2006). Qualitative research in classrooms: Pushing the boundaries of theory and methodology. In K. Tobin & J. Kincheloe (Eds.), *Doing educational research – A handbook* (pp. 15–58). Rotterdam, the Netherlands: Sense Publishers.