

WHAT HAPPENS WHEN SCIENCE TEACHERS COME TOGETHER WITH LATINO
FAMILIES IN A SCIENCE LEARNING CONTEXT

by

MEHTAP KIRMACI

(Under the Direction of Martha Alleksaht-Snider)

ABSTRACT

Researchers have begun addressing ways to prepare pre-service and in-service teachers to partner with culturally and linguistically diverse families. However, studies examining teacher preparation regarding family-school interactions in the context of school science remain limited. Building upon the Freirean notion of dialogic education, the study's purpose was to explore what happened when secondary science teachers came together with Latino families for their children's science learning during a three-year long program. The overarching research question was: How did secondary science teachers conceptualize the ways in which their participation in family workshops affected their perspectives and practices about working with their Latino students and their families?

For this case study, I recruited five in-service secondary science teachers with extensive experience in working with Latino students and families in the Steps to College through Science program. Data sources included individual and focus group interviews, participant observations, and extended field notes and researcher-generated documents. I engaged with a mode of categorical thinking incorporating Charmaz's constant comparative method and used a Qualitative Data Analysis Software program, ATLAS.ti 8.0, to analyze the data for four

European American teachers. Analysis of the data for an individual case study of one Latino bilingual teacher involved a mode of narrative thinking and developing connected narrative accounts.

My findings showed that in-depth and long-term exposure to content-based cultural immersion programs with parents and children supported teachers in cultivating a broader vision of science teaching linked to students' lives and communities. My findings also demonstrated that the power of teacher learning was enhanced when the program required active involvement of students' families in science inquiry practices, contrary to typical school programs that mostly position families as passive actors who watch their children being involved with learning activities or listen to school agendas. The findings also indicated that the possibilities or impossibilities of transformation in teachers' practices with culturally and linguistically diverse students and families are influenced by powerful discourses linked to standards-based curriculum and assessment policies, as well as by individual school administrators and individual teacher backgrounds. This dissertation concludes with implications for research and practice to unite schools, communities, and curricula.

INDEX WORDS: Case study, Community-based science learning program, Equity, Family-school relations, Science education, Teacher professional development

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CHAPTER 1

INTRODUCTION

It would be easy to throw up our hands and say that education is too full of contradictions, that it preaches what it cannot deliver, and that it's a utopian dream. Yes, all these things may be true. Yet, it is a teacher's responsibility to remain hopeful in spite of all these challenges. As Paulo Freire reminds us, "The educator's biggest problem is not to discuss whether education can or cannot accomplish, but to discuss where it can, how it can, with whom it can, when it can; it is to recognize the limits his or her practice imposes" (Freire, 2007, p. 64). The limits are real, but so is the power of hope. Living through the contradictions, although not easy, is an essential obligation of both teachers and teacher educators (Nieto, 2013).

It was 7:30 am on a winter's Saturday morning. The icy wind, forcing the tree branches to dance in harmony, blew the cold straight into my face. As I hurried into the building through the howling wind to protect myself from the cold weather, I saw Dr. Alleksaht-Snider approaching me in her grey sedan. With her smiley face she opened the window and said, "Good morning! Could you wait for me in here so that we can put the signs on the walls?" I said "Sure!" Then we placed several signs on the brick walls of the building, including, *Steps to College through Science Bilingual Family Workshop*, and *Bilingual Family Workshop on the second floor*, and *Take the elevator*.

As soon as we finished our job, I came inside to warm up. I took the elevator up to the second floor and entered the hall that was crowded with people. I was very surprised to see that

there were more than a hundred people clustered in the hall despite the inclement weather conditions. I saw Latino students, parents, siblings, and also secondary science and ESOL teachers and graduate assistants working as the project researchers. Everyone seemed to be energetic and excited about the day and seemed genuinely happy to be actively engaged in all aspects of the event. The hall was filled with the noise of families chatting, eating and drinking snacks and soft drinks; some who were lined up were waiting for their turn to sign-in. On the far left, one tall male student who was wearing a red hooded cardigan was explaining something to his friends with great enthusiasm. Next to him three groups of families sat on a bench eating snacks. Further to the right stood four teachers having a conversation and looking at the agenda that was attached to their clipboards.

I walked around and had teachers fill-out the honorarium forms, so they would earn \$150 for attending this workshop. I approached Walter Murray who was standing with two groups of families at the front side of the hall. He smiled and said “Good to see you!” I felt very pleased since he remembered me from the last workshop that took place last semester. Walter is a European American middle school physical science teacher in his 50s, but he seemed younger than 50 with his white sneakers, blue jeans and black hooded cardigan. As he filled out the honorarium form, we had a brief conversation:

Walter: Do you know I am retiring?!

Mehtap: Really? Congratulations! But this means we will not see you again.

Walter: I worked for many years and attended these workshops for a long time. I feel that I am more of a helper than a guest here...

We paused suddenly and leaned toward Drs. Buxton and Alleksaht-Snider who were standing at the center of the hall and talking louder in an attempt to catch people’s attention.

Even though I did not understand anything that was expressed in Spanish, I assumed that they welcomed everyone and gave brief information regarding the purpose of the workshop and introduced the agenda for the day. Following their speech, each staff member in the workshop introduced himself or herself. Then it was my turn: “Hello everybody! I am Mehtap Kirmaci. I am from Turkey and am a PhD student in Educational Theory and Practice at the University of Georgia. I am also a research assistant working at the LISELL-B project.”

After a while, the teachers and family liaisons accompanied groups of students and families to the different sessions. I joined group C heading toward the science inquiry room. This mid-size room had gray narrow rectangular tables that were arranged to make a U shape in front of two white boards. This group consisted of 26 people, including three teachers, 9 students who were escorted by one or two parents, and a few younger siblings who sat side by side around the U shaped table so that everyone could easily see each other. I saw several general-purpose and content-specific academic vocabulary cards posted on the walls – *Produce (producer)*, *develop (desarrollar)*, *conduct (conducir; conducta)*, *create (crear)*, *research (investigación)*, and *design (diseño)*. Each of the word cards included an explanation, example, and picture illustration that could easily capture the audience’s attention as they entered the room.

The purpose of the science activity in this room was to create a light bulb using batteries, wires, cups, and carbon lead. Each family was given these items and bilingual handouts required for the light bulb experiment. Sina, with Fernanda translating, facilitated the science activity session bilingually as the conversation switched from English to Spanish or and back and forth. At Sina’s request, a male student with brown eyeglasses held the handout in his hand and read it to the rest of the group. *We all have heard about Thomas Edison, the inventor, who invented the light bulb, but less is known about Lewis Latimer, the son of runaway slaves, who improved the*

design of Edison's light bulb to extend its life... Then a male student who was wearing a red sweater with a blue tank-top underneath volunteered to read in Spanish while placing his elbows on the table and looking at the group occasionally. All parents applauded him loudly as if to demonstrate their excitement about their children's using Spanish for academic purposes in the context of the workshop.

Sina gave general information about the activity, and he provided step by step instructions about the experiment and looked around the tables to see if everybody was on the same page with him. Sina held a small wire and showed it to everybody: "What does it look like? An alligator?" Then Fernanda translated what Sina said into Spanish as she recorded the main ideas on a paper chart on the wall next to the whiteboard. Once Fernanda finished translation, Sina took over the speech and said, "Take two alligator cords and attach them to the smaller cup's two sides." Jack Baumgarner, secondary life science teacher attending the workshop for the first time, stood behind his son who was around 10 years old and followed Sina's instructions while taping the cords to the sides of the smaller cup so that the clips could reach above the cup. "Can you say, 'strip the alligator wire' in Spanish?" Jack asked Fernanda. His request helped me to realize that he could not speak or understand Spanish, but he tried to say something to a parent who was sitting next to him.

I sat next to Lilian Williams, Dominican American ESOL and co-science teacher, who showed a picture on her phone to a mother sitting across the table and said, "Do you see? These trees were taller than me!" Then she turned and showed me the same picture as well. I saw some fallen trees that she said had fallen down because of the storm two days ago. Then the topic of the conversation changed as Lillian held the clips and said, "These are the alligator clips!" The mother said, "Crocodile?" As Lillian moved the clips she said, "You see, aaa." By opening and

closing the clips, she tried to show that since the clip resembled an alligator's mouth, it is called an alligator clip or cord. Then the table filled with laughter.

I walked over to Andrea Hull, European American 6th grade earth science teacher, who sat next to a female student with a white hooded cardigan and her mother with a red patterned scarf making a simple loop around her neck. Andrea touched the student's shoulder and told her something but I could not completely hear it. Then Sina announced, "Connect a pencil-lead between the two alligator clips so that the lead forms a bridge above the cup." With the assistance of Andrea, the student and her mom connected the pencil lead between the clips and placed the bigger cup over the smaller cup as the next step in the experiment. While Sina warned everyone to "make sure the large cup does not touch the pencil lead," the student and her mother connected the alligator cords to the large batteries, and the pencil lead generated light.

Mother: Sí, sí!

Andrea (teacher): This is awesome!

I saw Andrea and her partners having a good laugh together and a laugh at themselves as a way of showing their success, while they grabbed their phones and took pictures of the lighted pencil lead. This group caught the attention of the whole classroom- everybody leaned toward them to see their accomplished experiment. Using English, the mother leaned toward Andrea and asked her how the pencil leads generated light. Then Andrea explained that since pencil leads are made of carbon, they light up when we connect them to batteries. The electrical energy from batteries travels through the circuit and transforms the heat and light energy in the carbon filament. Then she explained why we change the bulb when the small thing is broken inside of it. She said, "That's why we change the bulb when its burn out." It seemed that Andrea wanted to make sure that the mother understood what she had explained to her, saying to her daughter,

“Could you translate it for your mom?” After her daughter translated what Andrea said, the mother smiled and nodded her head to indicate that she understood everything.

As soon as each group completed the experiment, Sina asked, “Who will answer the first question on the handout?” the room became quiet as no one answered, and it seemed that people were afraid to give a wrong answer. Then he tried to make the students and parents comfortable enough to speak up by using his sense of humor, “Do you know what teachers do, if students do not give the answer?” In response to his joke, the room filled with laughter. Sina asked “What was the effect when we connected the cords to the batterie holders?” Two fathers volunteered to write their own responses on the whiteboard in Spanish. The room suddenly broke into applause. Sina continued to ask questions: “What caused pencil leads to glow in the experiment?”; “What created the light?”. The silence colored the room again. After a while a grandmother with a black cardigan from the end of the table said something in Spanish with a very slow voice, as if showing that she was not sure that her answer was true. Sina wanted a volunteer to write about the cause and effect relationship in this experiment. Lillian leaned toward the student with a pony tail next to her and whispered something to her with a smiling face. Sina kept asking questions:

Sina: What kind of energy is this?

Student: Potential.

Lillian (teacher): And?

Student: Electrical.

Lillian: Yes!

Other students didn’t participate, seemingly preferring to listen.

Sina: What caused the filament to glow?

Lillian: If you....

Student: Connect.

Lillian: What?

Student: The circuit.

Lillian: Then?

Student: Batteries.

The words came together and became a complete sentence as Lillian helped and guided the student to answer the question. Then the session ended and Sina wanted people to leave the handouts on the table; he led them head toward the Family Educational Conversation Session. (An excerpt from an observation of the STC workshop, February 2015).

Since I started working at the Steps to College through Science bilingual family workshops (STC workshops hereafter) as a research assistant in the Language-rich Inquiry Science for English Language Learners through Biotechnology (LISELL-B) project, I had the privilege to closely work with groups of Latino families and secondary ESOL and science teachers from five middle and three high schools from two school districts in the state of Georgia, in the United States. In the course of these three years, with the generous support of my PIs and mentors, Drs. Buxton and Alleksaht-Snider, I was involved in several roles and responsibilities in these workshops. I organized the recruitment of families by communicating with family liaisons and particular teachers at schools; and assisted in planning the program logistics, such as coordinating the registration of families and teachers, which gave me a chance to have individual interaction with teachers and families. Sometimes I co-facilitated the family educational conversation session that positioned me as a full participant at the center of the classroom, but, more often, I joined the activities with families and teachers and rotated with

them through the sessions, which led me to step back and become less of a participant and more of an observer in the learning setting.

Being involved in the process of design and implementation in these STC workshops was enlightening for me as I realized how strongly these STC workshops were connected with my changing and evolving identities as a former elementary school teacher in Turkey, an emerging educational researcher, and a teacher educator in the United States. Being present in the STC workshops throughout these three years, I saw the parents' great enthusiasm for not only supporting their children's science learning but also for their own science learning. I heard fathers asking how they could find resources or scholarship opportunities for their children so that they could be more proactive in their children's college preparation. Mothers indicated that they were willing to do anything to make sure that their children would succeed in school as they shared their stories about having partners who still live in a different country, but the family viewed this arrangement as a necessity to send their children to American public schools to succeed in life. Parents talked about how they grew up in Mexico, why they did not get to go beyond the fifth grade, and how much they were willing to do whatever it takes to provide their children with better educational opportunities that they were not afforded. I witnessed parents who stood up during the lunch and shared their thoughts and thanked everyone many times for those learning opportunities that were provided for their children in the STC workshops.

While I worked with Latino emergent bilingual students and their families, I remembered myself as a third-grade private school teacher who was hesitant and scared to talk with parents, as if they were enemies trying to judge my profession at every opportunity. Under the influence of the school administration, I remember regarding them as my customers that I had to satisfy so that they would keep sending their children to the school where I was working. It was through

the STC workshops, I became curious to learn more about what kinds of roles families could play in their children's learning and how teachers could support families and involve them in their children's learning, questions I did not have during my teaching years in Turkey. What about the teachers? What did they think about families' participation in the STC workshops? How did being present in those workshops through these years influence their roles as educators in their relationship with their Latino emergent bilingual students and their families? How could we use this knowledge to support all pre-service and in-service teachers and school administrators, and empower students and families who could benefit from support? These are the questions that motivated me to conduct a study on secondary science teachers who regularly attended STC workshops.

The STC workshops were not the only spaces for me to interact with the teachers. Through different components of the LISELL-B project, teacher professional development workshops, summer student academies, and student assessment sessions, I developed a sincere relationship with most of the teachers who were consistently involved in several aspects of the project. In those spaces, we shared daily happenings in our lives, our concerns and angers, frustrations, and happy moments and wishes affecting us in our daily basic interactions with one another. During these intimate conversations, teachers shared how they suffered from the lack of administrative support to attend to the education of their emergent bilingual students. I saw teachers' anxiety being raised, based on how their students performed on standardized student examinations and how they performed in comparison to other county schools, but not based on what their students learned through the year. Teaching to the test by covering as much content as possible given the time was the main pressure that was put on the teachers, especially on those whose teaching content (science) was tested by state-mandated assessment programs.

I think exploring teachers' understanding in working with their Latino emergent bilingual students and their families in the STC workshops is pivotal, especially within the atmosphere of the schools they are working in. Reading through the arguments in the current educational literature during my doctoral studies, I could clearly see that these teachers' working conditions in their respective schools were not unique. They reflected the problematic educational structure in the United States in which schools claim to be neutral institutions that are committed to providing equal education for all students without any consideration of the possibilities and challenges their racial, cultural, and social differences and societal conditions offer. Current teachers work under the notion that schools are places of businesses where students are filled with information and deficiencies are fixed, but with no intention of understanding who the students are and where they come from (Nieto, 2013). As Delpit (1995) asserted more than two decades ago, "We all carry worlds in our heads, and those worlds are decidedly different. We educators set out to teach, but how can we reach the worlds of others when we don't even know they exist?" (Delpit, 1995, p.14).

Theoretical Background of the Problem

Too often, family-school-community collaboration is viewed as a supplementary activity that is independent from the main activities of effective schools (Mapp, 2012). However, as Freire (1998) argued "the school cannot abstract itself from the socio-cultural and economic conditions of its students, their families, and their communities" (p.62). The unfortunate reality is that the American public school system often seems to function contrary to this idea. Current policies in public schools in the United States insists on measurable and technical principles of learning, such as standard- based instruction and high-stakes assessments. Questions regarding issues of power and inequality and multicultural and multilingual funds of knowledge and how

these frame individual student and family experiences in classrooms, for example, are often absent in such formal educational settings. Raising the awareness of the fundamental role that local families and communities might play in educational pathways in high quality public schools in the United States entails a new level of commitment and reevaluation of current educational policy and practices around family-school-community interactions.

As a matter of fact, researchers, education leaders, and policy-makers have long emphasized the role of family-school-community partnerships as a means of increasing academic achievement, especially in schools identified for improvement (No Child Left Behind [NCLB], 2002; Henderson & Mapp, 2002; Jeynes, 2012; Wang & Sheikh-Khalil, 2014; Every Student Succeeds Act [ESSA], 2015). As in other countries, in the United States, numerous local, state and national education reform initiatives have been framed to push this agenda (Cutler, 2000; Mapp, 2012). For example, family-school partnership was one of the six targeted areas in the Elementary and Secondary Education Act [ESEA] of 2002— otherwise known as NCLB— and its latest reauthorization (ESSA, 2015). As a result, standards for the teaching profession were extended, and family-school collaboration was incorporated as a teaching competency in many professional associations (Kroeger & Lash, 2011). In a similar vein, the Family Engagement in Education Act [FEEA] of 2011 and its reauthorization of 2015 required local school districts and schools receiving title 1 funding to develop family engagement policies. For example, the FEEA of 2015 required local educational agencies to “train and support superintendents, principals, and teachers to fully engage families in the education of their children” (p. 25).

Language of family-school policies

In spite of this family-school partnership emphasis, the neutral language of these policy initiatives and increasing demands on performance measure of learning likely contributed to a

lack of common ground between schools and families when it comes to everyday practice. While the educational reform initiatives in the United States embrace collaboration, believing that joint effort between students' different environments enhance student learning, these policy documents mostly speak the language of consumerism and individualism, positioning parents as accountable agents in competing economies (e.g., via National standardized tests and school choice). In many ways, these policy documents are contradictory; this confusion has the potential to weaken the implementation process for family-school collaboration efforts. What is more, existing policies in the country contradict themselves as they frame teachers' role as "informers" under the language of partnership and provide insufficient training opportunities for in-service teachers to partner with parents. The researchers in the United States have recently brought to the surface the weak effects of partnership policies on parent-school relations and their limited implementation processes (Mapp, 2012; Lavery, 2016).

As another concern, the implementation of policy frameworks for school-home partnerships will likely be insufficient for a meaningful change as long as they frame a narrow narrative of partnerships. In these policy documents, parent-school partnership "is treated as a social fact on neutral terrain rather than as a socially constructed phenomenon on the contested terrain of schooling" (Auerbach, 2007, p.251). Families' roles are often defined based on a restricted vision, mostly White middle-class models of participation, such as helping with homework, attending parent-teacher conferences and volunteering (Crozier, 2001; Auerbach, 2011; Johnson, 2014).

This narrow frame of family-school policies is highly problematic, because public schools in the United States are very different places than they were 25 years ago (Nieto, 2013). While the mass movement of people across the world has led to tremendous demographic

changes, the nation's elementary and secondary classrooms are filled with many students from a wide range of racially/ethnically/linguistically diverse backgrounds. In particular, the United States accommodates the largest immigrant population, with 23 million immigrants, making up 19 % of the world's total number (United Nations Department of Economic and Social Affairs (UN DESA), 2015). According to the most recent federal data available, 10 % of the students in U.S. schools represent backgrounds other than English speaking, mostly coming from Latin American countries (U.S. Department of Education, 2017).

Given the changing demographic of families in the United States, a narrow vision of family-school partnership holds limited applications for the concrete situation in contemporary society. As this approach views family-school-community interactions as a set of recommended practices, it fails to account for its dynamic and multidimensional features that can change across different venues and different time spans (Carreon, Drake & Barton, 2005). Students and their families bring to classrooms and schools a variety of rich experiences, aspirations, needs, and resources. Seeing that the current approach overlooks nontraditional efforts that diverse families might make in their child's learning, the policies can influence teachers to regard families whose practices do not match those of European American families through deficit lenses (Lareau & Horvat, 1999; Freeman, 2010; Baquedano-Lopez et al., 2013).

Teachers' Deficit Perspectives

Not surprisingly, the deficit view by many teachers of their immigrant students and their families is well documented in the literature (Wainer, 2004; Shields, 2004; Elberly, Joshi & Konzal, 2007; Adair, 2013; Soutullo, Sanders-Smith & Navia, 2016). For example, Adair (2013) worked with 50 preschool in-service teachers in five different cities of the United States that had long histories of immigration. As a part of the broader Children Crossing Borders (CBB) study

that was conducted across five different countries under the direction of Joseph Tobin, Adair examined the teachers' reactions in relation to newly arrived immigrant families in their respective schools. Utilizing video-cued ethnography, the researcher and colleagues video recorded a typical day of a preschool classroom accommodating largely immigrant children; then teacher participants within focus group interviews responded to the pedagogical environment and practices shown in the video. Adair found that most of the teachers blamed immigrant families for turning their communities into dangerous places. They tended to be detached from immigrant families and held them responsible in trying to fit in their local community, but some teachers valued the presence of immigrant students in the classroom.

In another study that conducted focus group interviews with 21 in-service teachers serving children from preschool to fifth grade, Elberly and colleagues (2007) found that the teachers expressed negative judgements about non-European American parents' child-rearing strategies and viewed them as not caring for their child's education. Soutollo and colleagues (2016) investigated some barriers that elementary school teachers perceived as preventing partnership between school and immigrant families. Through interviewing 18 in-service teachers who were enrolled in a graduate program in early childhood education, they found that teachers identified several barriers to quality family-school interactions. The teachers perceived barriers that originated from schools' inefficient strategies to communicate with parents and barriers originating from the immigrant parents themselves for not being responsive to school invitations and barriers originating from parents' lack of resources necessary for their child's school progress. Interestingly, Soutollo and colleagues found that teacher participants expressed few concerns regarding their own attitudes that might prevent family-school partnerships.

Anti-Immigration Discourse in Policy Documents and Mass Media

In general terms, I think the above findings are not surprising as we know that teachers are also part of the society; they mirror the public discourse that manifests itself through the national policies and mass media. It is not very difficult to imagine a deficit discourse grounded education of immigrant students as teachers are left to deal with the conflicting perceptions that target immigration in addition to the huge disconnect between educational research and public policy (Mcdermott, Sheton & Mogge, 2012; Alleksaht-Snider, Buxton& Harman, 2012).

In addition to the narrow frame of many family-school policies, today's in-service teachers have been influenced by the restrictive language policies in America's public schools as some states, such as Arizona and California, have prohibited bilingual education with an English-only, assimilationist, rationale (Macedo, Dendrinos & Gounari, 2003; Goodwin, 2010; Civil, 2012). More recently, Georgia and Alabama authorized highly disputed anti-immigrant laws posing incredible challenges for immigrant students and their families. In Georgia, this has manifested itself through the passing of 2010 Georgia University System Board of Regents that bans undocumented students from enrolling in Georgia's five qualified state universities (Acosta, 2013). Today's pre-service and in-service teachers have come of age and are preparing to enter the teaching profession at a time of remarkable controversies over immigrant policies that continue to rage under the Trump administration since inauguration. The new administration recently released a burst of executive orders targeting the immigrant population. For example, the current administration's executive orders suspended admission of refugees seeking to resettle in the United States and issued deportation of undocumented immigrants associated with crimes (The White House, 2017), leaving those millions of undocumented immigrant families in the

United States (Lopez & Bialik, 2017) to grapple with a profound level of uncertainty about their futures.

In addition to harsh immigration policies, teachers have grown up amidst the conflicting messages that are embedded in the national media that has expressed hostility or ambivalence toward immigrant populations. Despite the increasing number of positive portrayals of immigrant families in the mass media, the images of those families as “uninterested, complacent, sub-literate, lazy, and negligent” (Compton-Lily, 2004, p.16) still remains within the American society (Orbe & Harris, 2015). Sexualized images of Latino adolescents in the entertainment media (Yosso, 2002) and depiction of African Americans and Latinos allegedly involved in various crime roles in newspaper reports (Dixon & Williams 2015); and problematic narratives of interracial marriages in broad-reach magazines (Luther & Rightler-McDaniels, 2013) and television shows (Washington, 2012) are well documented in the recent literature.

Need for Teacher Education for Family-School-Community Partnerships

Teachers are also human beings; they receive the same messages as others do. They likely enter teacher education programs with many preconceived notions and assumptions about families that are different from their own. However, the role of teacher education and professional development programs should be to help teachers to rethink those assumptions and challenge them, as they consider ways to recognize and build on all families’ cultural, social, and linguistic funds of knowledge.

It is clear that today’s pre-service and in-service teachers have to be equipped with knowledge, tools, and resources in order to work effectively with students and their families in socially and culturally complex classrooms (Delgado-Gaitan, 2012; Mcdermott et al., 2012). Teachers should be aware of and responsive to varying cultural experiences and linguistic

resources that students bring to the classroom which have great potential to be used as a tool to promote student learning. Use of such resources requires that teachers learn about communities where their students reside, have an understanding on how to partner with their students' families, and recognize the multiple approaches to school-family-community interactions, which can contribute to students' education (Calabrese-Barton, Drake, Perez, St. Louis, & George, 2004; Freire, 2005). There is a reason for optimism because research has confirmed that it is possible for teachers to cultivate those capabilities essential for such effective partnerships (e.g. Gallo & Wortham, 2012; Kroeger & Lash, 2011; Johnson, 2014).

Despite its potential, there still remains a long-standing concern of many researchers indicating a lack of training opportunities in many teacher education programs to help teachers to develop teacher competencies that are necessary for them to effectively work with diverse families (Greenwood & Hickman, 1991; Kroeger & Lash, 2011; Mapp, 2012; Tirell-Corbin & Cooper, 2014). Ironically, many teacher education programs actually do little to prepare pre-service and in-service teachers in this area, while most of them declared social justice as a foundation for their work (Zeichner, Bowman, Guillen & Napolitan, 2016). Except early childhood education and special education departments, most pre-service teacher education programs do not require candidates to take a course specifically on family-school partnerships; if offered, it is mostly left to teacher candidates' decision (Markow & Martin, 2005; Flanigan, 2007; Uludag, 2008; Zygmunt – Fillwalk, 2011; Bruine et al., 2014). Family-school partnership is often deemed as a subject to be addressed as part of a few required courses, rather than a specific course per se.

Significance of the Study

Not only is there not enough teacher preparation in the area of family-school collaboration; there is little research about the programs that can provide such opportunities. Research studies recently started to address ways to prepare teachers to partner with families and work with the larger community. However, it is fair to say that the current intervention-based research projects on family-school relations are still restricted to early childhood and elementary education levels. Studies focusing on secondary education teachers in this area comprise rare exceptions in the literature (Ferrara, 2009; Warren, Nofle, Ganley & Quintanar, 2011; Symeou, Roussounidou & Michaelides, 2012; Johnson, 2014; Zeichner et al., 2016). Another point to highlight is that most research attention has been given to pre-service teacher preparation relating to family-school relations; lack of emphasis exists regarding in-service professional development opportunities in this area. The research studies focusing on in-service preparation addressed this to a certain extent, but much more research is needed in this area as pointed out by several scholars (Bernier, Allexaht-Snider & Civil, 2003; Gonzalez, Moll & Amanti, 2005; Buxton et al., 2017).

Furthermore, the majority of family-school intervention-based research has been focused on teachers' experiences with families in the general sense; recent studies that examined family-school interactions in a science content context have been limited (Hammond, 2001; Upadhyay, 2009; McCollough & Ramirez, 2012; Buxton, Allexaht-Snider & Rivera, 2012; Ramirez, McCollough & Diaz, 2016). As structuring opportunities for teachers to learn alongside their students and parents while working with families has great positive potential (Bernier et al., 2003; Buxton et al., 2017), it is important that future research include more intervention projects

that involve pre-service and in-service teachers to support their work with families in science (and other content areas).

Statement of Purpose

The STC bilingual family workshops were one of the few research approaches bringing secondary in-service science and ESOL teachers, Latino immigrant students, and their families together in a science learning setting to explore new spaces for parent-student-teacher collaboration. The workshops were one component of a larger NSF-funded three-year-long research project, Language-Rich Inquiry Science with English Language Learners through Biotechnology (LISELL-B), aiming to enhance Latino middle and high school students' science learning and college preparation (Buxton, Alleksaht-Snider & Rivera, 2012). In the STC workshops, Latino families, teachers, and the project researchers engaged with science activities and involved in bilingual discussions around general academic and science specific expectations and resources required for post-secondary education (Buxton et al., 2017).

As a graduate research assistant who has worked with the LISELL-B project for three years, I aimed to explore what happened when in-service secondary science teachers came together with Latino parents for their children's science learning in the context of STC bilingual family workshops. The overarching question guiding this study was: *How did secondary science teachers conceptualize the ways in which their participation affected their perspectives and practices about working with their Latino students and their families?* Building upon the Freirean notion of dialogic education, the research presented here was initiated to explore the learning experiences and associated practices that developed or failed to develop when teachers interacted with their Latino students and families in this informal science learning space. By exploring experiences of teachers and families, I aimed to learn a lesson, if any, to support

educational practitioners in their working with immigrant families in adolescent children's schooling and contribute to the growing body of literature examining education for pre-service and in-service teachers about working with socially and culturally diverse families.

As Nieto (2013) stated earlier "the limits are real, but so is the power of hope" (p.18). Even when power is imbalanced and oppressive structures prevail through monolithic and monocultural classroom practices and relationships that maintain the invisibility of immigrant families, I believe that there are always alternatives and possibilities of change that can make things better. "In other words, though I know that things can get worse, I also know that I am able to intervene to improve them" (Freire, 1998, p. 53). I think this study is very unique, as it looks for possibilities of change in three areas (indicated above) that need be addressed more in the family-school-community interactions literature: (a) secondary teachers' experiences with immigrant families; (b) an in-service teacher professional development program regarding family-school relations; and (c) teacher and family collaboration regarding the discipline of science. In this sense, this study attempted to answer some of the questions that remain regarding those areas, especially in the geographical location within which the study takes place.

Organization of the Dissertation

In the following chapter, I provide a detailed description of the conceptual framework that guided my research study, Freire's (1970, 2005, 2013) notion of dialogic education and its essential principles: humility, critical awareness, care and hope. I also discuss the work by Nieto (2003, 2005, 2014) and Luttrell (2013) whose ideas are complementary to Freire's thoughts on education. Chapter 3 begins with the review of literature on national policies relating to family-school relations. Then, I provide a brief overview of theoretical and conceptual considerations guiding recent literature on teachers' experiences with families. Next, I discuss

recent literature examining teachers' perspectives on family-school relations, and teachers' self-efficacy and practices in working with families in the United States. In addition, I provide a systematic analysis of intervention-based research projects targeting teachers' learning in their work with families in general and in particular science content in national and international contexts. In chapter 4, I explain the research design and methodology, including a detailed description of data analysis procedures.

In chapter 5, I share my findings from a single case study focusing on a Latino immigrant secondary science teacher's experiences with Latino parents in the context of their children's science learning in the STC workshops. I discuss what impact the workshops had on her perspectives and her practices regarding working with her Latino emergent bilingual students and their families. In Chapter 6, I provide my findings from a multi-case study examining the experiences of four European American secondary science teachers with Latino parents in the context of their children's science learning in the STC workshops. Engaging with case-by-case analysis and then cross-case analysis, I outline how the workshops affected these four teachers' perspectives and practices in relation to working with Latino emergent bilingual students and families.

In chapter 7, I conclude with implications of this dissertation study for pre-service and in-service teacher education programs, policy makers, and future research connecting disciplinary learning with family-school relations. Finally, I briefly explain the limitations of the study and conclude with a synthesis of the key points made throughout this dissertation study.

CHAPTER 2

CONCEPTUAL FRAMEWORK

“Who am I becoming?” is a question that I have been asking myself since I started my doctoral studies. Nevertheless, navigating a variety of theorists and high-level theoretical orientations, over the course of the semesters was an eye-opening experience for me. Since engaging with diverse ways of making sense of the world, I feel in my bones that I am not the same person anymore. As St. Pierre (2001) put it:

A different theory, a different discourse, different statements and questions about living, different grids of normalcy and regularity could produce me differently, for better or worse. Theory was no longer some abstract, impenetrable discourse “out there” but a powerful, essential, personal tool that I needed to study for my own good (p. 142).

For now, critical theory occupies a central place in my intellectual life. It has influenced the way I see the world and make judgments about it. As St. Pierre (2001) said, “I began to understand that if I did not like the way I had been subjected, theory could perhaps help me resist and refuse that violence” (St. Pierre, p.142). I found myself in agreement with critical theory because it moves beyond describing “what it is,” to the direction of “what could be” (Glesne, 2011, p. 9). Critical theory is oriented toward critiquing and changing society as a whole—a theory that provides the descriptive basis for social inquiry aimed at decreasing domination and increasing freedom in all their respective forms. According to critical theories, the subject is structural, always part of the social world; it is not born into freedom, but instead into repressive symbolic systems. However, the subject is also viewed as thriving and active, producing and

reproducing, within the current social system; the subject is able to transform; therefore, it is both creator and product of history.

As an emerging researcher and teacher educator interested in social justice issues in education, I build my theoretical stance upon the work of Freire (1970, 1992, 1998, 2005, 2013) as well as critical philosophers, teacher educators, and researchers whose work can be said to be either influenced by or complementary to Freire's thoughts on education. I was influenced by the work of Nieto (2005, 2014) and Lutrell (2013) among others to be discussed in this chapter.

Freire, a Brazilian educational philosopher, is chiefly considered as "the inaugural philosopher of critical pedagogy" (McLaren, 2000), which is blended with the tenets of critical theory, and the Neo-Marxist philosophy of the Frankfurt school (Giroux, 1988; Burbules & Berk, 1999; McLaren, 2003). Critical pedagogy was developed particularly as an educational response to oppressive power relations and inequalities existing in formal educational institutions. In the name of critical pedagogy, Freire (1970) called for opportunities for strengthening teachers', students' and adults' knowledge regarding social and political realities that influence individual experiences. For Freire (1970), the central elements of critical pedagogy were dialogue, critical thinking, and conscientization. Emphasizing the interrelation of theory and practice, he insisted that theory should uncover the long-held antagonism of social conflicts in our daily lives so that we can produce space for liberation. In this study, apart from a general analysis of critical pedagogy or critical theory, I will call attention to Freire's (1970, 1998, 2005, 2013) notion of dialogic education and its relation to the concepts of humility, critical awareness, love/care, hope, and I will discuss the importance of dialogic education as it relates to the study.

Scientific Knowledge within a Dialogical Education

Before I begin a discussion of Freire's notion of dialogic education, I want to provide the definition of education and scientific knowledge that guided this study. Freire (1998) maintained that "the education of women and men can never be purely instrumental. It must also necessarily be ethical" (p. 57). He opposed the Cartesian view of scientific knowledge, seeing education as a neutral activity based on unified and reliable foundations and perfect certainty. In the Cartesian view, true scientific knowledge requires a complete absence of doubt and elimination of contingency. Freire called this the banking model of education, a model in which the teacher's role is transmitting knowledge to students and the student's role is to receive and accumulate such knowledge as he or she navigates through the educational pipeline. Rather, Freire (1970) recognized reality "as process, as transformation, rather than as a static entity" (p. 81). True education is the creation of a safe space for co-construction of knowledge between teachers, students, and their communities. Teaching is to be able to analyze conflicting accounts of reality and to unmask their ideological foundations within an anti-positivistic approach. As Freire (1998) stated, "If education were neutral, there could be no difference between people in their individual or social contexts, whether that be their style of politics or their value systems" (p. 101). Thus, it is impossible to act upon an ethical education unless it is guided by the knowledge that students bring from their homes and communities. A Freirean perspective on learning and teaching as embedded in social relationships, built upon students' interests and grounded in students' lives and communities that view the differences not as a problem to be solved but as rich resources to engage students' learning in the classroom, frames the research I conducted.

Dialogue is a Process of Learning and Knowing

Freire conceptualized teachers as researchers who aim to learn and respects students' lived experiences and culture in an attempt to eliminate dehumanization and recover humanization. This requires teachers to involve themselves in dialogues with students and learn from them. Such a structure might open space for teachers and students to recognize and critically think about their own circumstances and the world in which they live.

For Freire it is only through true dialogue that teachers and students develop critical understanding of their experiences with the world—a world that never “exists as really apart from man,” with the understanding that man has never been “isolated, independent and unattached to the world” (p. 69). This is particularly crucial for Freire, considering that “the more people unveil this challenging reality which is to be the object of their transforming action, the more critically they enter that reality” (p. 38). However, he warned that recognizing one's social realities is not enough to bring about social transformation, seeing that it does not certainly pave the way to “solidarity with the oppressed” (p. 34). According to Freire (1970), a manifestation of humanization was the key to solidarity with marginalized group members; it is a struggle to be recognized as human, and the educator who is partly responsible for social justice must start by recognizing his students as human beings. He wrote,

The oppressor is in solidarity with the oppressed when he stops regarding the oppressed as an abstract category and sees them as persons who have been unjustly dealt with, deprived of their voice, cheated in the sale of their labor--when he stops making pious, sentimental, and individualistic gestures and risks an act of love, in its existentiality, in its praxis. (pp. 34-35)

According to Freire (1970), humanization occurs through true dialogue: “without dialogue there is no communication, and without communication there can be no true education” (81). In order to enter into a productive dialogue, Freire (1970) insisted that the educator must “understand the structural conditions in which the thought and language of the people are dialectically framed” (p. 86). To this end, teachers, from a researcher’s standpoint, explore materials and themes on the basis of their emerging understanding of students and their sociocultural backgrounds (Souto-Manning, 2010). Here, Freire (1970) alerted educators to potential dangers of misunderstanding regarding the aim of the investigation, while considering that “the danger lies in the risk of shifting the focus of the investigation from the meaningful themes to people themselves, thereby treating the people as objects of the investigation” (p. 99). The examination of thematic material entails “the investigation of the people’s thinking—thinking which occurs only in and among men together seeking out reality” (Freire, 1970, p. 100). Such examination is crucial for teaching, partly because educators become aware of how students make sense of the world (A. Freire, 2000). So, teachers are able to envision pedagogies that can move them to discover “what they do not know and to identify what they want to know” (Denzin &Lincon, 1994, p.166).

As Allen (2007) indicated, “dialogue is one of the most difficult things in the world to achieve. Yet it is central to our very humanity” (p. 71). It is the one thing that differentiates human nature from that of the animals. “Animals, submerged within reality cannot relate to it; they are creators of mere contacts. But man’s separateness from and openness to the world distinguishes him as a being of relationships” (Freire, 2013, p. 3). According to Freire, humans are thinking beings who cannot engage with deeper thinking alone. Thinking becomes possible in relation with other human beings. “There is no longer an ‘I think’ but ‘we think.’ It is the ‘we

think’ which establishes the ‘I think’ and not the contrary” (Freire, 2013, p. 121). Here Freire insisted that knowledge is developed in an intimate association between human beings and the world. The role of educators should be to communicate knowledge, instead of issuing a communique, as the latter only gives rise to “domestication” of students under the act of extending teacher knowledge.

Legitimizing students’ and families’ voices is essentially political; as Nieto (2013) indicated, “teaching and literacy is about whose story is told” (p.15). It is crucial to develop conditions for changing hierarchical power relations between teachers and families so that those voices can be heard. It is about creating a community of learners where teachers become students and families become teachers (Freire, 1970). However, changing the power structures between teachers and families does not mean leaving all of the power in the hands of students and their families. As Freire (1992) clarified, this “does not mean denying the indispensable need for specialists. It only means not leaving them as the exclusive ‘proprietors of a basic component of educational practice” (p. 94). Just as “dialogue between teachers and students does not place them on the same footing professionally” (p. 101) so too does dialogue between parents and teachers does not require them to fully switch their respective roles. What can occur, though, is that teachers can develop a greater awareness of who their students and families are, what they value, and what they hope for, whereas families can understand what teachers expect from them. This would create grounds for mutual understanding, especially when teachers are not familiar with the experiences of their students.

Freire (1992) elaborated that “dialogue does not level them, does not ‘even them out,’ reduce them to each other. Dialogue is not a favor done by one for the others, a kind of grace accorded. On the contrary, it implies a sincere, fundamental respect on the part of the subjects

engaged in it” (p. 101). Here Freire criticized those who reduce dialogue in education to a mere conversation between two or more people, thus leaving it in a psychological sphere, such as a group therapy. This approach does not move beyond creating a comfort zone. Instead, he referred to dialogue as a way of “learning and knowing” (Freire & Macedo, 1995, p. 379). In this view, “dialogue is never an end in itself but a means to develop a better comprehension about the object of knowledge” (Freire, 1970, p. 18). It involves reflection and action to nurture an educational environment for marginalized students and families so that learning also happens for them. It is only through sustained dialogue that mutual understanding and positive relationships flourish.

In furthering his discussion regarding dialogue, Freire (2013) suggested that human beings could be conscious of “their social and political responsibility only by experiencing that responsibility” (p. 32). In order to enter into dialogue, teachers should understand the sociocultural and sociopolitical realities of the students that they teach. In this sense teachers should be part of the community where the school is located. Being part of the community, as Nieto (2013) indicated, does not require teachers to live within that community, but rather suggests that teachers participate in community events. As Freire (2013) suggested, this may occur through “intervention in the destiny of their children’s schools, in the destinies of their trade unions and places of employment through associations, clubs, councils, and in the life of their neighborhoods, churches and rural communities by actively participating in associations, clubs, charitable societies” (p. 32).

Essential Ingredients of Dialogic Education

Freire (2013) emphasized certain important aspects of dialogic education: humility, love/care, hope, and critical awareness. Given this, dialogic education cannot be accomplished unless one engages with these aspects. In contrast, anti-dialogue imposes a vertical relationship between human beings. It involves a process of engaging with others as an object in the absence of care, humility, hope, and critical awareness. Thus, “anti-dialogue does not communicate, but issues communiques” (p. 43) much like Freire’s banking model of education.

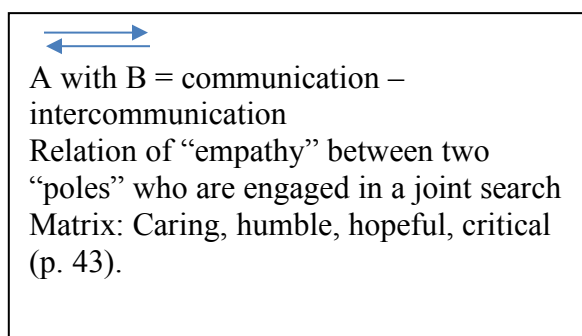


Figure 1: Dialogue.

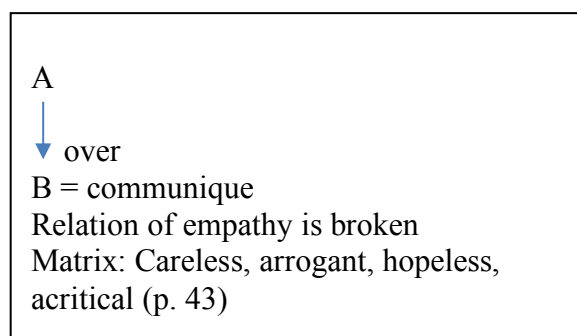


Figure 2: Anti-dialogue.

Humility

According to Freire (1970, 1998, 2005), one essential ingredient of dialogic education is humility. He affirms that humility means being conscious of the incompleteness in the state of the human being. It is a kind of realization that would allow humans to immerse themselves in a process for constant research. He stated, “Women and men are capable of being educated only to the extent that they are capable of recognizing themselves as unfinished. Education does not make us educable. It is our awareness of being unfinished that makes us educable” (Freire, 1998, p.58). In this sense, humans build and rebuild their knowledge, as they lay the groundwork to learn more.

In relation to teaching, Freire argued that one cannot isolate teaching from learning; the two necessitate one another. It rests on the recognition that one may have knowledge of

something, but one may not be master of everything. In furthering his argument, Freire (2005) fulminated against those assuming that science should be exempt from uncertainty “because they take science for the ultimate truth, outside of which nothing counts, believing that only science can produce certainty. Those immersed in scientism cannot be tolerant, though that fact should not discredit science” (Freire, 1998, p. 42). Those teachers who assume that they are the owners of absolute truth, take away the time afforded for students and make it their own. Freire (1998) called this “silent listening,” when the teacher undermines her own capacity to listen and in turn shuts down students’ voices in the classroom. Rather, teaching requires sustained openness to learning from others in that it creates conditions for a dialogic education.

Critical Consciousness

Critical consciousness is another fundamental aspect of Freirean dialogic education. For Freire, critical consciousness is “learning to perceive social, political, and economic contradictions and taking action against the oppressive elements of reality” (1970, p.17). Developing critical consciousness of a structural inequality entails investigation, reflection and dialogue, considering that “reading the world always precedes reading the word, and reading the word implies continually reading the world” (Freire & Macedo, 1987, p.35). Thus, one cannot become part of the process of intervention in the world unless she identifies some contradictions and questions the reasons for and consequences of such contradictions.

According to Freire (2005), in order for teachers to develop critical consciousness, they have to have access to contexts and experiences that challenge the conventional wisdom of education and engage in serious dialogue about their own way of viewing education. Conventional wisdom regards education as neutral activity based on unified and reliable foundations and perfect certainty and centers teaching around standardized curricula and

standardized performances. Confronting different perspectives, including different ways of looking at knowledge and truth, teachers can develop more nuanced understanding of complex issues in education. By involving themselves in consciousness-raising dialogues in diverse communities and learning contexts, Freire expected that teachers could reflect upon their long-held assumptions about what actions constitute learning and teaching and whether they limit their effectiveness on student learning. According to Freire (2005), this recognition is crucial for teachers, so they can form new identities for themselves and their students coming from diverse cultural and linguistic backgrounds. In this way, teachers can see the value of leveraging other ways of knowing and doing in the classroom by positioning students at the center of teaching practices.

Loving and Caring for Students

For Freire, dialogic education comes with love for the world and human beings and hopes to transform hierarchical power relations in all forms. He believed that critically engaging with the world in a true dialogue by means of an “act of creation and recreation, is not possible if it is not infused with love” (p. 78). For Freire, love and care is the foundation for dialogic education and also for the dialogue itself. It is not a mental state detached from the everyday world. However, it sounds old-fashioned when we talk about love and teaching in a same sentence, as if the profession requires teachers to abandon their emotions. However, teaching is different from other professions; teachers engage with human beings through their daily work, not with material things deprived of feelings and experiences. While teaching is a profession that requires certain sets of skills, knowledge, and extensive preparation, like engineering or medicine, it also involves relationships between teachers and students. In this manner, education cannot be thought of as a space where cognition and emotion are alienated from another.

In any discussion of love and care, it is important to clarify what these terms imply in the educational sphere. Here Freire (2005) warns us not to confuse care and love with a “coddling” in terms of education, as this assumption “reduces teaching to a feel-good process” (p. 26). Instead, he defined care outside the limits of empathizing or feeling of mercy for another. Caring and loving means faith, courage, and respect for students and acknowledgement for the strengths they bring to the classroom; they are a very important part of the intellectual process for effective education. Giving care is being careful and attentive to individual student needs without supposing to know what the students’ needs are; thus, it requires a dialogue between students, parents, and teachers.

Research demonstrated that love and care is a significant matter for student attendance and teacher retention, an essential condition facilitating the community of learners (Valenzuela, 1999; Nieto, 2003, 2005, 2014; Luttrell, 2013; McGovern & Devine, 2016). For example, in a public school with a highly diverse student population, Luttrell (2013) asked 5th grade students to take photographs of “what matters most” for them in their schools, homes, and communities, giving them disposable cameras to use for this purpose. Then in small discussions, each student shared five photographs with his or her peers and teachers, photographs that best spoke for their lives. It is through these discussions Luttrell found that “caring for” and “caring about” were the center of attention through students’ photographs and commentaries. Students shared the value of helping each other, sharing a picture of a teacher making sure they understand everything in the classroom, a principal who does “great job for caring about school” (p.299), or a school secretary because “she helps [them] out when [they] have a problem in class.” Students presented images of a mother in a kitchen cooking or mother/father in a work uniforms (some of them work in second shift jobs) to express their gratitude of how much their parents sacrifice for

their wellbeing. Here, Lutrell demonstrated that being cared for and caring for are essential to children's learning not only in the classroom but also among the members of the community.

Nieto (2003, 2005, 2014) conducted several studies with mostly urban schoolteachers across the United States to learn what kept them in the profession for a long period of time. She conducted focus group inquiry sessions with eight high school veteran teachers who were nominated for several teaching awards and recognized for their successful work with students from diverse backgrounds. Nieto was wondering why they persist in spite of problematic conditions of public schools where teachers are under the pressure of standardized testing, restricted curriculum, and teacher accountability with low resourced school conditions, low teacher salaries, and lack of respect. Analyzing written data from inquiry group sessions and participant observations, Nieto (2005) identified seven themes that describe the reasons that kept those veteran teachers in the profession. These themes were, autobiography, love, hope and possibility, anger and desperation, intellectual work, democratic practice, and the ability to shape the future. Problematizing current definitions of highly qualified teachers that focus narrowly on promoting high levels of subject matter and pedagogical knowledge without taking into account other important aspects of teaching, Nieto (2003) argued that schools are not merely places for enactment of planned actions; instead, and importantly, they are places for the formation of relationships of trust that are crucial components of teacher retention and student attendance and learning.

The findings in the above studies run counter to dominant educational discourse that values individual achievement over collaboration between student-family-community. Those findings run counter to the notion that defines highly qualified teachers based on students' test scores that take away teachers' energy and time to attend to students' social, emotional, and

pedagogical needs necessary for promoting student learning in the classroom. Freire, Lutrell, and Nieto have reaffirmed that a sense of belonging is not a luxury, but rather it is a core psychological human need. We need to belong to one another, to our friends, teachers, families, and the communities in which we live to find meaning in life and strive for it. In this regard, teachers' care is critical in building a community of learners; it is key in nurturing a sense of belonging among young people, and this is even more important for those who are different from the mainstream culturally, linguistically, and socioeconomically (Nieto, 2003).

Hope

According to Freire (2015), hope is yet another crucial element of dialogic education. Because, our existence in the world is not merely limited to witnessing the occurrence of events, whether we intervene or not, we play a role in what happens in the world. In this sense, we are “equally subjects and objects in the historical process,” not only ones adapting to the world in an “unchangeable situation” (Freire, 1998, p.73). For example, increased human understanding regarding earthquakes paved the way for the development of technologies that made buildings more resistant to earthquake destruction. While it is not possible to prevent earthquakes, we understood that we could minimize damages associated with it. This indicated that we can intervene in the world to the extent we believe that change would be possible. Having a dream is “a mover of history,” as “there is no change without a dream, there is no dream without hope” (Freire, 1992, p.81).

According to Freire (1998), hopelessness and despair are both the result and the source of a state of inaction or passivity. In the absence of hope, a struggle for radical change would be impossible. Without hope, “teachers are too often swallowed up by a system that is inequitable and hegemonic, that replicates power and privilege, and that rewards students according to their

identities and postal codes” (Nieto, 2013, p.15). Rather, it is hope that makes teachers enthusiastic and encouraged in their constant struggle and resistance to oppressive power relations so that they could enter a dialogue with their students and families. It is hope that can create a capacity to acquire the power through collective action essential for transforming schools into spaces where high-quality education is accessible for everyone.

We might think that without changes in broader sociopolitical contexts, teachers alone would not be able to move us beyond the current challenges we face in education. However, it is important that teachers maintain hope even when the real situation of schools may indicate the opposite. Educators should not discuss “whether education can or cannot accomplish, but to discuss where it can, how it can, with whom it can, when it can; it is to recognize the limits his or her practice imposes” (Freire, 2007, p. 64). For this reason, teachers cannot wait for these structural changes to take place. We desperately need more teachers and teacher educators who strive for social justice and democracy both within and beyond the walls of the classroom and to provide all students with more equal and high-qualified education.

Connecting Freirean Dialogic Education to Conduct of the Study

In previous sections, I discussed the Freirean notion of dialogic education and a number of conditions it involves, namely humility, care, and hope and critical awareness. I referred to a dialogic relationship among teachers, students, and families “who are immune to the bureaucratization of their minds and open to discovery and to knowing more” (Freire, 1997, p.99). As I indicated earlier, the dialogue in education that Freire spoke about is not a simple conversation between two or more people concentrating merely on individually lived experiences, rather it is a “process of learning and knowing” (Freire & Macedo, 1995, p.379) to facilitate more inclusive classrooms for all students. In this sense, I consider the notion of

dialogic education very helpful for imagining ways of fostering richer work between teachers, students, and parents that is critical for supporting students' learning in the classroom. That is, the notion of dialogic education may help us to inspire and excite other educators to design alternative contexts for teacher education that can disrupt aspects of the current dominant discourse governing public schools in the United States (Giroux, 2014).

Freire's analysis is even more relevant today, as the educational structure in the United States still suffers from maintaining Cartesian types of knowledge through standardized testing and restricted curriculum. We live in an era where oppressive power relations continue to thrive in our education and society through anti-immigration laws, English-only school policies, narrow frames of family-school partnership legislation reflecting practices of White middle-class families, and deficit public discourse of immigrant family in films, television programs, advertisings, and newspapers. Giroux (2014) defined this kind of education as a pedagogy of repression that characterizes students "largely by their shortcomings rather than by their strengths" and in doing so convinces them that knowledge and rights are limited to those who have power and privilege (p.494). I think Freire's work has the potential to re-conceptualize and change the ways in which the practices of schooling and research are enacted. It has the potential to show us what is really essential for teaching and learning, not the current national educational agenda of "test scores... rubrics or benchmarks or 'best practices' or teacher tests, but students and teachers and the future democracy in our nation" (Nieto, 2005, p. 11). Freire (1998) wrote:

My respect as a teacher for the student, for his/her curiosity and fear that I ought not to curtail or inhibit by inappropriate gestures or attitudes, demands of me the cultivation of humility and tolerance. How can I respect the curiosity of the students if, lacking genuine humility and a convinced understanding of the role of the unknown in the process of

reaching the known, I am afraid of revealing my own ignorance? How can I consider myself to be an educator, especially in the context of open-minded and enlightened teaching practice, if I cannot learn to live-whether it cost me little or much with what is different? How can I be an educator if I do not develop in myself a caring and loving attitude toward the student, which is indispensable on the part of one who is committed to teaching and to the education process itself? I can only dislike what I am doing under the pain of not doing it well. I have no reason to exercise my teaching function badly (p.65).

In the current paper, I use Freire's principles of dialogic education to understand secondary science teachers' engagement with Latino emergent bilingual students and their parents in the context of STC bilingual family workshops to contribute to the knowledge in the area of family-school relations. I believe that Freire's (1970, 1992, 1998, 2005, 2013) ideas described here provide a useful framework for understanding how a community-based science learning program with cross-cultural and dialogue-based learning interactions, such as the STC workshops, could serve as a context for teacher professional learning to support teachers in their work with diverse students and families.

Although Freire's ideas can fairly be described as revolutionary, it is his notion of dialogic education and its essential ingredients of humility, care, hope and critical awareness speak to me in this context of STC bilingual family workshops. As Freire (1997) states, "change is difficult, but possible" (p.64); we must look for the possibility of change in spite of all challenging conditions. All of these ideas articulated by Freire and the scholars who draw from him implicitly and explicitly advocate for profound transformation in the ideology and curriculum of teacher professional development programs to achieve quality of education for all students. Such programs should be oriented to see differences as not a problem to be solved but as rich

resources to engage students' learning in classroom. This is particularly important, given the current educational structures that often do not recognize students' home approaches as valuable contributions to their learning.

CHAPTER 3

LITERATURE REVIEW

In the first part of this chapter, I ground my discussion on what we need to know about family-school partnership policies in the United States that shape teachers' interactions with their students' families and communities. Then, I provide a brief overview of theoretical and conceptual considerations guiding recent literature on teachers' experiences with families. Next, I discuss recent literature examining teachers' perspectives on family-school relations and teachers' self-efficacy and practices in working with families in the United States. The literature that examines teachers' perceptions of the involvement of non-dominant parents in their children's education was shared in chapter 1 as I explained the background of the problem on family-school interactions in the United States. Finally, I present literature regarding how teachers have learned to work effectively with families in general and specifically in terms of science content in national and international contexts.

Family-School Policies in the United States

The increasing interest to improve family and school interactions sets the stage for examining fundamental assumptions about how national reform policies have influenced changes in the way school districts and schools are organized in the direction of family and school partnerships. While assumptions and practices on "parenting, teaching and schooling" might vary based on social and cultural contexts, the role of educational policies to influence those assumptions and practices cannot be ignored (Bennett, 2015, p. 5). This is especially important, partly because "what teachers and parents interpret they 'and others, should be doing' on behalf

of families in school is because of the ways laws and policies are written” (Kroeger & Bray, 2014, p.1). For instance, school approaches to family-school relations might differ according to how the central goal of education is framed – whether education is a concern of global economic competitiveness or social justice and equity for all students, or whether education is seen as the private interest of family or shared responsibility of the nation (Vincent & Martin, 2002; Bennett, 2015). In this respect, it is worthwhile to examine how the policies in the country frame family-school interactions and how they address equity in its changing society to gain an in-depth understanding regarding the impact of policies on teachers’ experiences with diverse families. With the above concerns in mind, I examine the history of changing policies and legislations concerning home-school relations and review studies evaluating their potential impact on non-dominant populations in the United States.

Examining the history of changing policy and legislation concerning home-school relations in the United States, the 1960s were the years when school-family interactions emerged as an awakening interest and began to be considered as a part of national policies across the nation and in most of the countries around the world (Byrne & Smith, 2010). This emphasis might be traced back to the Elementary and Secondary Education Act (ESEA) in 1965 and the Coleman Report in 1966 in the United States (Cutler, 2000).

In 1965 President Lyndon B. Johnson authorized the ESEA of 1965, otherwise known as the "War on Poverty" agenda. The ESEA was framed to allocate federal funding to low-income schools with low achieving students to close the achievement gap between children from working-class/poor families and those children who came from middle-class families. (Culter, 2000; Jeynes, 2011). To close the achievement gap, federally funded programs, such as Title 1 and Head Start Programs were established under the provision of ESEA to remediate the

discrepancy between diverse homes and schools (Rodriguez-Brown, 2009). Even though ESEA (1965) did not state anything about parents' role, these antipoverty programs framed parents as "learners" and then as "first teachers," while they aimed to enrich parents' capabilities to foster their children's cognitive development. For instance, these programs have been teaching parents school literacy practices and encouraging them to read to their children and listen to their children read under those initiatives (e.g., The National Center for Families Learning [NCFL], 2017). However, many scholars critiqued Head Start, and also many other family literacy programs, for their mentality of regarding culturally diverse and low-income parents as insufficient to ensure the academic and social well-being of their children (Auerbach, 1995; Kainz & Aiken, 2007; Baquedano-Lopez, Alexander & Hernandez, 2013). Although some have been helpful while they build on families' strengths and resources (e.g., Jasis & Ordoñez-Jasis, 2012), many programs have viewed ethnically, linguistically, and socioeconomically diverse households as "deprived" and needing intervention and wanted to turn them into places using certain parenting strategies to achieve academic success.

The Coleman Report (Coleman et al., 1966), otherwise known as the Equality of Educational Opportunity, set the stage for pushing for further parent-school interactions when it announced that the family factors are more influential than school factors in terms of student outcomes. To many educators (e.g., Cutler, 2000; Hiatt-Michael, 2008; Jeynes, 2011), this was considered a critical point when parents came to be seen as more responsible for the academic achievement of their children, thus providing a rationale for prioritizing and formalizing responsibilities in legislation, such as the Goals 2000: Educate America Act in 1994. For example, the first goal promoted that "Every parent in America will be a child's first teacher and will devote time each day to helping his or her preschool child learn; parents will have access to

the training and support they need to accomplish this’’ (United States of America House of Representatives, 1994). Again, what assumptions drove the purpose of these programs and to what extent parents’ knowledge and experiences were recognized and built upon, is a matter of question.

The reauthorization of ESEA, otherwise known as the No Child Left Behind Act (NCLB, 2002), referred to parents in several parts of the law, specifically in section 1118. Yet, for the first time, ESEA framed parents’ role as partners and key actors of educational reform (Mapp, 2012). Building upon Epstein’s (1995, 2002) six types of engagement model—parenting, communicating, volunteering, learning at home, decision-making, and collaborating with the community—it declared that:

... the participation of parents in regular, two-way and meaningful communication involving student academic learning and other school activities including ensuring that:

- Parents play an integral role in assisting their children’s learning;
- Parents are encouraged to be actively involved in their children’s education at school;
- Parents are full partners in their children’s education and are included, as appropriate, in decision-making and on advisory committees to assist in the education of their child;
- The carrying out of other activities, such as those described in Section 1118 (p. 538).

Epstein’s (1995, 2002) typology is also strongly visible in the latest homework guidelines of the U.S. Department of Education (2005). Even if there is no national homework policy in the United States, but it is up to the discretion of school districts, individual schools, or teachers, this

official document proposes detailed practices that parents should take up to support their children's homework (U.S. Department of Education, 2005). Those guides, that appear like a parent checklist, are related to how to monitor assignments, how to provide guidance and show children about the importance of education, and how to communicate with teachers about children's homework.

Along with the provisions of NCLB (2002), all school districts and schools receiving Title 1 Funding must have a parent involvement plan co-created by school staff, parents, and the local community to provide parents with more opportunities to play an active role in the educational process. With a significant shift toward high stakes standardized testing and accountability, the NCLB act also required schools to inform parents about school progress based on national standardized testing and provided parents with legal rights to choose their children's school accordingly. The latest reauthorization of ESEA (Every Student Succeeds Act [ESSA], 2015), acted as a successor to the NCLB act with no significant changes other than requiring teachers to receive training on how to work with parents as equal partners and embracing other family members in the home-school communication. According to this legislation, test accountability and parent choice and involvement are the powerful forces that might stimulate broader educational enhancement for low income and racially/ethnically diverse students. Accordingly, children's educational success or failure is not only the responsibility of schools, but also parents who are given a wide range of opportunities to be able to attend to this duty.

While policy narratives define parents to be empowered through partnership, choice, and accountability, the reported research findings show that in reality, these policies provided non-dominant parents with limited agency and knowledge and ambiguous roles for several reasons

(Rogers, 2006; Appleseed Foundation, 2006; Mapp, 2012; Lavery, 2016). For example, Mapp (2012) reviewed the evolution of policy narratives on parent involvement in the United States and their potential efficacy for non-dominant populations. Through interview data and analysis of policy documents, she concluded that state, district, and school staffs are provided little or no training to partner with families. Yet, Mapp found that there was only a limited evaluation of state and school districts in their implementation of parent-school activities. In a similar vein, Lavery (2016) investigated the extent of parents' understanding of their rights and responsibilities outlined in the NCLB act. By utilizing a survey of 484 parents across 13 diverse public elementary schools in the northern United States, Lavery found that few parents clearly understand how key provisions of the act influence their children's school experience and their rights, especially parents with schools identified for improvement.

Recurring Themes in the United States' Family-School Policies

Examination of family-school policies suggests two co-existing educational ideologies in the United States—collaboration and consumerism. One calls for collective action between school, community, and family, believing that collective action will enhance student learning; the latter focuses on individualism and standardization, governed by market principles, to educate citizens to contribute to the economic wellbeing of society.

Ideology of consumerism. Over the past three decades, it appears that the increase of globalization has heightened awareness of the global economy in the United States, which prompted the country to explicitly direct their educational policies in favor of long-term economic survival. Daun (2015) characterized globalization as a "meta-ideology" that constitutes the values of western ideologies of individualism and neoliberalism's market ideas (p. 34). During the past decade, the OECD-sponsored PISA assessments served as a significant tool for

spreading these ideologies across national and international contexts (Meyer, 2014). PISA assessments that involved the countries presented provide a cross-national comparison of students' math, science, and reading literacies, holding national governments accountable for how they influence student performance according to PISA scores.

Even though the United States made movements toward decentralization, giving greater authority to states and individual school districts and providing parents with opportunities for school choice and decision-making processes, the growing concern for global competition prompted the nation to recentralize the education system through national curriculum and national standardized testing. Within this logic, parents' roles are defined as "consumers", purchasing quality education on behalf of their own children. In this market-oriented stance, parents are provided national data on school progress and make decisions on which school best fits their children's needs accordingly. Giving a parental choice also positions parents as monitors of teacher and school accountability and makes parents primarily responsible for their children's educational outcomes. In this respect, education of a child becomes personal self-interest, and the responsibility of the parents rather than the collective interest of the local community. This individualist approach in the current trend of schooling that viewed learning as commodity to be tested might have debilitating effects on the capacity of schools and local communities to improve their public schools in the realm of cooperation with families and communities and public service (Mapp, 2012).

In the United States, the considerable appeal of parents' market-based options to transfer their children from low performing schools has been drawing attention to another point of concern. Parental choice discourse seems to be beneficial to only particular groups of a given society. For example, Lavery's (2016) findings, mentioned earlier, confirm this concern. Lack of

knowledge on the school policies and uncertain role definition prevent non-dominant families from exercising their rights compared to ethnically/racially dominant middle-class families. Complicated application forms, language barriers, and the lack of free transportation opportunities are among other hindrances to non-dominant families (Andre-Bechely, 2005). Consequently, parental choice puts non-dominant families at a further disadvantage by promoting unequal access to school resources and opportunities.

Ideology of collaboration. While the United States framed parents' roles as "consumers" in favor of market-driven competition, the country has also embraced the idea of collaboration between family, school, and community. In this respect, parents' roles have been framed as "partners" that assume shared responsibility, trust, and two-way communication. To this end, a wide range of policies were adopted, and lists of responsibilities were constructed for parents across many countries, but what is interesting is that those policies embraced mostly school-centric practices for parents to take up for their children. These school-centric practices include, but are likely not limited to, participating in school activities, participating in decision-making processes, taking representative roles in school boards/associations, and monitoring children's homework. All these practices indicate constrained forms of partnership that mostly concentrate on the school's agenda. What is missing across the national policies is the recognition that not all parents might share equal conditions and even interest in participating in formal forms of parent-school partnerships outlined in the policies.

At the foundation, there exists a heavy influence of Epstein's (2002) typology on many countries' parent-school collaboration policy documents. These policy documents directly cited or built upon Epstein's (2002) six-type involvement model. This narrow range of traditional practices reflect experiences of White middle-class parents while ignoring a variety of

educational aspirations and practices many other parents pursue for their children. Considering the United States is diverse in terms of its sociocultural and sociohistorical contexts, how these sets of practices will be helpful in recognizing the dynamic and complex nature of families is a matter of question.

While policies in the United States have required schools to provide opportunities for family-school collaboration, they lay out some responsibilities for teachers as well. In the official texts, teachers' responsibilities are listed, for example communicating with parents regarding school expectations, student progress, and guidance about homework. The national policies also required schools to train their teachers to work effectively with parents. However, to what extent teachers have been given time, space, and training to partner with parents is also not clear (Mapp, 2012).

What We Know About Teachers' Experiences in Working with Families in the United States

Given the family-school policies and their underlying assumptions in the United States, it is valuable to examine recent research on pre-service and in-service teachers' experiences regarding family-school-community interaction. Before presenting these studies, I would like to begin with a brief discussion of theoretical and conceptual approaches guiding the reviewed research studies.

Theoretical and Conceptual Considerations Guiding the Literature

A wide range of theoretical perspectives and conceptual orientations were represented across the studies related to teachers' experiences with families that I examined in this dissertation study. These approaches include sociocultural-oriented approaches, behavioral and learning theories, critical and post-structural theories, and individual typologies regarding

family-school-community relations. Despite the varieties, the review of the literature demonstrates that sociocultural-oriented traditions and Epstein's family-school partnership model are two dominant approaches used in the studies focusing on teachers' experiences relating to family-school-community relations.

Table 1: Theoretical and conceptual orientations guiding the studies.

Theories and Conceptions	Number
Sociocultural-oriented approaches:	
• Vygotsky's (1978) sociocultural theory (2) • González and colleagues' (2005) conception of funds of knowledge (5) • Culturally relevant approaches (5) • Bronfenbrenner's (1986) ecological systems theory (3) • Dewey's (1933, 1938) sustained inquiry model (2) • Kegan's (1982) constructive- developmental theory (1) • Cultural values framework of individualism/collectivism (Greenfield, 1994; Hofstede, 2001; Triandis, 1989) (1) • Henderson and Mapp's (2002) partnership model (1)	20
Epstein's family-school partnership model and other approaches to family-school interactions similar to that model:	
○ Epstein's family-school partnership model (11) ○ Bandura's (1977) social cognitive theory (1) ○ Fishbein's (1963, 1967) theory of reasoned action (1)	13
Critical and Post-structural Theories	
• CRT and post-structural theory (1) • Critical theory and postmodern theory (1) • Critical theory (1)	3
Typology consists of teacher-family-community involvement, teacher-family-community engagement, and teacher-family-community solidarity	1
Unspecified theoretical and conceptual orientation (except one, all of them used quantitative methods)	7

Thirteen studies among the reviewed built upon Epstein's (2005) overlapping spheres of influence and her framework of family-school partnership (Epstein, 1988, 1995, 2011; Epstein, Coates, Salinas, Sanders, & Simon, 1997; Epstein, Sanders & Clark, 1999). These studies embraced Epstein's six typologies: guidance on parenting, communicating with parents, recruiting parents in volunteering, encouraging learning activities at home, including parents in

decision-making, and collaborating with the community. In this review context, two studies drawing from Bandura's (1977) social cognitive theory and Fishbein's (1963, 1967) theory of reasoned action also approached family-school-community interactions in a similar way. Commonly, all these studies (mostly quantitative studies) measured participants' perceptions of and experiences with the specific types of collaboration activities and described participants' orientations to families based on those activities.

Although Epstein's typologies suggest that they are designed to foster equal family-school-community participation in students' learning, their tenets of partnership imply technical aspects of parent-teacher relationships and mostly delegate implementation of agendas to school staff and teachers. As this approach views family-school-community interactions as a set of pre-determined practices, it fails to account for the dynamic and multidimensional features that can change across different venues and different time spans. Even more problematic is the fact that these idealized forms of actions reflect European American middle-class values and expectations; absent are the cultural values and expectations of families from a wider range of cultural and social backgrounds.

Twenty studies were inspired by socioculturally-oriented traditions. These traditions include Vygotsky's (1978) sociocultural theory, González and colleagues' (2005) conception of funds of knowledge, culturally relevant approaches, Bronfenbrenner's (1986) ecological systems theory, Kegan's (1982) constructive- developmental theory, Dewey's (1933, 1938) sustained inquiry model, and the cultural values framework of individualism/collectivism (Greenfield, 1994; Hofstede, 2001; Triandis, 1989). Unlike Epstein's family-school partnership model, which represents a practice-based approach, socioculturally-oriented traditions concentrate on social practices as they unfold during day-to-day interactions. These approaches focus on people's

diverse social and cultural experiences and how these diverse experiences influence their social practices, to understand the complexities of human and family experiences.

Socioculturally-oriented approaches commonly embrace a more extended view of family-school-community relations that go beyond some of the more restricted visions of the topic. All these approaches place emphasis on creating opportunities for teachers to develop an understanding of diverse families and communities so that they can visualize a variety of ways parents can be engaged in their child's education to foster student learning. As Evans (2013) indicated in his review, these approaches demonstrate a number of shifts in understanding family-school-community relations and "suggest a new emphasis on relationship building [that] is slowly starting to replace more technical approaches" (p. 125). Another central aim is to accentuate the knowledge and experiences that families and communities can convey to teachers to be used as resources in the classroom. Building relationships with families, questioning personal hidden assumptions about diverse families and understandings of cultural diversity are seen as important aspects of family-school-community relations in this group of approaches.

While a great deal of studies built upon Epstein's family-school partnership model and socioculturally-oriented approaches, only a few studies approached teachers' experiences from critical and post-structural traditions. It is disappointing that only a limited number of studies embraced these theories given their potential to address family-school-community interactions in relation to broader sociopolitical, sociohistorical and sociocultural contexts.

For example, building upon CRT and post-structural theories, Adair (2013) examined how social construction of Whiteness influenced European American teachers' reactions regarding immigrant families. The aim was to demonstrate the hidden factors affecting relationships among non-European American families and European American teachers.

Drawing from critical and post-structural theories, Kroeger and Lash (2011) deconstruct the meaning of “typical family” in order to show how it includes and excludes experiences of particular segments of society. As evident in the above studies, critical and post-structural theories seek transformation in teachers’ thinking and their approaches toward families from culturally and socially diverse backgrounds. To this end, they stress building authentic relationships with families to learn about and from their experiences as socioculturally-oriented approaches do. Yet, critical and post-structural theories attempt to go further in deeply addressing how these individual experiences are embedded in broader social, economic, and political contexts and unearth these invisible factors shaping day-to-day interactions. They attempt to disrupt the dominant discourse and power relations related to family-school relations to seek a transformation and resistance to potential problems associated with them.

Particularly, critical theories use race, class, immigration, and power as lenses to examine family-school-community interactions (Prasad, 2005). Challenging teachers’ thinking on the structural forms of inequity and hierarchical power relations and pointing to spaces of possible actions would be the central aims in critical theories. Post-structural theories can help us to be skeptical about the dominant discourse, language, knowledge, and truth on home-school relations (St. Pierre, 2000; Burr, 2003). For example, post-structural theories would help us to understand how the ways in which we structure our language shapes our understanding and experiences in order to show that taken for granted concepts such as *typical family* can be reevaluated and reconstructed. As these theoretical perspectives challenge our thinking on the broader issues affecting family-school relations, they have great potential to open up new possibilities of change in family-school-community interactions.

Teachers' Perceptions on Family-School Relations

Examining recent literature that focused on teachers' experiences with family school relations in the United States, a body of researchers wanted to know how teachers perceived their roles and parents' roles in their relation to one another. This body of research showed that teachers possess positive attitudes in working with families but that their understanding of ideal family-school interactions was rather limited and unidirectional. The teachers defined ideal parent-teacher interactions with pre-implied tasks that parents are expected to accomplish at home and school, and suggesting that teachers are responsible to communicate those expectations to parents.

In one of the studies, the researchers (Pryor and Pryor, 2009) investigated teachers' beliefs about their role in parent-school relations by already drawing eight ideal teacher behaviors to involve parents and asking teachers to rate which of the behaviors they intended to accomplish. These behaviors were related to communicating school and classroom expectations, providing information and resources for home learning activities, and recruiting parents as volunteers in the classroom. Administering surveys to 40 in-service teachers from elementary and secondary schools, the researchers found that most of the teachers' attitudes were positive on communicating homework expectations and providing information on strategies to improve student learning and recruiting parents for volunteering (though rates of secondary teachers are slightly lower regarding volunteering), whereas their intentions were weak in providing service and resources for home learning activities. As the researchers were concerned about limited roles teachers perceive for themselves, what is more interesting about this study is the narrow frame of practices the researchers drew for teachers in the first place. These limited roles reflect technical aspects of parent-teacher relations and standard level of family-school interactions; absent are

potential of teachers to view parents as maintaining worthy information for their children and its potential to inform learning practices in the classroom (Swap, 1993; Calabrese-Barton et al., 2005).

Unlike the above study, in three other studies (Hindin, 2010; Christanakis, 2011; Patte, 2011), the researchers let the teachers define their understanding of parent-school relations. The teacher participants characterized their perceived roles either via open-ended surveys or individual interviews. Importantly, these studies went further and investigated the factors that might form these perceptions. For example, interviewing 15 in-service teachers in an inner city elementary school with high percentage of students of color, Christanakis (2011) found that the teachers experienced difficulty in the classroom due to lack of school resources and state-mandated paraprofessionals to support students with special needs in their classrooms. According to the author, working in under-resourced schools might have been a leading reason for teachers to conceptualize parent involvement as a set of practices to assist teachers to fulfill their curricular requirements. Viewing parents' roles as monitoring their child's school assignments, volunteering in the classroom, being present in the school trips have been seen as a way to lessen their extra teaching load. Building upon Epstein's (1995, 2005) parent involvement model, Patte (2011) and Hindin (2010) examined teacher candidates' learning experiences in their teacher education programs and found that teacher candidates did not observe ideal parent-school interactions in these spaces. For example, Hindin found that the teacher candidates in one university observed their mentor teachers mostly interacting with families only through parent-teacher conferences and sending notes home. In addition, these teacher candidates observed their mentor teachers working in urban settings having problematic relationships with families. Although teacher candidates learned a variety of ways to work with parents through their

coursework, the researcher found that teacher candidates' perceptions of parent involvement echoed the practices of their mentor teachers.

These findings demonstrate that field experiences offer teacher candidates more than opportunities to observe and implement instructional skills they learned in their course work. In those spaces, teachers observe a range of community-school-family interactions as well. Quality and extent of these experiences seem to have major influence on teachers' beliefs on their roles in relation to families. Additionally, the above research indicates that the availability of school resources (e.g., extra school staff) may orient teachers to understand parents' roles in certain ways. Teachers' cultural and social backgrounds and their own experiences as students are also critical elements that might shape their perceptions on ideal parent-teacher interactions and should be paid attention for future research considerations.

Teachers' Practices Concerning Family-School Relations

In general terms, the research on teachers' family-oriented practices has seemingly been rather limited in the past 10 years. As educational policies in the United States require schools to develop curricula on family-school relations and to provide in-service teachers with training opportunities (ESSA, 2015; FEEA, 2015), it is disappointing that relatively few studies investigated how these policy initiatives are enacted in-service teachers' practices (Barnyak & Mcnelly, 2009; Upadhyay, 2009; Jensen, 2011).

In this line of research, some of the studies (Barnyak & Mcnelly, 2009; Jensen, 2011) investigated the association between teachers' intentions and their current actions in working with their students' parents. Utilizing survey as a data collection instrument, similarly they found that the in-service teachers did not effectively implement communication systems to collaborate with parents, which they believed would foster students' school learning. For example, drawing

from the “Parent involvement Inventory” document published by Illinois State Board of Education (1994), Barnyak and Mcnelly surveyed 92 in-service teachers working in K-12 classrooms in an urban school district in Pennsylvania. The researchers found that the teachers highly valued informing parents about homework policy and strategies on how to monitor homework, holding parent-teacher conferences, communicating to parents in case of misbehavior, and providing parents with strategies to enhance student learning. However, teachers’ usual course of action merely consisted in attending big parent events and communicating with parents in case of misbehavior.

Surveying 131 elementary school teachers based on Henderson and Mapp’s (2002) partnership model, Jensen (2011) found a discrepancy between teacher attitudes and practices. She also raised attention to schools’ requirements for teachers in establishing parent involvement. The researcher found that most of the schools where she conducted her research only required teachers to attend parent-school conferences and back-to-school nights. The schools’ weak implementation of national family-school policies might be one possible explanation for the teachers’ weak implementation process, but these are preliminary findings. Since two of the studies did not ask teachers themselves why they did not implement what they believed as important for students’ school progress, we do not know for sure the actual reasons preventing teachers from using these communication strategies. In this sense, it is necessary to conduct further research in this area to conceptualize why this pattern exists as the results have potential to inform areas of support for teachers to effectively work with families. Weiss and Stephan (2009) and Mapp (2012) already pointed out this concern as they call for in-depth evaluations and more research effort to monitor school administrators’ and teachers’ practices in

family-school relations, school's level of compliance with national family-school policies and efficacy of these practices to improve family-school relations.

While the researchers in the above studies asked teachers to identify strategies they currently employ to work with parents, Upadhyay (2009) investigated this phenomenon by observing a teacher in her classroom over a period time. This particular study is quite different from the above studies for another reason; it offers a sense of inspiration for how a teacher might utilize families as resources of knowledge for their children and in turn foster students' learning interest in the classroom. Drawing upon the notion of funds of knowledge framed by González, Moll and Amanti (2005), the researcher investigated one Hmong female in-service teacher's experiences in working with parents in the context of a science classroom hosting mostly a Hmong student population in a low-income neighborhood. Conducting participant observations and interviewing the fifth grade teacher, Upadhyay found that the teacher frequently interacted with families inside and outside of the classroom, valued their experiences, and used their funds of knowledge when designing science curriculum and instruction to make concepts relevant to students' lives. During the classroom observations, the researcher found that the teacher highly regarded parents' knowledge and made them feel that they were important contributors to their child's learning by inviting them to the classroom to share their experiences related to science concepts. The conversation below, which the researcher recorded during class, summarizes this sentiment. During the lesson focusing on the connection between plants and weather, a Hmong parent encouraged Hmong students to think about what they had seen at home in their gardens.

Parent: What do you see in your garden?

Teacher: Tell us [pointing to the parent] what you do and see at home?

Student 9 [girl]: All vegetables are ready.

Parent: What did you do before planting?

Student10 [boy]: We [prepare] the garden [soil]. . .

Parent: What do you do to prepare soil?

Student 9 [girl]: We [add] food for plant [fertilizer], dig the ground . . .

Student11 [girl]: make rows and put seeds . . .

Teacher: Do you plant in the Fall . . .

Student9 [girl]: In spring . . .

Parent: Why?

S10 [boy]: Very cold. Plants die.

As Upadhyay (2009) acknowledged, the teacher's linguistic and cultural background seemed to make it much easier for the teacher to effectively work with Hmong parents and weave their knowledge and experiences into her classroom instruction.

Teachers' Self-Efficacy on Family-School Relations

Some studies investigated perceptions of in-service teachers (Markow & Martin, 2005; Melnick & Meister, 2008; Zygmunt – Fillwalk, 2011) and pre-service teachers (Uludag, 2008; Pedro et al., 2012; Bruine et al., 2014) about their capabilities for working with families in the United States. The findings revealed different levels of self-efficacy pre-service and in-service teachers developed in their teacher education programs, but commonly in all these studies participants expressed a need for more educational opportunities in their training programs, such as dedicating a course or offering community outreach experiences specifically in this area. Based on these findings, it would be naive to make some generalizations regarding teachers' self-efficacy about family-school relations in the United States. Nonetheless, this body of research actually echoes the long-standing concern of many researchers indicating the lack of

training opportunities in many teacher education programs to help teachers to develop teacher competencies necessary to effectively work with families (Greenwood & Hickman, 1991; Flanigan, 2007; Kroeger & Lash, 2011; Mapp, 2012). Although small, the review of this category still points out a need for those programs to address this issue more thoroughly.

For example, Flanigan (2007) conducted focus group interviews with 33 faculty members from Illinois's five Professional Learner's Partnership Universities regarding preparation of pre-service teachers to partner with parents and communities. Flanigan found that faculty participants expressed concerns about the shortage of institutional training in cross-cultural issues that are often unfamiliar to pre-service teachers' own life experiences, mixed messages that pre-service teachers may receive from experienced teachers regarding the concept of family-school-community interactions, and a lack of community field experiences for preservice teachers to interact with families. Teachers' perspectives appear to be in line with the beliefs of faculty members in Flanigan's study. For example, based on the 2005 Met Life survey, new teachers viewed working with parents as a major challenge (Markow & Martin, 2005). According to the survey results, teachers found working with parents to be an even greater challenge than the issues of classroom management, the pressure of standardized testing, and the lack of classroom resources.

In another study, Zygmunt – Fillwalk (2011) surveyed 60 recent graduates from an elementary education program in a Midwestern University to learn how their self-efficacy differed based on their pre-service education preparation. Comparing reflections of beginning teachers who had taken a "Family and Community Relations" course in their pre-service education and those who had not, Zygmunt-Fillwalk found that teachers who had taken the course expressed a theoretical and practical understanding of the benefits of family involvement,

while others expressed frequent resentment and contradictory perceptions toward families. The researcher also found that teachers without a theoretical and practical understanding of family involvement had difficulty in finding communication strategies and experienced a loss of confidence when their attempts to work with families were not met with success.

Bruine et al. (2014) examined not only quantity but also quality of those experiences teachers had in their pre-service preparation program with respect to family-school partnerships. Conducting research in three universities, located in the United States, Netherlands, and Belgium respectively, the researchers found considerable similarities in these universities' curriculum regarding family-school partnerships. All three universities offered a few required courses including subjects linked to family-school partnerships with limited attention given in secondary education programs. Closely examining the content of these courses, the researchers found that great emphasis was placed on lectures and discussion mostly focused in a limited manner on one-way communication from teacher to parent, including informing parents about school programs and expectations. Conducting focus group interviews with 65 elementary and secondary teacher candidates and 32 teacher educators, the researchers also found that primary teacher candidates felt a need to be better prepared for family-school interactions, even after they had taken a course specifically in this area. Although the majority of secondary teacher candidates and teacher educators perceived family-school partnerships as mainly a topic of interest for primary, not secondary teachers, they indicated a need for preparation for communicating with parents in case of problematic situations.

It is important that this line of research made connections between teachers' pre-service education experiences and teachers' self-efficacy. However, when targeting in-service teachers, such studies did not pay attention to teachers' in-service learning experiences, which is also

critical in their preparation to work with families. To what extent teacher in-service professional development programs prepare teachers to work with families and how they influence teachers' sense of confidence are areas of research awaiting further exploration.

Interestingly in this category of studies, teacher self-efficacy was explored in relation to families in general. Even though two of the studies found that teacher candidates felt prepared for working with families (Uludag, 2008; Pedro et al., 2012), these studies did not describe in detail how teacher candidates felt prepared to work with families from diverse social and cultural backgrounds. Research is still needed to address the ways teachers develop their beliefs about their knowledge about family-school interaction and how teacher education programs and individual teacher educators play a role in their preparation in working with diverse families.

Teachers' Learning in Working with Diverse Families in National and International

Contexts

Concerning the inefficacy of family-school policies especially for non-dominant families and the lack of teacher training and teachers' practices in this area, educational researchers in the United States and elsewhere recently began to examine teachers' learning in working with families and communities. A majority of these impact-oriented intervention projects were conducted by the authors in their own classrooms or in their teacher education programs. These studies employed a broad array of educational strategies, including home visits, parent interviews, mock parent-teacher conferences, classroom discussions, community outreach experiences, and professional development workshops. Despite the varieties in terms of theoretical and methodological traditions, the majority of the researchers tended to use students' written assignments and oral reflections as their data collection sources. The time scale ranged from a single workshop to one- semester-long learning experience to four-year-long learning

experiences. While the majority of the studies focused on pre-service teacher education, few studies focused on formal or informal in-service professional development environments. Not surprisingly, most of the studies targeted early childhood and elementary education.

Table 2: Educational strategies and their impact on the participants.

Experience	Result
• Book club with mothers (Pushor & Parker, 2013) • Home visits (Lin & Bates, 2010; Meyer, Mann & Becker, 2011; Stetson, Stetson Sinclair & Mix, 2012; Johnson, 2014) • Family interviews (Kroeger & Lash, 2013) • In-service teacher workshop (Fisch, Trumbull & Garcia, 2009) • Panel discussions conducted by parents (Norris, 2010) • University affiliated after- school family program (Schester & Sherri, 2009)	Increased level of familiarity with diverse families and broadened view of family diversity
○ Group discussions (Symeou, Roussounidou & Michaelides, 2012; Smith, Smith-Bonahue, & Soutullo, 2014) ○ Conducting home visits (Amatea, Cholewa & Mixon, 2012) ○ Watching film about parents (Gallo & Wortham, 2012) ○ Interacting with families in informal learning settings (Ramirez & Mccollough, 2012)	Increased awareness of assumptions regarding diverse families
• Interview with families (Baumgartner & Buchanan, 2010) • Interacting with families in alternative learning spaces (Pohan & Adams, 2007; Loughrey & Woods, 2010; Flecha & Soler, 2013; Zeichner, Bowman, Guillen & Napolitan, 2016; Mccollough & Ramirez, 2012; Ramirez, Mccollough & Diaz., 2016) • Conducting simulated parent-teacher conferences (Hooks, 2008) • Seminars and class discussions (Ferrara, 2009; Brown, Harris, Jacobson & Trotti, 2014; Tirrell-Corbin & Cooper, 2014).	Improved skills on working with diverse families

Numerous important findings emerged from this research that have the potential to enlighten the broader field of family-school-community interactions. The recurring findings among the studies were improved skills in working with diverse families, increased ability to reflect on personal assumptions regarding diverse families, and a broadened view of family diversity (see, table 2).

Several researchers reported that teachers have increased their skills in working with families as a result of their intervention projects. While some studies had teachers interview families (Baumgartner & Buchanan, 2010) or interact with families in alternative learning spaces (Pohan & Adams, 2007; Loughrey & Woods, 2010; Mccollough & Ramirez, 2012; Ramirez, Mccollough & Diaz, 2016; Zeichner et al., 2016), others had teachers conduct simulated parent-teacher conferences (Hooks, 2008) or directly focused on seminars and class discussions (Ferrara, 2009; Brown et al., 2014; Tirrell-Corbin & Cooper, 2014).

For example, Zeichner and colleagues (2016) had elementary and secondary teacher candidates attend weekly panel presentations relating to issues of equity and diversity coupled with debrief sessions. The candidates were also given opportunities to have small group conversations with families in their school placement regions and simultaneously to receive training on how to make positive phone calls, conduct home visits, and involve parents in the curriculum. In addition, elementary teacher candidates attended a three-week summer program in their local schools where they had the chance to learn about the families in the neighborhood. Utilizing surveys and individual/focus group interviews with 16 teacher candidates, the researchers found a significant shift regarding teachers' understanding of family-school collaboration and teachers' responsibilities for achieving collaboration. Framing a typology consisting of three different approaches, teacher-family-community involvement, teacher-

family–community engagement, and teacher–family–community solidarity, the central goal of the researchers was shifting the position of families from “barriers” to “resources” to help candidates to re-conceptualize their roles in family-school relations. Conducting follow-up case studies with two elementary education graduates and one secondary teacher education graduate in their first year of teaching, the researchers found that the elementary teachers continued to use strategies they learned during their teacher education programs—making positive phone calls and home visits and using students’ cultural resources in the curriculum, while the secondary teacher continued to use teacher-family communication strategies that she learned in the panel discussions in her pre-service teacher preparation program.

While the above studies reported increased teacher self-confidence, some studies found raised level of consciousness in teachers’ personal perceptions regarding diverse families. This realization came through participating in seminars and group discussions (Symeou et al., 2012; Smith et al., 2014), conducting home visits (Amatea et al, 2012), interacting with families in informal learning settings (Ramirez & Mccollough, 2012), and watching a film about local parents (Gallo & Wortham, 2012).

For example, Gallo and Wortham (2012) created a film that was intended to be used for an in-service teacher professional development program. In the film, Mexican descent immigrant parents in a community accommodating a high Latino population shared their experiences and perspectives regarding their child’s school, such as personal values regarding parenting, concerns about equitable schooling, and difficulties regarding homework assignments. The film was viewed by teachers serving in the local schools. Analyzing the feedback sheets teachers anonymously filled out as a reaction to the film during the professional development sessions, the researchers found that participants realized that the immigrant parents desired increased

parent-teacher communication, while they previously positioned the parents as reluctant to communicate with teachers. In addition, the teachers articulated how they had once been frustrated with the lack of effort made by the parents to interact with teachers and ask questions when their children were struggling. However, the participants came to understand that the families actually had high educational expectations for their children but faced difficulties initiating contact with teachers. One teacher commented, “I shouldn’t shy away from contact just because it isn’t easy. Just because it is difficult, doesn’t mean it isn’t wanted” (p.11).

In some of the studies, participants demonstrated an increased level of familiarity with diverse families through book clubs with mothers (Pushor & Parker, 2013), home visits (Lin & Bates, 2010; Meyer et al., 2011; Stetson et al., 2012; Johnson, 2014), family interviews (Kroeger & Lash, 2013), in-service teacher workshops (Fisch et al., 2009), panel discussions conducted by parents (Norris, 2010), and university-affiliated after-school family programs (Schester & Sherri, 2009).

For example, Johnson (2014) asked nine graduate in-service teachers and four pre-service teachers to conduct a home visit as a requirement in a practicum course with emphasis on English as a Second Language (ESL) and bilingual education at a university located in the Washington area. Building upon González and colleagues’ (2005) conception of funds of knowledge, the participants were initially exposed to a variety of readings and discussions related to the topic. Then the participants were asked to schedule and conduct a home visit with a family whose first language was not English. Analyzing student reflection sheets collected before and after the home visit experiences of the participants, the researcher found that most of the participants felt “anxiety” and “uncertainty” before conducting home visits; as one participant articulated, “I was not sure what to expect. I was uncertain what Ciarra’s parents

would think of me or why I decided to visit their home in particular. I was nervous and afraid I would not be able to carry on a conversation with the family” (p. 370). However, following visits, the researchers found that participants became closely involved with students’ living environments, which alleviated their stress and anxiety. The anxiety was replaced with appreciation as they learned about the funds of knowledge the families possessed and gained new understandings as they were exposed to living experiences that were different from their own. In addition, the researchers found that the in-service teachers benefitted from this intimate interaction with families in the classroom, as one participant commented:

I enjoyed spending time and getting to know Arianna’s mom [Leticia]. I would love to keep doing this. I feel like I have such a better relationship with Leticia and also with Arianna. Now when I see Arianna’s mom at the pickup area, we actually talk and have a conversation instead of just smiling and saying hi. I also feel like Arianna listens more now because she knows I have that connection with her mother (p.374).

As evident in the above examples, this category of research suggests that devoting energy to address family-school relations has a positive influence on pre-service and in-service teachers. Across the studies, opportunities to reflect on personal assumptions about diversity and to have authentic interactions with families were referred to as an important component of teacher learning. This research direction is highly promising because it responds, at least partially, to long-standing calls for research made by several scholars (Freire, 1970; Allexaht-Snider & Schwartz, 2001; Civil, 2012) whose work invited us to work with teachers in intervention-based research projects to help them see the value of deep and broad understanding of students’ families and communities.

To what extent positive changes in teachers' understandings were sustained over time is a matter of question. Relatively few studies in this category conducted follow-up studies and investigated how teacher participants applied these learning experiences in their classrooms with their students and families (Gallo & Wortham, 2012; Tirell-Corbin & Cooper, 2014; Zeichner et al., 2016). Yet, the majority of these intervention projects were temporary and short-lived efforts with either one-semester-long classes or one-shot workshops; few studies invested significant time and effort in their research (Ferrara, 2009; Tirell-Corbin & Cooper, 2014; Zeichner et al., 2016). Additionally, none of the studies examined how changes in teachers' understanding of family-school relations influenced student learning in the classroom. These are the areas that should frame future research, as they have great potential to contribute to the field of community-school-family interactions in terms of research and practice.

Teacher Learning in Working with Diverse Families in the Context of Science

While a growing body of family-school research focuses on teachers' experiences with families in the general sense, only a few programs have been designed to encourage pre-service or in-service teachers to collaborate with the parents of immigrant students in their children's science learning (e.g., Hammond, 2001; McCollough & Ramirez, 2012; Buxton, Allexaht-Snider & Rivera, 2012; Ramirez, McCollough & Diaz, 2016). Science is the significant discipline of focus for two particular reasons: First, science is vital for school success and college and career opportunities while students of historically non-dominant communities continue to be underrepresented in STEM fields (Nevarez, 2015). Second, low-income immigrant parents' potential for involvement in their children's science education is often overlooked.

Science is vital for school success and college and career opportunities while students of historically non-dominant communities continue to be underrepresented in STEM fields

(Nevarez, 2015). The research specific to science education and non-dominant students often portrays a limited image, only focusing on barriers to success for non-dominant students. Aikenhead et al. (2014) illustrated how current classroom practices often sustained standards and methods that portray science as “neutral” as though it is not connected with ways of knowing of students from linguistically and culturally diverse backgrounds possess. Calabrese-Barton (1998), long ago, called this approach a “one size fits all” educational mentality (p.531). In this view all students are treated as homogenous, regardless of sociocultural and sociopolitical factors that have traditionally disconnected science from people and context. The neutrality of science, however, has been refuted by many scholars (Lee, 2005; Roseberry, Ogonowski, DiSchino & Warren, 2010; Calabrese-Barton, Tan & Greenberg, 2017; Harper, 2017). These scholars demonstrated that it is impossible to enact an ethical science education unless it is joined to the knowledge, skills, and experiences that students bring from their homes and communities. They contradicted mainstream forms of science teaching and learning that have been built upon monocultural and text-based lessons to prepare students for high-stakes standardized testing.

For example, Calabrese-Barton et al. (2017) envisioned critical literacies in their work with youth in an after-school and community-based makerspace program, which provided students with more power to interact with science in a variety of ways and provided them agency while their life worlds were recognized as valid sources of knowledge. Given this focus, their critical science education relied on three principles: (a) critical engagement with histories and geographies of youth’s lives (b) connected engagement with and for community members, and (c) collective engagement together for the public good (p. 24). The researchers concluded that these three forms of engagement supported students to have sustained and mutual engagement with science in the makerspace. By referring to sustained and mutual, Calabrese-Barton, et al.

meant education in which the different needs of youth from diverse backgrounds can be concurrently addressed, without one yielding power to the other. Their work challenged the field to consider science learning in relation to history and context to provide students equitable access to science education.

Drawing from Bakhtin's notion of heteroglossia, Rosebery and colleagues (2010) envisioned science learning settings that "conceptualize the heterogeneity of human cultural practices as fundamental to learning, not as a problem to be solved but as foundational in conceptualizing learning and in designing learning environments" (p. 2). Integrating this concept in their work with students from non-dominant groups in an urban public elementary school, the researchers concluded that all students from dominant and non-dominant backgrounds gained a deep and rigorous science learning by exploring possible meanings embedded in their everyday understandings of science without adapting in limited ways to a dominant culture view of science. Harper's (2017) study is another example of a counter narrative to the notion of a neutral science education. She collaborated with a Karen parent to support Karen-refugee (first-generation refugees from Burma) and non-Karen students' science learning through a cross-cultural science after-school program. Building on a critical pedagogy of place perspective—decolonization and re-inhabitation—the researcher allowed students to engage with science inquiries in a variety of ways, using observations and everyday language to construct scientific arguments, engaging with science lessons that integrated cultural and experimental knowledge, and demonstrating their embodied knowledge of culture and science through developing narrative portraits at the end of the program. Harper found that Karen students learned how to utilize their cultural and family knowledge as they conducted science inquiry investigations and

demonstrated a higher level of agency as they were able to leverage their Karen cultural knowledge and language in their science learning.

As it is evident in the literature, all children, irrespective of their home culture and first language, arrive at school with rich knowledge and skills that have great potential as resources in teaching and learning science. However, the primary task for teachers who teach students who come from non-dominant communities is to discover and take advantage of these potential instructional resources. For example, Planas and Civil (2009) focused on professional development projects with high school mathematics teachers and immigrant students to address the need for teachers to restructure their identities while teaching and learning mathematics. Building on social justice perspectives, they argued that teachers' empowerment was highly associated with students' empowerment. This requires teachers to consistently reflect on questions, such as "whose mathematics problem is it? Whose language gets privileged? And whose language gets valued?" (Civil, 2012, p. 1). Then teachers can better understand their students and their families and recognize multiple ways of doing and demonstrating mathematics and other content areas, such as science, that are available in different contexts (Civil, 2012).

Low-income immigrant parents' potential for involvement in their children's science education is often overlooked. Structuring opportunities for teachers to learn alongside their students and their parents while working with families has greater positive potential. The research below demonstrated that these kinds of research settings with a science focus have potential to help teachers to better understand their students and their families' ways of thinking in relation to academic concepts, would allow them to recognize multiple ways of doing and demonstrating science contents, and would offer teachers an idea of how they can efficiently work with students and their families.

For example, Hammond (2001) examined a teacher education program in the Western United States involving pre-service and in-service teachers and Mien families in an urban elementary school serving high poverty immigrant students. Teachers and Mien parents collaborated on gardening and house building projects that provided a bridge between community-based and school-based knowledge around science. Drawing from Ogawa's (1995) multi-science perspective that incorporates (a) indigenous science, (b) personal science and (c) Western modern science, Hammond demonstrated the benefits of building a cross-cultural learning community with a mutual adaptation between school and community. She concluded that this approach not only accommodated students and families to traditional school science curriculum but also helped teachers to reflect on their own view of science and transformed their view of teaching from the transmitter of Western science to that of "cultural broker" (p. 987) to assist students to cross the borders between ways of knowing.

McCollough and Ramirez's (2012) work with pre-service teachers of Latino students and their families demonstrated the advantages of incorporating community knowledge into science lesson plans. As a part of coursework, pre-service teachers gathered funds of knowledge possessed by Latino families and then developed culturally relevant hands-on science activities to be implemented in the Family Science Learning (FSL) events serving elementary and middle schools located in ethnically diverse school districts. By facilitating pre-service teachers' work alongside Latino families in FSL events with an emphasis on culturally relevant science, McCollough and Ramirez were able to provide these future teachers with opportunities to engage with parents in authentic ways. Those families participated in the FSLE while being engaged with the study of clay in several science learning activities, such as determining real clay from other sediments, finding the impact of fire and water on clay, and discussing how clay differs

across the regions. Analyzing participants' written reflections, formal lesson plans, and survey responses, the researchers found that teachers' confidence levels and self-efficacy were increased in terms of communicating and working with diverse families.

In another study, Ramirez and McCollough (2012) required pre-service teachers to prepare culturally relevant math activities and implement them in the Family Math Learning Event (FMLE). As a part of an undergraduate math content class, the researchers asked pre-service teachers to interview Latino families and design math teaching activities accordingly. As a part of the assignment, the participant student teachers interviewed families about a card game called La Loteria, which is a traditional family game that has been played in Mexican culture for generations, so they could learn their level of familiarity with the game and how they play it. Following the interviews, most of the pre-service teachers felt that integrating this game in a math activity could be a great way to engage all family members with mathematical investigations as they observed that the family members were highly engaged with the activity. After the pre-service teachers planned the math activity, those families that participated in the FMLE while being engaged with the La Loteria card game embedded in several math learning activities, such as finding various types of rectangles on the game board and estimating the number of Loteria game boards that could be built with the set of 54 Loteria picture cards. At the end of these two studies, the researchers found that pre-service teachers were really surprised by parents' strong abilities to learn and solve problems in the context of the FMLE, contrary to what they expected in the first place. In these informal education settings, the student teachers came to the realization that parents' science and math knowledge is not limited by their low formal education level. The researchers concluded that having direct experiences with parents and

working with them in a specific content area such as mathematics helped pre-service teachers change their prior misconceptions about parents' ability to assist in their children's education.

In another study, Bernier, Civil, and Allestaht-Snyder (2003) examined elementary teachers' experiences with low-income immigrant parents in their children's mathematics education in an alternative mathematics context in which teachers, students, and their parents learned together in egalitarian relationships as they "participated as co-constructors of knowledge within mathematical sphere" (p. 24). By shifting the hierarchical power discourses, they resisted mainstream views of family-school interactions through situating teachers as learners, teachers, and leaders while they positioned parents as learners, teachers, and parents. The researchers argued that situating teachers in these three roles when they actively worked with families helped teachers to be learners of mathematics and led them to rethink their perceptions of what constitutes family-school collaborations as they started to conceptualize parents as strong resources in their children's mathematical learning. They also found that giving parents the authority of being teachers in these settings emancipated them from the feeling of "being not enough" as perpetuated by the dominant culture and created opportunities for them to be role models for their children's mathematics education.

Chinn (2006) worked with pre-service and in-service science teachers to develop culturally relevant and standardized-based science curriculum for Hawaiian students. In this project, teachers were engaged in in-depth immersion experiences in the local community and collaborated with Hawaiian teachers in development of the curriculum. During the immersion program, teachers were guided in areas in which culture, place, and school curriculum intersected where they "restored and planted taro pond fields, restored fishponds, built rock walls via traditional farming" (p. 388). Teachers gained a deep understanding about Hawaiian culture,

their students' ways of understanding the world, and the value of connecting the culture to education; these teachers also enhanced their skills in the development of culturally relevant lessons that aligned with state-mandated science standards. At the end of the project, the researcher found that teachers' active participation in the community through doing and observing was critical to motivating a shift in teachers' thinking and in their practices in their teaching of science.

In a similar vein, the researchers in informal science contexts supported the idea of interactive and multiple ways of communication between family, school, and community that acknowledge families' cultural practices (Ash, 2004; Weiland, 2015; Dawson, 2015). Ash (2004) has advocated for an alternative discourse of science learning within collaborative family interactions. In applying sociocultural paradigms in her work, Ash investigated dialogic inquiries between families, researchers, mediators, and science exhibitions during an aquarium visit. She concluded that families engage with their children in dialogues through observing, questioning, and switching from everyday language to scientific language, which are practices that can serve as routes for advanced formal education and science proficiency.

Throughout this analysis of the literature on family-school partnerships in science education, I have written little of teachers' learning in collaborating with families because research that focused on teachers' experiences in family engagement and science education comprises rare exceptions in the literature (Hammond, 2001; Upadhyay, 2009; McCollough & Ramirez, 2012; Ramirez, McCollough & Diaz, 2016). Although teachers are expected to collaborate with families, a lack of professional learning opportunities and administrative support for in-service teachers in working with diverse families continues in this regard. The STC bilingual family workshops in the LISELL-B project were one of the few research approaches

that focused on teachers' orientations to and preparation for working with diverse students and their parents in the context of science education.

CHAPTER 4

METHODOLOGY

In this chapter, I explain the context for the research including the STC workshops and research site where the STC workshops were located. Finally, I provide detailed description of my study design including my research question, research participants, research methodology including a detailed description of data analysis procedures.

Context for the Project Schools

The STC workshops were located in areas (I will call them Stonybrook and Woodstone school districts) within the North portion of Georgia that have seen rapid increases of Latino students, chiefly from Mexico and Central America, over the past decade (Buxton et al., 2017). Hamman, Wortham and Murillo (2002) refer to these regions as the new Latino diaspora, in which “increasing numbers of Latinos are settling both temporarily and permanently in areas of the United States that have not traditionally been home to Latinos” (p.1) compared to the states of Arizona, California, Colorado, Florida, Illinois, New Jersey, New Mexico, New York, and Texas, all of which have longstanding Latino communities with deep-rooted histories of immigration. The rise of the Latino population in the Stonybrook and Woodstone counties can be attributed to emerging markets in the regions attracting Latinos to poultry and meat-processing industries that have been recently turned into “Hispanic labor” industries (Schwartzman, 2013, p.19). Construction, agriculture and mining are other industries Latinos occupy with 27% in the state of Georgia (Pew Research Center, 2014).

This rapid growth in the Latino population presents some challenges to newcomers, as long-term residents are not accustomed to living alongside the newcomers. Having historically different racial dynamics that mostly spiraled into to a Black and White dichotomy, the Southeastern United States' attitude toward new Latino diaspora communities have been characterized as not welcoming for Latino families (Hamann & Harklau, 2015). Anti-immigrant policies forbidding undocumented students to attend some of Georgia's top universities illustrate this unwelcoming sentiment perceived by many Latino families (Acosta, 2013). Anti-immigration policies have also been the case in the counties of Woodstone (Floyd, 2015) and Stonybrook (Russakoff, 2017) that undergo deportation raids affecting Latino families' socialization into the local and broader community. This is especially prevalent in Stonybrook, which is one of the four counties in Georgia having a formal agreement to report incarcerated undocumented immigrants to the Department of Homeland Security, so violations such as receiving a traffic ticket can pave the way to deportation proceedings (U.S Immigration and Customs Enforcement, 2016). As the Trump administration heightened anti-immigration anger across the country, it is not difficult to imagine that these numbers will increase in the near future – conveying a fear of an unpredictable future on the part of immigrant Latino families.

Latino emergent bilingual students constitute an important segment of the public school population in Stonybrook and Woodstone districts, accounting for 43% and 25% respectively (Georgia Department of Education [GADOE], 2017). Ninety-two percent of the students in the Woodstone district and 57% of the students in the Stonybrook district qualify for free or reduced-price school lunch (GADOE, 2016). Despite the fact that a majority of immigrant students speak a language other than English at home and learn English as a second language at school, the school policies interestingly advocate for English-only instruction. In contrast to

areas habituated in receiving immigrants, new Latino diaspora destinations such as Stonybrook and Woodstone are less likely to have bilingual resources and services available to non-English speakers (National Academies of Sciences, Engineering, and Medicine, 2017).

Although there is no specific source published related to Stonybrook and Woodstone teachers, from my experience in those districts' secondary schools through the LISELL-B project, I can say that most of the educators are European American and female. As a matter of fact, this portrait represents the current teaching force in the United States, which remains overwhelmingly European American representing 80% of the teaching profession, and with teachers of color accounting for merely 20% (U.S. Department of Education, 2017). Moreover, these European American teachers are largely monolingual, and come from middle class backgrounds (Nieto, 2013). This contradictory demographic portrait between the student body and the teaching force raise an additional challenge for the education of Latino emergent bilingual students. Teachers in Georgia's public schools are more likely not to be familiar with experiences of diverse population and less likely to receive linguistic and pedagogical preparation to interact with emergent bilingual students and their families (Harklau & Colomer, 2015).

Setting for the STC Workshops

With these demographic shifts in mind, in 2009 the project began to invite secondary science teachers, ESOL teachers, their Latino students and their accompanying families to participate in STC workshops as a part of a design-based project. LISELL-B was the latest iteration of the project that started in Fall, 2014 and recently ended in May 2017. The project was a dynamic collaboration among the research team, approximately 50 teachers, 4000 of their students and their accompanying families in three middle schools and one high school from the

Stonybrook district and two middle schools and two high schools from Woodstone district (Buxton et al., 2017).

In each academic year, five STC bilingual family workshops were offered and approximately 50 students, 40 parents, and seven teachers participated in each workshop. The four-hour long workshops took place in various academic environments, including university campuses, technical colleges, and school district career academies in different areas of Georgia. During the STC workshops, participants rotated through three different sessions:

Family educational conversations session, in which teachers, families, and researchers



Figure 3: Students and parents interviewing each other about science education and science related careers.

engaged in bilingual conversations regarding preparation for post-secondary education. In some workshops, parents and students interacted in bilingual language-rich parent-student interviews

that related to knowledge about careers in science, knowledge about academic language, experiences in the STC workshops, educational goals for students, and decisions about attending college. During the interviews, teachers had a chance to sit next to families and listen to their educational concerns, ideas, and goals related to science education and science careers. In some

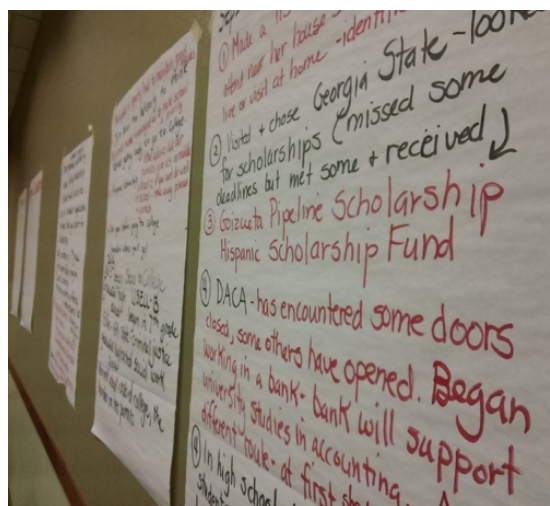


Figure 4: Notes from the conversations about college scholarship opportunities.

workshops, guest speakers, mostly Latino college/graduate students, were invited to share their



Figure 5: Teachers, families and researchers talking about post-secondary education.

experiences about college preparation, and they provided information about general aspects of how to apply for scholarships and how to write college application essays.

Family science investigation session, in which students engaged in bilingual language rich science investigations with their families, their teachers, and project researchers. Students were equipped with bilingual science activity handouts, general academic vocabulary cards, and concept cards, available in both English and Spanish, for the investigations. Students, mothers, fathers, and teachers thought together, engaged in dialogues, and answered questions that were raised by the facilitators. Families shared their prior experiences that related to the scientific



Figure 6: Families, teachers and researchers working on *Carbon Filament Light Bulb Activity*.

concepts as a response to the questions in the handouts, such as “What is your previous knowledge about the process of handwashing?” “Why do you think some ways of washing hands can be more effective in preventing the spread of diseases than others?” Families worked together with teachers and project researchers in hands-on science investigations and discussed scientific processes in small group and whole group discussions. Time was also provided for students and families to translate their everyday language into scientific language as they engaged such questions as “Use your own words to describe the role the variables played in your dirty hands investigation” And “Use scientific language to describe the role the variables played in your dirty hands investigation.” These highly interactive investigations gave students and family members the chance to be included in dialogues and practices around scientific inquiries as well as to consider science as a more familiar, non-threatening discipline that is actually linked to their everyday lives.

Science investigations were followed by *college information and STEM research*



Figure 7: Families, teachers and food scientists looking at egg yolk through microscope.

sessions in which students and families visited science labs and discussed careers and studies in STEM-related fields with university faculty and college students. Each STC workshop was followed by a shared lunch, which provided opportunities for informal conversation.

In the STC workshops, teaching and learning practices were constructed in a way that emergent bilingual

students were offered opportunities to interact with science “in multiple languages where they choose from moment to moment which language best serves their needs” (Buxton et al., 2017, p. 11). This approach was one way to show teachers that using the home language of students is a

rich academic resource to enhance emergent bilingual students' science learning. The aim was to demonstrate that when teachers shift the power structures regarding the dominance of one language and validate all students' cultural and linguistic resources, all students benefit from this (Freire, 1970). Such a shift is a necessary condition for the possibility of dialogue-based education, so that students' home knowledge is recognized and valued.

In the STC workshops, the teachers' roles were conceptualized as co-learners along with their students and families, in line with Freire's (1970) notion that "in order to communicate effectively, [an] educator must understand the structural conditions in which the thought and language of the people are dialectically framed" (p. 86). This approach allowed teachers to interact with their students and families when they occupied the participant position rather than the facilitator role.

Research Question

Building upon the Freirean notion of dialogic education (Freire, 1970, 2005, 2013), the purpose of this study was to explore what happens when in-service secondary science teachers come together with Latino parents/grandparents for their children's science learning in the context of STC bilingual family workshops. The overarching question guiding this dissertation study was: *How did secondary science teachers conceptualize the ways in which their participation affected their perspectives and practices about working with their Latino students and their families?*

Research Design

Characteristics of Case Study

This study was conducted as a qualitative case study. According to Merriam (1998, 2009), case study is helpful when researchers are interested in an extensive understanding of a

single phenomenon or entity. The focus is on “the process rather than outcomes, in the context rather than a specific variable, in discovery rather than confirmation” (Merriam, 1998, p.298). Merriam defines case study as “intensive descriptions and analyses of single unit or bounded system (Smith, 1978) such as an individual, program, event, group, intervention or community” (1998, p.298). Her definition is thus in line with Stake’s (1995) definition of a case as an “integrated system” (p.2) functioning with different components. The unit of analysis then can be a case or cases on the condition that they can be surrounded with boundaries and “fenced in” (Merriam, 1998, p.392).

In order to differentiate a qualitative case study from other types of qualitative research, Merriam described case study with three characteristics – particularistic, descriptive, and heuristic. Particularistic means that the study focuses on a specific situation, program, individual, or group so that the study can provide readers some ideas on “what to do or what not to do” in analogous circumstances. In this sense, a case study can investigate an individual situation but can also address a broader issue. According to Merriam (1998), the descriptive aspect of a case study refers to “thick description of the phenomenon” (p. 426) in terms of reporting findings of the study. In this view, a case study incorporates as many factors as possible and describes their relation over a passage of time by using information from variety of sources. As Yin observes, qualitative case studies aim to elicit the phenomenon within its own circumstances considering the impossibility of separating the unit of analysis from its context. Its heuristic feature enlightens readers’ comprehension related to a given situation and provides “insights into how things get to be the way they are can be expected to result from case studies” (Stake, 1981, p.47) and evaluates and discusses the main points and discovers or confirms the process, thus raises the potential relevance of the focus of the case study.

My decision to conduct a qualitative case study stems from my particular interest in providing readers a holistic description of what happens when teachers come together with their Latino students and families in a bounded and integrated unit, the STC workshops. A case study approach was appropriate for my study because I concentrated particularly on addressing *why* and *how* questions aiming to elicit in-depth explanation of a phenomenon (Yin, 2014). For the purpose of the research study, the bounded case was the experiences of teachers in working with families within the STC workshops. Through in-depth and longitudinal examination of this unique informal school-based science learning environment, this study sought possible applications for teacher education programs and K-12 settings with similar demographic characteristics.

Participant Selection

Merriam (1998) suggested two levels of sampling in qualitative case studies: the first step involves selecting the case(s), unit(s) of analysis, to be examined. In the next step, the researchers involve “doing sampling within the case” (p.866) in accordance with the content that they seek to elicit. While sampling within the case, purposeful sampling is the common strategy to be used in qualitative case studies, mostly arranged in advance of the data collection process. The researcher establishes the criteria in order to select participants who would provide rich information that is central to phenomena of interest. Patton called this kind of sample “information rich cases” from which one can learn a great deal about issues of central importance to the purpose of research” (Patton, 2002, p. 46).

With the above information in mind, I identified teacher participants who experienced the phenomenon and were able to give a rich account of their experience in the STC workshops (Roulston, 2010). With the assistance of Dr. Alleksaht-Snider and Dr. Buxton, I recruited five

secondary science teachers who had extensive experience in working with Latino students and their families in the workshops to participate as focal teachers in the research. Table 3 provides demographic information about these teacher participants, including pseudonyms. The teachers were paid \$50 by the LISELL-B project to compensate them for their time interviews and as an incentive to participate in this research study. I purposefully selected these teachers from the large number of teachers who attended workshops because they had at least two years of consistent attendance at these workshops in a regular fashion and agreed to participate in the present study. I created the following criteria to guide my participant selection.

In order to participate in the study, teachers must:

- Be a secondary science teacher who is involved in the LISELL project
- Have participated in the workshops regularly for at least 2 years
- Have a desire to share personal educational experiences and their experiences about participating in the STC workshops

Obtaining in-depth descriptions of people's perceptions, I gained insight into the experience of teacher participation in the STC workshops on an individual level by examining the cases of these five teachers. The size of the sample for this study was relatively small because the aim was depth not breadth in terms of understanding of the phenomenon. Because the use of a large sample size does not always provide insight into the experience of a phenomenon on an individual level, this small sample size allowed me to achieve that purpose.

Table 3: Summary of research participants.

Teacher name	Race	School	Percentage of Latino students	Status of the school	School district	Major and grade	#Total years of workshop participation
Donald	European American	Creek Middle School	% 53 [†]	Title 1*	Stonybrook	8 th grade physical science	2
Teresa	Latino	River Middle School	% 56 [†]	Title 1*	Stonybrook	6 th grade life science	3
Jennifer	European American	Fall High School	% 48 [†]	Not Title 1*	Stonybrook	11-12 th grade forensics /oceanography science	3
Julie	European American	Oak Middle School	% 39 [†]	Title 1*	Woodstone	6 th grade earth science teacher	7
Allyson	European American	Spring Middle School	% 40 [†]	Title 1*	Woodstone	7-8 th grade ESOL/science co-teacher	3

Source: Data are derived from *GADOE (2016) and [†]GADOE (2017)

Data Collection Methods

In order to generate a profound understanding of the phenomenon of interest, qualitative case studies rest on multiple sources of data that differentiates them from other qualitative studies that use mostly one or at best two sources of data (Stake, 1995; Merriam, 2009). All three means of data collection, interviews, participant observation, and document analysis are required to understand the case(s) in its own circumstances because as Patton (1990) indicated, “no single source of information can be trusted to provide a comprehensive perspective” (p.244).

Merriam (1998) regarded data collection methods in qualitative case studies as a “recursive and interactive process” (p. 1656) in which employing one strategy might guide a researcher to collect consecutive sources of data that were not planned previously. In this study, I used a variety of data sources to be open to new ideas that manifested themselves in the preliminary analysis process and informed the next phase of the data collection process. These data sources included focus group teacher interviews that were collected by the project

researchers and from my personal notes that I took during the LISELL-B teacher professional development sessions, LISELL-B classroom observations conducted by the project researchers in the focal teachers' classrooms, participant observation of teachers that I conducted during the STC workshops, the STC workshop reports that were written by the project coordinator in collaboration with the project researchers, and individual teacher interviews that I collected during the research process. The two finding sections that I wrote at the end of this study—a single case study of a Latino bilingual and multicultural teacher (chapter 5) and a multi-case study of four European American teachers (chapter 6) in the STC workshops, two methods of data collection, interviews and participant observations, predominated while other methods assumed a supportive role in developing an extensive understanding of the phenomenon. LISELL-B classroom observations were the only source of data that is only pertinent to the single case study in Chapter 5. All other sources of data apply to both of the studies.

Individual interviews. As qualitative case studies aim to elicit detailed descriptions and interpretations from others, interviewing is the main road to achieve that purpose (Stake, 1995, Merriam, 1998). As Patton (1990) stated, interviews allow researchers to enter into “what is in and on in someone else’ mind” (p. 278). Through interviews, the researchers aim to learn intentions, behaviors and feelings that can be neither directly observed nor obtained from other means of data collection (Patton, 1990).

I conducted individual semi-structured and open-ended interviews with each teacher participant to understand the meanings they ascribed to their interactions with their Latino families in the STC workshops. The semi-structured, open-ended interviews comprise a set of questions that do not need to be written or sequenced in advance. The interviewer is free to establish a conversational tone and phrases the questions spontaneously. Probing questions are

located at appropriate places where more information is needed (Patton, 1987; Roulston, 2010).

This open-ended, semi-structured and non-leading interview structure allows research participants to define their worlds in unique ways and encourages them to offer reasons to illustrate their ideas and provide examples for their experiences, so they can provide and reflect on their in-depth responses.

Individual interviews were conducted two times with each teacher participant during Summer 2017. In the first interview, I planned to focus on teachers' personal history – teachers' cultural and social backgrounds and their own experiences as K-12 students regarding family-school interactions, their educational experiences in relation to working with diverse students and families in their respective pre-service and in-service teacher education programs up to the time when they started attending the STC workshops, and schools' expectations for them regarding this area. This interview provided contextual information about the focal teachers that supported an understanding of their experiences in the STC workshops in relation to their social, cultural, and historical locations. The second interview focused particularly on teachers' experiences in the STC workshops, their learning across the years and how it informed their present and future practices in working with their Latino students and families, and their ideas on students' attendance in the program. The second individual interview captured the details of their experiences within the contexts in which they occurred and their current and future practices that are associated with those experiences. During the second interview, follow-up questions were addressed based on the analysis of initial interviews and other sources of data. Follow-up questions gave me an opportunity to encourage participants to clarify, elaborate, and verify my interpretations regarding their experiences.

Although I planned to be flexible in wording of the questions in a semi-structured format, I developed an interview guide for both of the individual interviews (see, appendix A and appendix B), including my interview questions and some possible probes that were written in advance to maintain those questions as focus of the conversation. I arranged the interview questions based on Patton's matrix of sequenced question types (Patton, 1987). As he suggested, I began the interview with experience/behavior questions since they require minimal interpretation and are relatively easy to answer, such as "How did you become involved in the STC family workshops?" These kinds of questions served as good transition questions and functioned as "ice breakers" in the interviews. Then I followed with sensory questions, such as "If somebody had been in the LISELL-B family workshop with you, what would s/he have seen you doing during the science activity session?" This kind of question allowed the respondents to recapture their experience by imagining it. Then I followed with opinion /belief questions such as "What would you tell one of your colleagues about why they should attend a family workshop?" Finally, I asked demographic/background questions, such as "How long have you been teaching?" The wording and sometimes the sequence of the questions changed based on the participants and the flow of the interviews. During the interviews, instead of asking many different questions, I used probes as an interview technique to go deeper into the interview responses (Patton, 198; Roulston, 2010; Glesne, 2011). Since listening to the interviewee is an essential part of probing (Glesne, 2011), I carefully listened to my respondents to ask probing questions in appropriate places.

When it comes to setting up the interviews, I scheduled interviews based on the convenience of the interviewees. The majority of individual interviews were conducted in local coffee shops where the focal teachers resided; other places included the household of a focal

teacher, a public library, and a university campus. I noticed that careful consideration should be given even for selecting settings for interviews. Using open and public spaces might become highly problematic for the researchers due to their noisy nature. One of the interviews that I conducted in a coffee shop can be used as an example for this unwanted scenario. Even though there was noise in the space, thankfully, I was able to hear and identify our conversations from the audio recorder following the interview. In terms of timing, I informed participants that the interviews will not last more than 90 minutes. I kept track of time and avoided overstaying to prevent potential discomfort or boredom on the part of participants. Nevertheless, the interviews lasted between one and half hour to two hours upon the interests of the participants to stay longer in the interviews. Given the permission of teacher participants, the interviews were audiotaped and transcribed verbatim to allow further analysis of the interviews.

Focus group interviews. As an additional source of data, I used focus group interviews that were conducted with several groups of teachers in the past three years during the annual LISEL-B Summer Professional-Learning Institutes. These focus group interviews were administered so that teachers were grouped according to the schools where they worked, and these colleagues discussed a set of topics that were introduced by the moderators who were the project researchers. The moderators within each group followed an interview protocol that explained the purpose of the interview and interview questions and encouraged participants to comment on each other's' experiences and viewpoints.

The purpose of the focus-group interviews was to generate information relating to participants' responses to particular experiences in the LISELL-B project, such as perspectives on using LISELL-B science investigation practices in the classroom and their influence in supporting emergent bilingual students' science learning and academic language and these

teachers' ideas toward individual school policies that affect science teaching practices in the classroom. In the final set of focus group interviews that were conducted in 2016, the interview protocol included additional questions (see, appendix C). These additional questions concerned teacher professional goals in attending the STC workshops and key take-away messages from the program.

Through reading and analyzing these focus group interviews, I specifically focused on the accounts of my five research participants from the large number of teachers who attended the focus group interviews and sought information that could provide me with an understanding in relation to my research question. Analyzing the reflections of my research participants in these focus group interviews offered me some insights into the teachers' experiences with their Latino students and families and led me to some follow up questions that I asked during the individual interviews.

Participant observations in the STC workshops. In addition to interviews, I used field notes from participant observation that I conducted in the STC workshops during the 2014-2015 and 2016-2017 academic years to develop a better understanding in regard to experiences of teachers in the STC workshops (see table 4). According to Merriam (1998), participant observation is critical in qualitative case studies in two respects. First, observations enable researchers to understand the case(s) in their natural settings; second, researchers experience a "firsthand encounter" (p. 1181) with the process that is pertinent to the study which can enhance their acquaintance with the focus of the study. With the above purposes in mind, I conducted 16 hours of participant observation and took 48 pages of field notes over the course of six workshops that took place over the past three years to collect divergent data which would contribute to "immersion in others' lives and enhance sensitivity to interaction and process"

(Emerson, Fretz & Shaw, 2011, p.3). With immersion, my goal was to view from the inside how teachers and families respond to the activities while they are occurring and how meanings emerge from those interactions.

The participant observations included a registration session, a family educational conversation session, a family science Investigation session, and a lunch period that the five focal teachers attended at least once. However, the structure of the observations and observed events differed depending on the role that I played in each workshop. According to Merriam (1998), what to observe is determined by “the conceptual framework, or the questions of interests” (1208) so that the observation can offer researchers rich understanding for the purpose of the study. In the same vein, I mostly concentrated on the five focal teachers, and I paid attention to their interactions with the families. Reflections of students, parents, and teachers during whole group discussions was another area of focus in those observations.

Since I was a member of the STC workshops, assuming certain responsibilities as the project researcher, I was a complete participant in this setting. However, my stance purposefully ranged across a continuum from complete participant as co-facilitator of Family Educational Conversation Session to participant as observer by joining the activities with teachers and families as they rotated among sessions of the workshop to observe as participant with a minimum engagement. For example, during the workshop in which I conducted my first participant observation, I preferred not to remain among the participants, so I took notes from the back of the room during the science and family conversation sessions. However, I realized that even though I could observe nonverbal expressions, gestures, and movements, separating myself from the participants prevented me from hearing detailed aspects of talk and interaction between teachers and parents. In some of the observations, I sat next to participants and worked with them

in activities to capture short and extended direct quotations during interactions with other participants. My presence in the groups also afforded me a sense of what it is like to be a participant in the STC workshops.

I realized that playing the role of *participant as observer* offered me better insight into the lived experiences of teachers with families. However, as Glesne pointed out, “a paradox develops as you become more of a participant and less of an observer. The more you function as a member of the everyday world of the researched, the more you risk losing the eye of the uninvolved outsider; yet, the more you participate, the greater your opportunity to learn” (p. 65). Being aware that each stance has advantages and disadvantages, I tried to balance my roles of insider and outsider, so I could understand the interactions between teachers and families from different angles.

I used a field notebook as a primary recording tool to record my notes from the observations. But I realized that writing notes is not an easy task because this process requires researchers to know what can be written about and how. As Emerson et al. (2011) emphasized, how and when a field researcher makes jottings might have significant consequences in relation to how others see and understand what the jottings are about (p. 35). For instance, in the first workshop, I jotted down full sentences instead of key words since I was afraid to forget the details of what I observed. However, I realized that writing full sentences attracted the attention of people and distracted them. As I wrote some notes in my notebook during the science activity session, one mother looked at my notebook several times and tried to read what I was writing. Trying to write every detail also caused me to miss some moments that could be very important for the study. By practicing trial and error, in the subsequent workshops, I tried to write a few key words instead of full sentences in my notebook.

The content of my extended field notes included physical description of the place, participants, and activities; direct quotations of participants; and my reactions to what I observed in the STC workshops. During the writing process, I strived for accuracy, so my notes would help me to be able to visualize the moment and interactions in the workshops even years later (Glesne, 2011; Emerson et al., 2011). Instead of using vague and evaluative adjectives (e.g., some, many, nice), I paid close attention and tried to give more concrete descriptions, such as *There are about 37 people in the room including the facilities and teachers*. I also wrote sensory details of observed sites, interactions, and people. For instance, as I mentioned a science teacher, *Mr. Walter, I tried to visualize that person for the audience: He is also a white American man in his 50s, but he seems younger than 50 with his white sneakers, blue jeans, and black hooded cardigan*. As Emerson et al. suggested, I wrote verbatim dialogues of the participants in order to show rather than tell people's behavior: *Then Mrs. Molly turns back to the room and walks over this group by loudly saying, "She is my student!"* I completed each set of field notes within 24 hours of each participant observation to provide more accurate information about the events that were described.

The accumulated written record of my observations in the STC workshops provided useful information regarding the activities and the focal teachers' experiences as they happened during the STC workshops.

LISELL-B classroom observations. LISELL-B classroom observations were conducted and field notes were taken by the project researchers in the project teachers' classrooms, so I could examine their use of LISELL-B teaching resources and materials. Multiple teachers who were associated with this project also attended these observations and wrote field notes about the observed teacher's practices. The content of the field notes included teachers' instructions, type

of learning activities that took place, any resources and technology that were used and interactions among students and between students and the teacher during the observation. This is the only source of data that is pertinent to the single case study in the chapter 5 where I examined the experiences of a Latina bilingual and multicultural teacher, Teresa, in working with her Latino emergent bilingual students and families during and following the STC workshops. I was able to access the field notes that were taken during the LISELL-B participant observations in Teresa's science classroom where she was working on *Strawberry DNA Extraction* experiment with her students in Fall 2016. This source of data provided information about how Teresa's science teaching provided a space for dialogue-based learning interactions in which she argued that she learned dialogue-based learning processes from the STC workshops. It would have been helpful to examine LISELL-B classroom observations that were conducted for other four focal teachers, but I could not access these resources of data.

Documents. As a final source of data apart from interviews and participant observations, I employed a range of written materials relevant to study. These documents were collected by the project researchers in several components of the LISELL-B project, including recorded chart papers from the STC workshops, and the workshop reports written by the project coordinator and my personal notes from the LISELL-B teacher professional development workshops. Merriam (2009) called these kinds of documents *researcher generated documents* that were collected for the purpose of investigation. Being aware that all of these documents were not relevant to the purpose of my study, there were some components that offered me some clues into the cases and provided me with some startling ideas for further analysis of research data. For example, my personal notes that I took during the LISELL-B teacher professional development workshops

helped me to better understand the main agenda of each school in which focal teachers were working and the teachers' expected roles in accomplishing those agendas.

I also analyzed reports that were written by the research coordinator following each STC workshop. These reports included detailed information about the goals of the workshop, number of participants who attended the program, and the activities that were carried out in the family educational conversations session, science investigation session, and college information and stem research session. The reports also included reflections of the project researchers regarding the program and suggestions for continuing to support family and teacher learning that came out of the family workshop.

An analysis of those written documents that have been collected over the past three years helped me to gain background information about how teachers' experiences in the STC workshops influenced their perspectives and practices regarding working with diverse families.

Timeline of the Study

Table 4: Stages of the dissertation study.

2014-2017	• Focus group interviews with the focal teachers at the annual LISELL-B summer professional-learning institutes • The STC workshop reports including project researchers' written reflections about the program • Chart paper notes taken during the STC workshops • LISELL-B participant observations in Teresa's classroom
Spring 2015	• Participant observation of STC workshop in Stonybrook County (1.24.2015) • Participant observation of STC workshop in Woodstone County (2.28.2015) • Participant observation of STC workshop provided for both counties (3.28.2015)
Fall 2016 - Spring 2017	• Participant observation of STC workshop in Woodstone County (10.8.2016) • Participant observation of STC workshop in Stonybrook county (2.25.2017) • Participant observation of STC workshop provided for both counties (3.18.2017)

Summer 2017	• Conduct preliminary analysis with initial data to identify interview questions with focal teachers • Conduct first individual interviews with each focal teacher • Conduct second individual interviews with each focal teacher • Involve with preliminary analysis while collecting more data
Fall 2017	• Conduct intensive analysis of data for chapter 5 (single case study of a bilingual and multicultural teacher) and chapter 6 (multi-case study of four European American teachers) • Write findings chapter for the chapter 5
Spring 2018	• Write findings chapter for the chapter 6: presenting case-by-case analysis and then cross-case analysis • Write conclusion chapter for the dissertation

Data Analysis

As Merriam (1998) pointed out, explaining data gathering and data analysis in separate sections may be misleading partly because gathering and analysis should be a “simultaneous process” in qualitative research (p. 1866). Once researchers have collected first sets of data, whether it is a first observation, a first interview or a first document, researchers should initiate the analysis process to inform subsequent steps of data collection (i.e., through follow up questions, clarifications, etc.). Following Merriam’s suggestions of not waiting until all of the data collection process is completed, I read and re-read transcriptions of focus group interviews, the field notes, and the written documents that were collected from the STC workshops and LISELL-B professional development programs. This process guided my first interview protocol. I have also written a memo to myself to keep track of my ideas right after each individual interview. Memo-writing during the data collection phase provided me with an opportunity to engage with the initial analysis of the data. Keeping my initial analytical notes informed my second interview protocol, adding follow-up questions for each research participant to clarify, elaborate or verify my interpretation of their experiences with their Latino students and their families.

It is not to say that the analysis process is completed at the end of the data collection process; rather, “analysis becomes more intensive as the study progresses, and once all the data are in” (p. 1871). Several approaches to manage this phase of intensive analysis exist in qualitative research, but the common methods are “still inductive and comparative” (Merriam & Tisdell, 2015, p.227). In the following sections, I explain my analytical approach for the two findings sections that I wrote in chapter 5 and chapter 6.

Analytic Approach for Chapter 5

In chapter 5, I examined a single-case study of Teresa, a Latina secondary science teacher. I attempted to describe how Teresa conceptualized the ways in which her participation in the STC workshops affected her perspectives and practices about working with her Latino students and their families.

In this single case study, I mostly engaged in a mode of narrative thinking in analyzing the data (see Freeman, 2017). To begin the analysis, I first carried out an inductive process to seek emergent meanings across the individual and focus group interviews, the field notes from the STC workshops and Teresa’s science classroom, and the written documents collected from the STC workshops and LISELL-B professional development programs. I conducted line-by-line readings of these data sources several times. As I read the interview transcriptions, field notes, and written documents, I developed notes and added labels in the margins of each page of data. I also wrote memos to myself to track my evolving assumptions and reflections during the analysis processes.

Freeman (2017) defined narrative thinking “based on the belief that narrative structures reflect a human tendency which is to connect events, characters, circumstances, decisions, and so on in a way that provides meaning to that experience” (p. 32). In this sense, narrative thinking

allows researchers to “connect disparate events into coherent accounts and connect individual experiences to universal human themes” (p. 40). Thinking through what will be included and what will be eliminated, I condensed the data and linked the events together in a narrative that revealed the meaning that I received from studying the phenomenon. I presented the findings in the form of organized and connected narrative accounts that explain the data in relation to my research question. This intensive and holistic descriptive narrative included the following: (a) navigating the school system as a Latino student, (b) Teresa’s progress as a bilingual and multicultural science teacher, (c) the challenges and tensions that Teresa continued to face in her science classroom, and (d) the ways in which the STC workshops influenced Teresa’s perspectives and practices in regard to working with diverse students and families.

I concluded the analysis process by examining how Freire’s (1970, 2005, 2013) principles of dialogic education were connected to Teresa’s pedagogical goals, perspectives, and practices in regard to her work with Latino emergent bilingual students and their families.

Analytical Approach for Chapter 6

Chapter 6 is a multi-case study of four European American secondary science teachers. In this chapter, I examined how these secondary science teachers conceptualized the ways in which their participation in the STC workshops affected their perspectives and practices about working with their Latino students and their families.

In this multi-case study, I employed categorical thinking as the primary analytical strategy (see Freeman, 2017) and incorporated aspects of Charmaz’s (2014) constant comparative method (CCM) to sift through information that was essential for my research study. The CCM, developed by Glaser and Strauss (1967), was adapted by many researchers in a variety of disciplines who were not employing grounded theory as their methodology to seek

substantive theory. Charmaz (2014) attributed the wide use of this analytical approach to its systematic nature. The CCM is systematic because it involves clear guidelines: coding, category construction, constant comparison, and memo-writing. In fact, not only is the CCM a systematic method, it is also an interactive method prompting sustained interplay between researcher and data during the analysis process. This interactive space immerses researchers more deeply into the data while creating opportunities for more than a causal reading of the data. The CCM is also a comparative method in the way that researchers start analyzing an incident in one set of data and compare it with another incident in the same or subsequent data. These comparisons are continuously made until a theme diagram is developed or theory formulated.

According to Charmaz (2014), the CCM does not rely on preconceived codes and categories to be tested; rather it requires researchers to be involved in inductive analysis to discover data-driven codes and categories. In this view, any analysis is positioned in a time, context, and situation that can be transferable to similar contexts and is not subject to broader generalizations. This perspective contrasts with that of Glaser and Strauss (1967), because it contends that researchers should be involved in the data analysis process without preconceived notions. Rather, Charmaz suggested that readers be “open-minded, yet acknowledge that researchers hold prior ideas and skills” (p. 117). In this view, Charmaz assumes that theories are not discovered, but they are constructed by the researchers as they interact with the research field and participants.

Building upon Charmaz’s (2014) work, I engaged with several coding strategies. The types of coding included initial coding, focused coding, and theoretical coding. I used a Qualitative Data Analysis Software (QDAS) program, ATLAS.ti 8.0, to navigate the analysis process, including the phases of initial, focused, and theoretical coding; writing the coding

dictionary and memos. In the following sections, I present how I translated these analytical tasks into software tools to accomplish the analysis process.

Initial coding. As a first step of the analysis process, I imported the individual and focus group interview transcripts and field notes from the STC workshops in ATLAS.ti QDAS program in addition to written documents collected from the STC workshops and LISELL-B professional development programs. By using the *document group* component of ATLAS.ti program, I organized my data by each research participant (e.g., Allyson's data, Donald's data, etc.).

Following the guidelines of Charmaz's (2014) CCM, I engaged with a careful reading of each data document in an open-minded manner as much as possible. As a next step, I performed initial coding, labeling the segments of the data incident by incident (coding events) using the *open code* component of ATLAS.ti program. According to Charmaz (2014), initial codes are provisional in the sense that researchers continue to be observant of every analytic possibility to develop codes that best capture the data. For Charmaz, this is the essential feature of CCM initial coding that stimulates further thinking and eventually provokes new understandings. However, being open-minded does not mean clearing away prior ideas and assumptions, considering the fact that "there is a difference between an open mind and empty head" (Dey, 1999, p.251. cited in Charmaz, 2014, p. 117). Remaining open-minded, researchers recognize what data reveal and where coding takes them.

Making comparisons between incidents motivated me to examine every piece of data, so I was able to minimize the possibility of overlooking any crucial details related to the research phenomenon. While coding, I made an effort to preserve the actions using the gerund form as much as possible so that my initial codes captured the data. A data-driven inductive strategy was

especially appropriate for my study, considering that my goal was to provide readers with an in-depth description of the cases related to the study. Table 5 provides the example of an initial coding incident by incident.

Table 5: An example of the incident by incident coding.

Excerpt from First individual interview of Allyson when I came out to West Georgia, West Georgia was at that time a very strong Ku Klux Klan area, and there was a very definite distinction between white people and black people and they didn't mix and all of that.	Being exposed to racial divide
In the military, there wasn't any of that. So, that kind of set me on a path, kind of set my mind for I didn't really care where you came from or whatever and we just all had a lot of fun. We'd run coffee can string phones across the parking lot, and we actually ran some all the way across the parking lot from my upstairs window to my friends which lived two hundred feet away and so we were always coming up with things to play with having a good time. The neighborhood where I lived was all white. At that time in Georgia, there were white neighborhoods, and there were black neighborhoods, and they didn't really mix together. So, at my house, the only kids that were around me were white, and so they were the kids I knew I was playing with and actually none of the kids that lived around me went to school with me except a couple. The ones that lived immediately around me they all either went to...they went to the city school which you had to pay an extra tuition to go to.	Having cultural immersion experience in the past
Linguistically, I wasn't really thinking about it, and I didn't really think about until I started teaching. I didn't really have any friends....I did when I was young in the military, but...everybody also spoke English. So, even though I had some friends who were Vietnamese and I had Indian friends and they may have spoken that language in their home, but we all commonly spoke English. So, when we were together, it was just always just English, and I never thought about linguistically until I started teaching.	Questioning
Did my student teaching there in Savannah and got my certification to teach high school biology. Immediately after that is when I started working for the private school and was teaching third and fourth graders because they offered me a job while I was in that process and it was a school that I was really interested in. It was a very progressive school at the time, it was very much child-oriented and kind of allowed	Experiencing teaching

children to develop at their own pace, and it had a diverse culture of students.

During initial and subsequent coding processes, I developed explicit definitions for each code and category, including ideas that encompassed codes and categories, and exclusion/inclusion criteria for assigning data pieces to categories, which were systematically documented as part of a *code comment* (used for codes) and *code-group comment* (used for categories) components of the ATLAS.ti program. The ATLAS.ti program displayed the list of codes in an alphabetical list on the left side of the navigator. In this way, I compared the codes in the first set of data to the following sets to determine whether the codes in the first set were visible in the following sets as well. For example, I compared the first individual interview of one research participant with the first individual interview of other research participants. This initial coding process was conducted with second individual interviews and focus group interviews in the same manner. In this way, I was able to apply those codes to subsequent relevant data in a systematic way.

Focused coding. As the next step, I engaged with focused coding to refine my initial codes. According to Charmaz (2014), focused coding is an easy technique and progresses expeditiously. It entails the selection of the initial codes that hold analytical legitimacy to categorize the data directly and completely. In this sense, focused coding involves evaluating initial coding that was developed earlier and selecting the codes which appeared frequently or codes which are significant for the purpose of the study. During focused coding, researchers analyze what messages those initial codes convey regarding the data. Researchers use these initial codes to “sift, sort, synthesize, and analyze large amounts of data” (p. 138). Focused coding can also

involve coding your initial codes. For Charmaz, this phase of analysis is crucial because it underscores what researchers discovered to be significant in the results of their initial analysis.

During this focused coding process, I noticed that my list of initial codes contained too many codes. For example, I generated 150 codes that were generated coding the first three interviews. On those grounds, there were too many instances where overlapping codes with different names were applied to the same concepts. Following Charmaz's (2014) suggestion of generating exhaustive and mutually exclusive codes and categories, I merged these overlapping codes into single codes. Utilizing the *merge codes* tool of the ATLAS.ti program, I selected the code into which the other codes were merged. All segments of data applied to different codes automatically fell under that selected code. In this way, I was able to reduce my list of initial codes into 52 codes corresponding to all sources of data that were imported in the program. As a subsequent part of focused coding, I concentrated on the codes relevant to my research questions, discarding the superfluous parts that distracted from the main purpose (Charmaz, 2014).

Next, I examined my focused codes and sought to group those codes that seemed to go together to develop categories related to the studied phenomenon. For this purpose, I used the *code-groups* component of ATLAS.ti program, organizing all related codes into a code-group that I deemed as a category. During this analytic process, I constantly returned to my data with new questions and ideas until recurring themes emerged. Ten code-groups (categories) were generated as a result of this process. Figure 8 is an example of data analysis for the category "pro-action" using the *network* component of ATLAS.ti program.

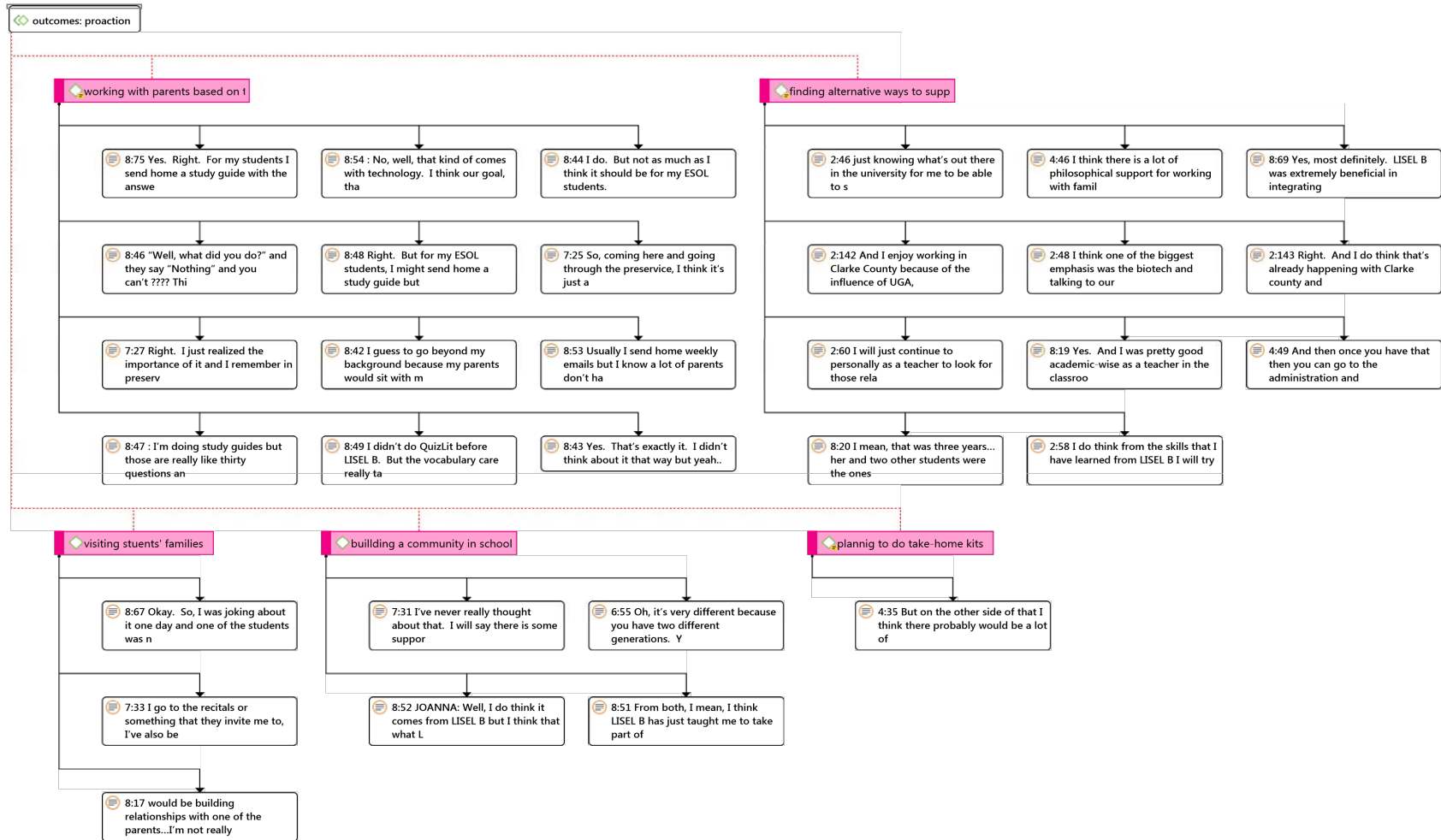


Figure 8: An example of data analysis for the category of pro-action.

Theoretical coding. Following the focused coding process, I performed theoretical coding. Theoretical coding is the final stage of coding involving the integration of categories/substantive codes that were developed through focused coding. According to Charmaz (2014), theoretical coding not only helps researchers to develop relationships between substantive codes/categories, but also helps researchers to generate a coherent abstract narrative that explains the phenomenon researched. In this sense, theoretical codes bring clarity and precision to the analysis process by theorizing data. However, theoretical coding does not mean creating theory per se, considering that researchers may or may not pursue a theory for their studies. It “underlies [researchers’] substantive codes and shows relationships between them, rather than replace the substantive codes with ones constituting their theory” (p. 150).

In this analysis phase, I attempted to build connections with the categories to generate a narrative regarding the studied phenomenon. The ATLAS.ti program does not have a component that can be used to accomplish that task. However, I used prefixes in a way that the name of each code-group began with a prefix indicating the corresponding theme, for example, internal influential factors: family background, internal influential factors: educational background, and internal influential factors: goals attending the STC workshops. Using the same prefix for the code-groups serving the same purpose caused the ATLAS.ti program to sort these code-groups together as a group based on the prefixes. In this way, I was able to consolidate ten code-groups into five themes (see, table 6). In addition to using prefixes, I utilized the *color-code* tool of the ATLAS.ti program, giving each code a color indicating which codes were assigned to which theme. The colors therefore primarily played a role of visual cues for me to see the connection between codes and themes.

Table 6: Themes, categories, and codes.

Themes	Categories/code groups	Codes
Internal Factors	1.Family background	1.1. Being exposed to racial divide 1.2. Having community service experience in the past 1.3. Having cultural immersion experience in the past 1.4. Living church-oriented life 1.5. Separating self-home-experience from Latino students'
	2.Educational background	2.1. Concerning about educational support for f-s interactions 2.2. Concerning about educational support for teaching immigrant students 2.3. Exposing Sts and Pts with in-depth community 2.4. Taking ESOL endorsement
	3.Goals attending the STC workshops	3.1. Becoming involved in the STCWs 3.2. Coming to STCWs for community involvement 3.3. Coming to STCWs for learning teaching techniques
External factors	1.Barriers to family-school interactions	1.1. Being not appreciated for doing LISELL framework 1.2. Experiencing pressure on text scores 1.3. Feeling school far from changing dynamics of classrooms 1.4. Feeling school not welcoming for immigrant families 1.5. Having lack of time for f-s interactions 1.6. Having parents don't know the education system 1.7. Providing parents English classes 1.8. Seeing funding as a barrier 1.9. feeling school as depersonalized 1.10. Separating students' home and school language
	2.School practices for family-school interactions	2.1. School practices for family-school interactions 2.2. School's requirement for teachers on f-s interactions
Learning experience	1.Dialogue	1.1. Assisting in the STCWs 1.2. Building personal connections with students 1.3. Engaging with different networks 1.4. Learning about families in the STCWs 1.5. Observing in the STCWs 1.6. The time period involved in the STCWs
	2.The essence of the program	2.1. Separating PDL from STCWs 2.2. Separating school family events from STCWs 2.3. Separating school framework from LISELL
Outcomes	1.Recognition	1.1. Becoming more sensitive to immigrant students 1.2. Developing empathy for students and families 1.3. Feeling the need for learning Spanish 1.4. Questioning 1.5. Understanding language/culture differences as not barrier 1.6. Understanding the value of designing authentic lessons 1.7. Understanding the value of building students' prior knowledge 1.8. Understanding the value of recognizing families' linguistic resources 1.9. Understanding the value of building a relationship with families 1.10. Working with students more easily in the classroom
	2.Adaptation	2.1. Adapting STCWs in school events 2.2. Communicating families with educational resources 2.3. Helping students use their skills and resources 2.4. Making reflection time in the classroom 2.5. Using LISELL resources

	3.Pro-action	3.1. Building community in school 3.2. Finding alternative ways to support students and families 3.3. Visiting students' families 3.4. Working with parents based on their needs
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This coding stage helped me to move beyond concrete codes to reach abstract themes. My goal was not to pursue a theory, but rather to generate a diagram conveying connections among themes that emerged from the multi-case study.

In this final process, I approached the data for an additional focus. I examined how my themes aligned with my conceptual orientation, Freire's (1970, 2005, 2013) notion of dialogic education. Approaching the data from this conceptual lens, I isolated code groups that explicitly provided insights into the teachers' orientations and practices toward essential ingredients of dialogic education— humility, care, hope, and critical awareness—in their work with their Latino students and families. In order to transform this strategy into software tactics, I utilized the *code-smart-group* component of ATLAS.ti program. Apart from the code-groups I created previously, I created a code-smart-group for humility, care, hope, and critical consciousness by continuing to use the first stage of code-groups. However, smart-code-groups cannot combine individual codes belonging to different code-groups. Considering this feature, I created a code-smart-group for some components of dialogic education in which I created additional code-groups for other components of dialogic education by combining the initial stage of relevant codes from different code-groups. It is worth noting that the code-smart-groups and code-groups that were created for Freire's (1970, 1998, 2005) conception of dialogue were kept in a separate area. They did not change the first stage of codes or code-groups that reflected the research findings.

In the multi-case study, I situated the findings in two sections: case-by-case analysis and cross-case analysis (Merriam, 2009). First, I represented case-by-case analysis by illustrating

each teacher as a case including their family background in relation to cultural and linguistic diversity, prior experiences in working with immigrant families, their experiences with attending the STC workshops, and how they thought their perspectives and practices changed after attending the workshops. After representing each case of teacher participants, I illustrated cross-case analysis by presenting the research findings around three categories in light of Freire's principles of education. Similarities and differences among the cases were scrutinized with respect to categories of (a) *recognition* of student resources outside of the classroom, (b) *adaptation* of the STC practices in working with Latino bilingual and emergent bilingual students and families, and (c) self-initiated *proactive practices* that focal teachers personally developed to extend their work with Latino families in the context of science education (see, figure 9 for visual representation of research findings for the multi-case study).

Memo Writing

Memo-writing is the essential component of CCM and constitutes “a pivotal intermediate step between data collection and writing drafts of papers” (Charmaz, 2014, p. 162). Charmaz discussed the number of benefits of memo-writing for researchers. For example, writing memos allows the researcher to maintain a close relationship with the data, keeping the researcher engaged with analytical work early in the research process. According to Charmaz, memos capture researchers' thoughts, assumptions, and preconceived notions and emerging questions about the studied phenomenon to be pursued during the research process. In this manner, memo-writing creates opportunities for researchers to have a sustained dialogue with their data, emerging codes, categories, themes, or theories.

According to Charmaz (2014), there is no rule for memo-writing; researchers write memos in any structure that advances their thinking. This unstructured writing liberates

researchers from academic writing procedures and formal evaluations and these liberated memos can be maintained as a private analytic written record. Despite the flexible nature of memo-writing, the aim should be “increasingly analytic” (p. 164) so that researchers generate more ideas. Additionally, researchers should write memos as soon as new ideas emerge or new questions arouse their curiosity so that their natural voice will not be endangered.

Considering the benefits of memo writing, I paid effort to be an attentive listener and observer of myself as a beginning researcher reflecting on my assumptions, evolving ideas, and emerging findings during the data collection and analysis process. These analytical notes acted as a rudimentary portrayal of my ideas and developed in precision and elaboration as my analysis progressed during the research project. During the intensive data analysis stage, I used the *free memo* component of ATLAS.ti program to keep my thoughts in a systematic way. I created a separate free memo document for different purposes, including limitations of the study, description of the study, and my evolving ideas during the analysis process, and implications for future research and practice. Writing memos in the ATLAS.ti program provided me straightforward access to all of my written memos without opening too many separate files in my individual computer.

Reflections on using the ATLAS.ti 8.0 program

Learning to use QDAS that can help one to accomplish analytical tasks of a particular research project is one challenge to manage. This requires users to go beyond the straightforward use of QDAS and using it in a sophisticated way so that they can find ways that can meet the needs of the analytical tasks (Woolf & Silver, 2017). It is fair to say that learning to use the ATLAS.ti program took my time and energy. However, as a becoming qualitative researcher, the use of the program prevented my data analysis process from becoming a daunting task in a

number of ways. I was able to keep my entire data set in the ATLAS.ti QDAS program and easily access each document, code, code-groups and written memos without operating too many separate files. Not to mention the value of its *comment* component, where I easily kept my definitions of codes and code-groups as well as the *merge* component that automatically merged all my overlapping codes in a selected code.

It is essential to harness the ATLAS.ti program appropriately according to your chosen methodology and particular style of analysis (Woolf & Silver, 2017). I think that Charmaz's (2014) CMM was easily fed into the ATLAS.ti program. As the program provided my initial codes in the alphabetical list in the left side of the navigator, I easily compared the first phase of data with the second phase of data to see if this list of initial codes were visible in the following data sets. I was able to use the code-group component to organize my initial codes into categories in this ATLAS.ti program. However, the program did not have a specific component to build connections between code-groups. I used the color-code component in addition to using prefixes to accomplish that task. Another limitation of ATLAS.ti is that it did not have a network view component to illustrate connections between themes, code-groups, and their corresponding codes. For this purpose, I utilized the Microsoft Word program to illustrate the connection between my themes and their corresponding categories and codes.

Addressing Validity, Reliability, and Ethics

The way in which data are collected, analyzed and interpreted in qualitative research has significant applications to what is being investigated because the findings have the potential to be utilized in future practice. Thus, it is imperative that researchers involve a careful thought process concerning issues of validity, reliability, and ethics during phases of their research design and implementation and employ strategies that can elevate such concerns. What makes

qualitative research studies trustworthy or rigorous is a disputed topic among methodologists. Merriam (2009) described this controversy as a necessity in the qualitative terrain, which is “based on different assumptions about reality and different worldviews, should consider validity and reliability from a perspective congruent with the philosophical assumptions underlying the paradigm” (p. 239). Bearing this information in mind, I utilized Merriam’s (2009) following techniques and strategies to enhance trustworthiness in this constructivist-oriented qualitative case study.

Validity

Merriam (2009) framed validity as different than reality itself and considered that “reality is holistic, multidimensional, and ever changing; it is not a single, fixed, objective phenomenon waiting to be discovered, observed and measured as in quantitative research” (p. 242). Qualitative researchers cannot fully obtain an objective reality, but they can establish a plan of action to demonstrate that their research is trustworthy and plausible. Merriam (2009) evaluated validity in qualitative research in two respects, *internal validity and external validity*.

Internal validity. Internal validity concerns with the question of how the research findings serve the purpose(s) of research. In order to address this question, methodologists offer several strategies that can be used to increase the internal validity of research findings. Drawing from those strategies, triangulation, member checks, long-term observation, and identification of my subjectivities and my theoretical framework, I made every effort to achieve that purpose.

Merriam (2009) suggested that researchers account for their worldview, assumptions, and theoretical orientation to clarify their own researcher bias as a way to ensure internal validity. However, the aim is not to eliminate researcher values or assumptions but to demonstrate to the reader how those values and assumptions influenced the design, implementation, and

conclusions of the study. I am also aware that I brought my own theoretical orientation, assumptions (see, chapter 2), and subjectivities (see, chapter 1) into this study. Having not grown up in the context of the United States and not being a student or a teacher in the American K-12 school system, there is a possibility for me to use my own cultural, social, and historical positions as an international doctoral student in the United States, a former elementary school teacher in Turkey, a parent of a young child, and a daughter of a retired teacher (my father), and housewife (my mother). I could use these positions as reference points to interpret the experiences of my research participants. I am also aware that I am quite invested in the perceptions of this program, as well as its success. My insider status in this project have affected my interpretations of the data as well. However, my conversations with Drs. Trena Paulus and Melissa Freeman acted as a reminder for me to be cautious of my status when interpreting teachers' experiences with their Latino emergent bilingual students and their families. During the analysis and writing process, this was the question that I constantly asked myself: Are you open to finding out that the program does not work in the ways you assume that it does? For this purpose, I attempted to ask teachers questions that did not lead them in certain direction. I also took pains to be an attentive listener and observer to understand the experiences of the research participants and clarify possible vague points through follow-up questions to increase the accuracy of my findings. When writing this dissertation study, I also refrained from presenting only success stories. I made an effort to describe the cases in their own diversity, letting the story come through from their complexities that research participants in each case have told me and I observed.

Adequate engagement in data collection is another strategy that can enhance internal validity of research. However, according to Merriam (2009) the extent of time that a researcher

should spend at the research site, depends on the purpose of the study. Considering my purpose, developing an in-depth understanding related to phenomena of interest, long term observation at the research site was necessary to my study. My presence at the research site, at the STC workshops, over three years gave me the chance to build a relationship with the five focal teachers and I repeatedly observed their interactions with families. This prolonged engagement in the research site offered me an opportunity to develop trust with the teachers in a way they are comfortable to share adequate information that I am looking for.

Merriam (2009) pointed out triangulation as another powerful technique, “whether you make use of more than one data collection method, multiple sources of data, multiple investigators or multiple theories” (p. 245), to validate research findings. One way to achieve triangulation is “comparing and cross-checking data” that are collected through multiple sources (p. 245). In a similar vein, I believe that integrating insights from the focus group and individual interviews, participant observations, and written documents offered me a more accurate understanding regarding the teacher cases that I investigated for the purpose of this study. I believe that cross-checking the data that were generated across the different sources assisted me not only to capture different dimensions of the same phenomenon but also to compensate for the weakness of one method with the strength of another. In addition to triangulation, I incorporated the strategy of member checking by sharing my findings with my research participants and asking them to comment on my interpretations of them. I believed that generating perspectives of participants who were involved in the study would help me to produce a more holistic and accurate interpretation of what occurred in my study. I have received feedback from three of the five research participants regarding my research findings. These three teachers expressed their satisfaction for my interpretation of their perspectives and they found my findings as accurately

representing themselves and their changing perspectives and practices in their work with their students and their families. However, Allyson pointed out my mistake regarding the name of the location where she first started teaching and I changed the name of the location based on her feedback. Donald realized some grammatical mistakes regarding my writing and recommended me to have my writing proofread. Teresa did not suggest any changes regarding her piece in my dissertation.

External validity. External validity concerns how generalizable a study is (Merriam, 2009). While I am aware that the small sample size of this case study cannot be generalized into a broader population, I am also aware that no qualitative research can be generalizable to a broader population. The production of generalizable knowledge from qualitative research studies is found as an improper goal for many researchers (e.g., Patton, 1990; Flyvbjerg, 2006). For example, Patton shared that the aim of qualitative research should be providing “perspective rather than truth, ... context bound extrapolations rather than generalizations” (p. 491).

According to Merriam (2009), providing rich and thick descriptions regarding the design and findings of the research is one way to ensure external validity of a qualitative research study so that researchers could decide how the findings can be applicable to their contexts. Qualitative case studies, with their particularistic, descriptive, and heuristic nature are very eligible for that purpose (Flyvbjerg, 2006). To ensure external validity of this dissertation study, I used thick description regarding my research design and research findings in a way that readers would have some ideas on whether this study will be relevant to their own circumstances.

Reliability

Researchers not only want their findings to be valid, but they also want it to be reliable. In the context of qualitative research, reliability deals with whether research findings are

consistent with the data (Merriam, 2009). According to Merriam, an audit trail is one possible way to ensure reliability of research findings. The audit trail suggested by Merriam, refers to “a detailed account of how the study was conducted and how the data were analyzed” (p. 253) so that readers would have a sense about how the researcher arrived at the results through the inquiry. Following Merriam’s strategy, I provided a rich and detailed description regarding my study design and analysis process to show the readers how I arrived at those findings. When it comes to reporting my findings, I presented each teacher as an individual case and provided an extensive account regarding their own family background in relation to cultural and linguistic diversity, prior experiences in working with immigrant families, experiences attending the STC workshops, and how they thought their perspectives and practices changed after attending the workshops. I believe that these thick descriptions regarding the study design, data analysis, and each teacher case enhanced the reliability of my dissertation study.

Ethical Considerations

Institutional Review Board (IRB) approval and consent forms signed by research participants is requisite for research studies to protect participants from potential emotional and physical harms that may arise with the research project (Glesne, 2011). For this study, IRB application and teachers’ consent forms were not needed since the goal of this study fell under the general research purpose of LISELL-B project that had already obtained IRB approval and signed consent forms from focal teachers that are valid until 2019. I pseudonymized the data by changing names of the private institutions and person’s names. All data is stored in my password protected personalized computer and backed-up in a hard drive that is stored securely.

Ethics entails more than just receiving approval from the ethics research committee and pseudonymization of data; there might be other factors that I had to consider during the data

collection and writing process. An intimate relationship with research participants, which is required in a qualitative case study, might bring some ethical dilemmas. Glesne (2011) emphasized that we can come across “dangerous knowledge” through having an intimate relationship with research participants (p.169). Thinking about what can be done with this dangerous information is also one of the ethical questions that I had to consider during the research process. For example, there were times during the individual interviews where some of the focal teachers shared intimate information with me regarding their family and personal backgrounds. I did not ask further questions for teachers to clarify or elaborate on this intimate information as they appeared very vulnerable in those moments. I also did not include any of this information in the findings section in order to protect the confidentiality of the participants and prevent the possibility of their experiencing the possible result of emotional distress.

Potential conflicts might also have arisen during the member checking process. I was aware that there was a possibility that my research participants might not agree with my interpretation of them. In this case, I planned to be attentive to their reactions and modify my writing if this was seen as necessary after having conversations with the research participants. To minimize this possibility, I took pains to provide a fair description regarding each participant in ways that would not disturb them.

My effort in this study was to implement this study in a rigorous and systematic manner, while I made a conscious effort to be transparent in the conceptualization, design, and conduct of this study and present the perspectives of the participants as authentically as possible. Recognizing the complexities of these issues, my goal as a beginning researcher was to share my intentions to ensure validity, reliability and ethics in this study through the above strategies.

CHAPTER 5

STORY ONE

SINGLE-CASE STUDY OF A LATINO SCIENCE TEACHER: “I’M OKAY BEING HATED BECAUSE SOMEBODY HAS TO BE STRONG”

In this chapter, I analyze a single-case study of Teresa, a bilingual and multicultural secondary science teacher in her mid-thirties. I describe what impact the STC workshops had on her perspectives and her current or future practices regarding working with her Latino emergent bilingual students and their families. This intensive and holistic narrative account includes the following: (a) navigating the school system as a Latino student, (b) Teresa’s progress as a bilingual and multicultural science teacher, (c) the challenges and tensions Teresa continued to face in her science classroom, and (d) the ways in which the STC workshops influenced Teresa’s perspectives and practices regarding working with diverse students and families. I conclude this chapter by describing how Freire’s (1970, 2005, 2013) principles of dialogic education—humility, care, critical consciousness, and hope— is connected to Teresa’s pedagogical goals, perspectives, and practices regarding her work with Latino emergent bilingual students and their families.

Navigating the School System as a Latino Student

I think that Teresa’s own schooling experiences are a crucial component of her view of teaching science to her emergent bilingual students and of the challenges that she faced in attempting to accomplish that task. Because of her life story, it is not difficult for Teresa to identify with the struggles that many immigrant students go through in their educational

pathways. According to Teresa, many of her Latino students' parents have two jobs and still live below the poverty line. Yet school still holds the non-English speaking students at the same level as the other students and they do not offer any resources or any help for those students to get where they need to be. In the following sections, I describe how Teresa was connected with these experiences in a number of ways.

Teresa was born in a small town in Texas, but she was taken back to Mexico by her parents to be raised by a great aunt for five years due to financial family conflicts.

Well, my father and mother decided to move to the United States because it was a business opportunity for my father. But my mother also wanted to make sure that...she didn't want us to live in poverty and she wanted us to be able to have an education. That was their main focus, wanting to make sure that we did have an education and my mother had done the research where she found out that the public system did offer a free education and that we had a right to that education. So, when she was pregnant with her first three children and she lived in Mexico, she made sure that she would come here and have her babies and go back to Mexico.

Teresa was aware that her parents had immigrated to the United States to provide their children everything that was needed including an education, even if that meant leaving their family, their culture, their practices, and their friends in Mexico. Teresa's parents left all that behind for free "quality education," the American dream, which was the major reason for Teresa's mother during her first three pregnancies to cross the border to deliver her babies in the United States. The United States was believed to be a country where millions of "American Dreams" would be fulfilled and where children of all different cultural, racial, and socioeconomic backgrounds would have equal chances in life.

A new life journey began for Teresa when she was brought back to United States and started to live with her six siblings; her mom, who was a homemaker; and her father, a brick mason. Teresa grew up in poverty in that her father worked hard for long hours for the family to survive financially. Teresa described this period as going back and forth between Michigan and Georgia because of her father's business opportunities. This meant that she had to pursue part of her k-12 education in Michigan and the other part in Georgia during the same academic year. The family lived in a portable shelter made of cloth—a kind of tent—in the woods for several years. She described these years as follows:

We didn't have a kitchen or a stove or anywhere to really cook and so our first task was to go and look for logs and cut logs to make our meals with. So, we always had to cook outside. Our showers were also outside because we didn't have a location to take showers. So, that's mainly in Georgia. On the other hand...in Michigan, I remember that we would come home and we did have all of those appliances, like the bathroom and all of that.

I want to point out that Teresa did not describe the experience of living in a portable shelter in a negative way; she was very proud instead. Even though the family experienced financial difficulties, she always remembered weekends as family gatherings, meals, music, dancing, telling folktales or recalling family stories. She described her mother's cooking, her helping, and her dad's outside construction work. They knew how to entertain themselves, had boundless energy, and enjoyed strong relationships with extended family. She described these moments as the happiest in her life.

Her parents' involvement in Teresa's education

Teresa described her family as very supportive of her education, and educational support had multiple meanings for her. Teresa's mother would ask Teresa and her siblings to complete their homework as a priority once they arrived home from school. Support meant having a table ready for her and her siblings to work on. It also meant having a mother who would find a way to have a computer at home whenever Teresa needed one for homework and who would always get the children to school on time. These were the physical and practical aspects of educational support Teresa received, mostly from her mother. These strategies, which continue to be largely invisible to the school system, were essential for Teresa's strong view of education. Helping Teresa with school assignments was another way that Teresa's mother supported Teresa; however, her mother was able to support her only to a certain extent. Although Teresa's mother had already obtained an accounting degree, language was a barrier that kept her mother from helping Teresa beyond the seventh grade.

Well, my mom couldn't help us with homework. No, she only knew so much because math problems or practices or strategies are done so differently in the United States than they are in Mexico, even though it would take us to the same answer, the process, the method was...the steps that were expected to be seen were not correct and so she couldn't help us with work, not even with our English work. So, that was kind of hard. Now, on lower levels she helped a lot. But once we got into higher levels, she couldn't help anymore.

Despite her parents' inability to help her with content, their roles in Teresa's education were central to her determined agenda for advancement. The parents supported their children's education through strong emotional support, strong ties, and episodic academic help. Teresa was

generally appreciative of her parents' support, acknowledging her parents with having kept her and her siblings focused on schoolwork and seeing her parents' push as a signal of caring and support for her education and college preparation.

Learning the Language of School

During her school years, becoming proficient in English did not happen in the short term for Teresa as it did for other emergent bilingual students. She was not fluent in speaking until middle school, and she was not fluent in writing until high school. Learning another language was a difficult process, and she lacked the confidence to participate actively in learning activities in the classroom. Teresa did not have opportunities that might have encouraged her to make cultural or linguistic connections with content, including science, taught in the classroom. Having teachers who viewed another language as a barrier to students' learning added one more layer of difficulty for Teresa in regard to school success.

It was a math teacher that said this to another teacher and she thought I didn't speak any English. "She [Teresa] doesn't speak English and why did I get her?" She assumed I didn't speak a word of English and so I didn't understand what she said and I looked at the teacher and said, "You know what? I might not speak perfect English, but I did understand you, and what you can do to support me is first believe in me. I understand numbers." She just looked at me with wide eyes and she turned really red.

In addition to those negative experiences, Teresa also had great teachers who had high expectations for her. Mrs. Smith was one of the teachers who recognized Teresa's ability: "You have to come out of your shell, and you have to start speaking up and start showing how smart you are." She was pushed to speak up, and that was one of the reasons Teresa became passionate about being a science teacher—to push others who are in need of that.

Identity Struggles as a Latino Student- *I Would Be Called “Preppy Mexican”*

Looking back at her schooling in the United States, Teresa remembered herself as part of the only Latino family until she graduated from high school. She struggled when having a conversation with somebody else in the classroom due to her fear of saying something wrong that would offend her peers. Teresa thought that if she learned how her classmates interacted with other individuals, she would start talking to them in a same way. Thus, Teresa desperately tried to act like a European American—what she called “acting like a snob”—to receive respect from others.

Whites thought that they always had the upper hand in any situation, like...they were always the ones that made the rules or always in charge. So, I didn't like that. And so I'd play their role sometimes. I would act like the snob. So, I would be what they called the “preppy Mexican”—that's what I was known as, “The preppy Mexican”—because whatever they showed me, I would mirror back to them. So, if they had a negative attitude towards me I would give that negative attitude back, and it would throw them off. But because I did that to a lot of my friends, they became closer to me because I guess they kind of felt like if they behaved that way that I could also behave in that way. So, if they mistreated me, I would mistreat them the same way. It was almost like a reflection of how they treated me so I would treat them just like they treated me. So, it was like mind-changing for them. So, I felt like a lot of them would back down and treat me right versus treating me wrong, like being unfair or unjust. So, I would do things like that on purpose.

Being the only Latino student in a school in Georgia created a tension between fitting into the mainstream school culture and showing herself as a Latina individual. Teresa preferred to play

their game in order to be accepted in the first place. However, during her high school years, she started to question her identity and her desire to engage in behaviors that mirrored those of her European American class mates.

It was difficult because you come to a public school system, and they want to assimilate you quickly. They want you to speak English quickly, do this and that....and it doesn't work that way. It's like...I felt like something was being taken away from me, and I didn't like that. So, I wanted to be the way I was, and a lot of that was first showing them that I was intimidated by them. And then I was not afraid of my culture and showing who I really was because if they had something to say, I would just look at them and that was enough or they'd ask me a question about it, which I always welcomed, but I had to be kind of...mean. And it wasn't mean; I'd say it was more...I wouldn't take any negative comments from anyone, and they quickly realized that, and so they started showing me respect.

According to Teresa, her classmates were probably afraid of her until they understood that she was not trying to compete with them, but only trying to be a friend. They started losing that fear of Teresa once she was seen as a person who also had the ability to achieve in the classroom. This was a turning point for Teresa.

Beating the Odds

Teresa became pregnant with her 14-year-old son when she was in eleventh grade. However rather than accepting the lowered expectations of her teachers and friends, she did not quit school, determined to finish high school and begin college. Teresa did not see being a teenage mother as a barrier to her education. She was very positive and did not describe this

situation in a negative way, even though that experience added enormous responsibilities to her life—the status of single mom and the necessity of becoming an adult at an early age.

Having a child at a young age was nothing new to me because I practically help raised my four younger siblings and so it was nothing new, it was just another child except this time it was my flesh and blood. My mother was supportive as in when I went back to school, she would bring my son to me to breastfeed.

I wondered whether Teresa had any regrets; she was experiencing the tension between maintaining her cheerful countenance and dealing with a host of difficulties that could interfere with the accomplishment of her goals. This was apparent in all of her responses. Her mother's supportive stance was one reason for her upbeat perspective of the situation. She was lucky that her mother was willing to take care of her son while she continued high school. On the other hand, she still had to navigate the difficulties of her life journey, including the judgment of others, the abundance of responsibilities, and the lack of time to begin working towards achieving her dream of becoming a science teacher. Despite the struggles and obstacles, Teresa found the strength to finish her school assignments, to maintain good grades, and to graduate on time with her class. In addition to this accomplishment, she was the first in her family to earn a college degree through her dedication and commitment to her future. Teresa started at a competitive public university in Georgia and majored in middle school teacher education. However, there were also times when the responsibilities that Teresa shouldered each day seemed to outweigh the promises of the future.

Whenever I started college because I went to school immediately after high school, it was kind of difficult because at the time my father was sick, and he was sick for a good two years and that meant that throughout high school and my first year in college I had two

full time jobs and it was hard. So, I went to school for a good year and then I had to stop and just continue to work. And then I didn't go back to school until 2009 and from there I have not stopped. I have continued to go straight through school.

Despite her father's health problems and the emerging financial challenges, Teresa thought that "having bad grades in school wasn't going to get me anywhere." Nevertheless, Teresa had to leave college for six years to help her family and her little son. She had to maintain two full-time jobs and survive with very little sleep. Eventually, Teresa returned to college; however, she still had to work to pay the tuition until she was awarded for a full-ride scholarship for the rest of her college education.

So, I went to school at five o'clock in the morning all the way to eight o'clock in the morning and then from eight to nine I would drive and be at work from ten to six. And from there I would go to night classes at [the university]. So, I did three or four night-classes. And there were times at night time I would only sleep two hours, three hours. And then weekends were the only days that I was able to sleep in and get rest. And then to do the week day all over again.

Teresa had every reason to be depressed, to be disheartened, and to give up. Instead, she was determined to remain hopeful despite diminished expectations. I think she is an excellent example of what people can accomplish despite cultural, economic, and social barriers to the completion of secondary and post-secondary education. In spite of the odds, she persistently maintained the belief that a college degree would provide a better future for her and her family. This belief and her determination helped her accomplish these goals.

Teresa's Progress as a Bilingual and Multicultural Science Teacher: "*I Was Able to Put My Bilingual Skills into Work*"

As an undergraduate student, Teresa started her field experience in a middle school serving predominantly European American students. However, she sought opportunities to work in a school serving Latino students to gain a better understanding of how to teach linguistically and socially diverse students. According to Teresa, she had a good understanding of how to teach European American students, but not students coming from other backgrounds, including Latinos. This was not surprising, because her entire education had been in an American education system that advocated English-only instruction policies reflecting the practices of middle-class European American families. This situation helped her recognize the challenges faced by monolingual and mono-cultural European American teachers who do not have the linguistic and cultural background to connect easily with their emergent bilingual students.

I didn't know how to teach my own kind. And even though I am Latino, it was a challenge to teach people of my kind, and I understand now when teachers say that it's hard to teach somebody who doesn't speak English. It's hard because you want them to understand the content. You want them to learn, but it's hard whenever they don't speak another language. I'm a Latino teacher and know how a Caucasian teacher feels frustrated and struggles with students that don't speak any English; it's hard, and it's not easy.

Starting her teaching profession in River Middle School as a life science teacher, Teresa was able connect her own difficulties as a Latino student with the difficulties of her emergent bilingual students. She was aware that the assimilationist school system tended to invalidate students' linguistic and cultural resources. Teresa's critical awareness of how and why emergent

bilingual students disengage with science motivated her to become an advocate for providing equal educational opportunities for them. According to Teresa, one way to motivate students was by validating their diverse ways of science knowing and thinking in the classroom.

Our Latino students come in with a lot of background knowledge, and sometimes teachers fail to understand that these students do experience science in their own countries and that they can bring prior knowledge from home and implement it in the classroom. And as far as the African American culture, any other culture, I try to hear their prior experiences related to science content, and how they would solve problems because at home you're taught how to solve a problem, right? So, I try to hear how it is that they solve problems and take that into account.

Despite Teresa's attempts to validate her emergent bilingual students' language and prior knowledge in the classroom, the results were not aligned with her goals. Although bilingual and multicultural herself, Teresa still struggled to support her Latino emergent bilingual students in their science classes because the school she was working at did not provide opportunities for teachers to support the learning of diverse students. Yet, the school did not approve of teachers who allowed their students to approach science concepts in nontraditional ways. The high-stakes standardized testing created a situation in which Teresa's attempts to scaffold her students' scientific understanding was constructed by the school administration as a waste of time. As a result, helping students take advantage of their diverse ways of knowing and learning proved to be a very challenging task.

The Challenges and Tensions Teresa Continued to Face in Her Science Classroom

River Middle School is a Title 1 school situated in a small rural county in Northern Georgia. Despite the size of the Latino population, 56% (Georgia Department of Education,

2017) of the student population in 2017, Teresa was the only bilingual teacher—there was, however, one bilingual staff member—in the school. In the following sections, I demonstrate how Teresa’s attempts to validate her emergent bilingual students’ language and prior knowledge in the classroom were restrained within this school context.

School’s Stance for Bilingual Instruction—“*I am Told to Shut Up!*”

The administration at Teresa’s school reported her to the Teacher and Leader Effectiveness (TLE) platform, which is a system for teacher performance evaluation in Georgia. She was criticized because of her use of a second language in her science classroom. The administration reasoned that Teresa prevented Latino students from learning English and meeting the rising academic standards. Teresa commented, “They feel as though if I speak Spanish I’m helping the students not want to learn the English language.” Interestingly, Teresa’s teaching was depicted as deficit despite her attempts to increase her Latino students’ linguistic and cultural capacities to learn science. In this sense, she seemed to be very frustrated with the administration, and her frustration was apparent in all of her responses including the following one.

Well, the students can speak Spanish all they want but they quiet me, they tell me “No” and so it’s a form of...it’s discrimination, point blank discrimination against me, not only as a Latino but also as a female. So, it’s not okay, and so my school where I currently teach is not open. The support from my administration has been negative. They do not like for teachers, like myself, to use my second language, which is Spanish, in the classroom. They’re very straightforward and say, “No use of the second language within the classroom.” And it’s sad. So, the support is zero. None. It’s kind of embarrassing to say that because it just shows the ignorance of their understanding of what bilingual

education is or bringing students' prior experiences into the classroom or using their second language to help boost whatever knowledge they have in being used within the classroom.

According to Teresa, River Middle School attempted to assimilate immigrant students into the mainstream American school system in a manner similar to what she experienced in her own schooling. Creating an environment in which Latino students felt embarrassed about talking in Spanish in the school hallways and classrooms was one example of the way River Middle School accomplished that task. Teresa knew that the "melting pot education mentality" was not the best way to teach emergent bilingual students. She knew that these students were internalizing the deficit messages that were positioning them as inferior and weakening their bilingual identity. Teresa's Latino students were acting White to fit in a way similar to her experiences as a Latino student. Expressing her despair, she described the overall problem as follows:

They [school administration] don't see it as a value; they see it as something that holds them behind versus as something of value. So, I see that my students have a hard time being Latinos because they're so busy trying to be White. So, it's sad to see that, they're losing a sense of their culture, of their racial background and who they are. A lot of them are shy now to speak Spanish, their second language.

When I asked Teresa how the Trump Administration had influenced the school administration regarding their English-only policy, she commented, "It used to be where you couldn't tell but now...because it's so widely open. They don't accept people of my ethnicity there. They don't want it there. And I'm a professional and I see the discrimination, and when I see it done towards students it outrages me." According to Teresa, the school administration had made it

very clear who they were and what their beliefs were. She was told to “shut up and be quiet.” This was sad for Teresa because she was not allowed to express her feelings as a teacher.

River Middle School’s practices regarding families— “*We Have Nothing to Do with Community*”

Despite the negative climate in terms of immigration at River Middle School, Teresa was hopeful for the future. She was hopeful because she observed that many of her European American students stuck with their Latino peers as they coped with increasing psychological distress due to the high possibility of deportation. However, there were also some European American students adopting Trump’s rhetoric to bully their Latino peers. Many of Teresa’s European American students were standing against their peers saying, “Dude, you need to shut up. If you look around this classroom, I am not the only white person that is telling you to shut up. You need to respect other people of different racial backgrounds.” Teresa was hopeful that there would be no racial or cultural divide anymore. She believed that change would be slow but that it would surely come.

Teresa was experiencing a tension between her positive beliefs about the future education of emergent bilingual students and the negative environment and conflicting views at River Middle School. According to Teresa, the current school climate had been created by the principal and teachers. River Middle School provided an unwelcoming climate because it was detached from the values and norms of its students and families. Despite the large Latino student population at River Middle School, Teresa was told by the principal that the “Community was separated, the Latina and White community were separated, and that we have nothing to do with the community or educating the community.” River Middle School and the community were separated, which created a situation in which Latino students and their families were constructed

as a deficit, having nothing to offer their children's school. Because of this, many Latino parents chose not to attend school events, including parent-teacher conferences with Teresa.

The classroom environment has to be more welcoming and we're not welcoming. And then a lot of the parents feel intimidated or they don't have that second language, they don't speak English correctly and so they don't feel as welcomed as they would if they knew more English. Does that make sense? That second language is really more of a barrier. We can't interact with our community because we don't have a good school climate. And the fact that we don't is what speaks louder than anything else.

By stating "we are not welcoming," Teresa was also casting blame on herself as a teacher as well as the school administration, believing that "the school is a big team" and that every stakeholder shares a responsibility for the environment created. She was not sure whether the school truly served Latino emergent bilingual students and their communities. Despite her intentions, Teresa felt that she was also doing a disservice to her emergent bilingual students and their families with her restricted practices.

The Ways in Which the STC Workshops Influenced Teresa's Perspectives and Practices Regarding Working with Diverse Students and Families

I met with Teresa in one of the STC bilingual family workshops where she was bouncing around with endless energy. One of the things I noticed about her was her positive energy, which seemed to come from her warm-hearted manner and which was on display when she encountered people, even if she was meeting them for the first time. Sometimes I saw her in the STC workshops bubbling over with enthusiasm about conducting science investigations with students and parents. Sometimes she was walking around the tables to see if some families needed

assistance. She engaged in conversation with participants and smiles and laughter were common. In those moments Teresa discovered something new about her Latino students.

I did a lot of the walking and talking to the families about the science investigation and how they felt about working with their own child and to find out that the students are very amazed that their parents know a lot of what they're learning about and the students don't even know that...their own children don't know that until they started these family workshops with parents. The students are very surprised that their parents are able to answer those questions and they found out, "Oh, my dad knows science"; "my mom knows science"; "they're smarter than I am." I heard a couple of students say, "My parents are smarter than I am; they figured out the experiment before I did." I wanted students to be able to see that about their parents.

Teresa's observations on students' reactions to their parents' scientific knowledge is actually not surprising. School policies have created an environment in which the home languages of emergent bilingual students are seen as inferior and in which these students are not viewed as ready for academic learning in public schools of the United States (Hollie, 2017). Any school policy that does not recognize non-dominant linguistic and cultural resources creates a conflict for emergent bilingual students and families. Often, the result is that students and families view academic English as a higher science, and this view causes them to internalize deficit narratives about their academic ability. Knowing this, Teresa was very excited to see her Latino students discover their parents' ability to carry out a science experiment and participate in conversations through a wide range of scientific knowledge and linguistic resources. Teresa's excitement was obvious when she said, "I wanted students to be able to see that about their parents." That excitement is what kept her going to the STC workshops whenever they were held.

Teresa was excited to see that Latino families have power to demonstrate alternative approaches to scientific investigations where they can decide which prior knowledge they want to bring to the classroom. The STC workshops provided families a space for different ways of being and knowing about science that is not available at school or supported by the restricted school discourse.

The workshops don't have that, you're very welcoming, very open to diversity and you see value from it and they notice that, very important. You show that you're interested to hear what they've got to say. What they say is important...we don't have that at school. They're like, "Hello...bye" ...they're gone.

In the STC workshops, students and parents were engaging with one another in scientific investigations and articulating their ideas publicly in response to the discussion questions. For example, parents shared how they found a solution to a contaminated water problem in Mexico. The parents at the lower socioeconomic end, who were the majority, explained how they sterilized water in their homes or made it drinking water. The parents had a different way of interacting with those problems. Teresa was very happy that her colleagues had also the opportunity to see that Latino parents are like American parents and that they also know how to solve problems.

Learning to work with families--*"I was always afraid of doing something wrong."*

Teresa admitted feeling afraid to talk with families, even with the Latino families who shared a similar racial and cultural background with her. This anxiety came from two sources. First, she did not have educational experience in working with students' families and communities. Second, River Middle School demanded a formal teacher-parent relationship based

on school bureaucracy. Teresa told me how the anxiety appeared during her first year of teaching at River Middle School.

I was not much of a talker or didn't really like interacting with the parents because at school...I don't know, the school always made it seem as though you've got to be careful what you say, how you interact, because you are part of the school. You are this, you are that, you're representing our school. And so I was always afraid of doing something wrong.

The lack of knowledge and the message Teresa received from the school administration caused her to set strict boundaries between herself and her students' parents. She labeled herself as an ineffective communicator as a consequence. "I would always hold my posture of them like 'I'm the teacher and you're the parent.' I would put that distance in between us."

During the STC workshops, Teresa was able to work with parents on a personal level without being restricted by the school bureaucracy. She found that her relationship with parents drastically changed. The parents were more willing to come in and volunteer in the classroom to help her in facilitating with the science experiments. Last year at open house, the hallway outside of her classroom was filled with Latino parents wanting to meet Teresa, even though she was not necessarily the person who taught their children. Additionally, students who attended the workshops started to help Teresa in the classroom by talking about their experiences in conducting science experiments and motivating other students in the classroom. Teresa learned that once a student sees a teacher trying to get to know his or her family outside of the classroom, the relationship changes and a different connection develops. She demonstrated what this relationship looks like in the classroom in the following example:

I had a student and he was one of the students that was a very smart child but not very confident. It started out with the mom going and then the dad started being a part of it. And then the brothers started to become a part of it, too. I would sit down and talk to them about whatever experiment or we'd conduct an experiment together. The child would come to school, and we really developed a very close relationship. They would come and they'd try their best to show me that they knew what they were doing with labs. The students were able to ask me more questions than sitting there and being quiet and so they started to develop that relationship with the teacher where they were more confident to ask the teacher questions and, in that case, it was me. It just took three or four workshops and the whole family became involved and I could see the students' growth.

Teresa has learned that a teacher has to be part of the community in order to see positive influence in the classroom. This emphasis led Teresa to open herself to her students' parents and make personal connections with them, particularly with those Latino parents who were recent immigrants. "I become more sensitive to what they [parents] have to say." She started to provide more persistent support for her Latino students, informing parents about a variety of scholarship opportunities that they were previously not aware of. These discussions were furthered when needed through home visits or dinner invitations providing a safe space for both parties. In this sense, the personal connections with parents became a very important part of the teaching profession for Teresa. In section of *Overriding the System*, I also illustrate how Teresa began actively working with Latino parents as willing partners to engage students in their science learning.

Proposing Latino Science Night at River Middle School

Teresa was very sad that the STC workshops end at the time of this study. She was sad because she had witnessed all the benefits of the STC workshops and see how they sparked Latino families' interest in science learning and science related career pathways. The students were learning about science content, while their parents were becoming acquainted with the school science expectations that were placed upon their children. Her goal was to provide her Latino students with an equitable school experience in a consistent way. Teresa attempted to meet these goals in a number of ways.

Adopting the science investigation portion of the STC family workshops at River Middle School was one way to maintain these benefits. Teresa thought that if the school could hold a parent event like the STC workshop, not only would Latino families receive consistent educational support, but also the school could be a welcoming arena for them. In her mind, the working-together mandate was also ideal because students could discover their parents' knowledge about science, which they were not aware of as a result of the White and middle-class science the school system privileged for the most part.

There is a lot that came from that [the possibility of Latino science night]. And here, the students say, "Oh, gosh, my mom knows a lot about this," and it's like the students become more interested in what else their parents know. "What else do you know? I didn't know this about you? You didn't tell me about this." [this happened in the STC workshops] So they become more involved with their parents, which is a good thing. And they all see their parents—they just go to work, they don't have an education. They do have an education. They do know science. They have to figure out problems and find

solutions to them. A lot of that is what I want to replicate at science nights, a lot of what happened at LISEL –B, for us, if they get approved.

Keeping these benefits in mind, Teresa officially proposed Latino science nights at the River middle school for the upcoming school year. She proposed a monthly afterschool program where families and teachers would come together and conduct science experiments as what occurred in the STC family workshops. She had planned the program in every detail. For example, her plan was using the school lunch room as designated area for the program. She planned to use LISELL-B science investigation kits (see Buxton et al., 2017). These kits are “LISELL model lessons” (p.227), hands-on science experiments, which are aligned with the current middle school science units. Each LISELL-B kit includes lab materials, a set of bilingual academic concept cards (definitions of related science terms) along with bilingual science investigation handouts to carry out experiments. These bilingual handouts were designed to include two to three discussion questions for families to think and discuss their prior experience related to content. They were designed to build on students’ linguistic and cultural resources. Teresa was waiting a decision by the school administration regarding her proposal in the time of the study.

Implementing Dialogic Science Practices

According to Teresa, watching facilitators carrying out science investigations with students and families in the STC workshops was also helpful for her to provide more enriched learning environment for her diverse students in the classroom. Teresa, being otherized as an immigrant student, was already cognizant of the value of validating wealth of knowledge students bring to their learning experiences. However, the STC workshops provided her a framework for facilitating learning activities that build upon and further develops that knowledge

in teaching the science curriculum. Teresa was still feeling the tension between the school discourse driven by mono-cultural and monolingual teaching orientations and her attempts to validate wealth of knowledge students bring to their learning experiences. Nevertheless, the workshops seem to give her a courage to challenge the assimilationist and deficit orientations of River Middle School.

In her science classroom, she began to provide regular time frames for dialogue-based learning interactions similar to what she observed in STC workshops to give students a voice in their science learning process. For example, *Teresa carried out LISELL-B Strawberry DNA extraction activity in her science classroom. The task was to break apart the cell membrane of a strawberry and separate the DNA from the nucleus to analyze a DNA structure. As an introduction activity, Teresa provided her students an opportunity to discuss and share their prior knowledge related to the concept to demonstrate how DNA is connected to everyday lives. She asked students to think about the questions: "Have you ever wondered what DNA looks like? How should the DNA look when you extract it? Do you think results would be different if you were to use a different fruit other than strawberry?" The students including Latino emergent bilinguals actively discussed what they have seen and heard about DNA so far with their peers and then with the class. Teresa placed a set of LISELL-B concept cards and relevant general academic vocabulary cards on each table: precipitate, DNA, genes, evidence, observe, hypothesis, result involve. The cards included both English and Spanish version of the words with user-friendly definition and illustration. As students filtrated the DNA from strawberry by following the procedures, they seemed to be very engaged with activity walking around and showing their extracted DNA to others with a great excitement. Next, Teresa asked students to record their observations on their worksheet using everyday language and then scientific*

language as they added alcohol on strawberry with a pipette. As a closure activity, she provided students sufficient time to discuss their observations with their peers and then with the class (LISELL-B participant observation in Teresa's classroom, December 2016).

Teresa has successfully leveraged other ways of doing and knowing by giving students a voice to share their scientific ideas transitioning from one language to another based on which language serves their needs to express their knowledge. Students confidently communicated their knowledge with their peers knowing that their scientific ideas are also valued as a part of learning science. She has effectively oriented her students to express their ideas in everyday language and then use scientific language with the support of vocabulary cards placed on their tables.

According to Teresa, giving students sufficient time to think and talk was another skill she had gained observing the facilitation of the science investigation activities in the STC workshops. As a science teacher, she remembered herself asking questions but not having a patience to provide opportunities for further thought and action. Breaking the silence was a common practice for Teresa either by reformulating the question or giving the answer in a short amount of time.

I learned for wait time, that's something I didn't have, wait time. Giving the students time to answer and that's something I really picked up from Cory (Principal investigator of the LISELL-B project and facilitator of the science investigation session in the STC workshops), because I'd see him pause and give them a minute to answer. That's one of the strategies that I had a hard time following because I wanted a quick response.

Watching Cory that you've got to give them a wait time.

From the observational notes and her articulation of her own practices, it is clear that Teresa became an attentive listener celebrating what her students have to say in the classroom. She was able to structure positive science experiences for her students as they develop their self-identities and parents have become her active helpers in this regard.

Overriding the system

In Teresa's attempts to provide equitable educational opportunities for her Latino students, not only did she go against the grain, such as when she proposed to adopt the STC science investigation session in the River Middle School or facilitated dialogue-based learning interactions in the classroom, but she also went against the rules of the River Middle School. As Valenzuela (1999) stated, "The inflexibility of bureaucracies often places caregivers in the problematic position of having to break rules in order to be caring" (p. 81). In this example, Teresa implemented bilingual instruction in the classroom. Teachers were not allowed to speak Spanish in the River middle school, but the school rules did not require parents and students to use Spanish as part of the classroom instruction. However, given this rule, one can easily assume that the classroom instruction should be English only. Teresa took advantage of the ambiguity of this rule by having parents volunteer to translate her instruction to Spanish for her Latino emergent bilingual students.

Teresa knew these parents from the STC workshops, and they asked if Teresa was implementing similar science investigation in her science classroom. This offer provided Teresa an opportunity to invite them to do translation whenever she facilitated science experiments in the classroom.

Whenever I needed help I would just tell their son or daughter, "Hey, tell your mom we're doing this on this day and she's welcomed to come in to help me" and sometimes

they would stay all day, and sometimes they'd just stay two class periods, but they started coming in that way and helping me that way. It was them speaking Spanish and me speaking English. That's how we did that this year. Do you see what I mean?

With this question ("Do you see what I mean?"), Teresa forced me to think about the complexities of her practices in respond to the school system. She played the school's game by not speaking Spanish in the classroom but at the same time subverted the rules by eventually implementing bilingual instructions and using bilingual resources. That was how she overrode the system.

Pursuing structural change

Even though the River middle school administration constrained Teresa's attempts to foster alternative science education, she found herself discovering creative ways to achieve some of her goals with the support of LISELL-B project. However, she came to the awareness that her practices often made little difference in the larger school context advocating for assimilationist practices. This created a constant conflict between Teresa and River middle school administration.

Because I communicate differently, I'm told that I'm mean, and I'm told that I have to be nice that's how I have to react to the people around me. It's not mean, it's just very truthful, I'm very truthful and people don't like the truth. So, that's not being mean. But I'm not a mean person, just very factual, I speak the facts and I show evidence and I speak with the truth. And a lot of people in my school see that as threatening and I'm okay with that. I'm okay to be hated because somebody has to be strong.

Experiencing these inequities firsthand as a Latino student, the invalidation of non-dominant students' cultural and linguistic resources hit Teresa in a more personal way. This

seemed to put extreme pressure on Teresa which could have provoked her to leave the profession as many other non-dominant teachers (Goldring, Taie & Riddles, 2014). On the contrary she did not leave the profession but has chosen to pursue a doctoral degree to effect change in larger context.

I want to find myself in a position where I can have a positive influence or be an encouragement or be a safe haven for those people that are being discriminated against because they need someone to go to and be charged up again with motivation and I want to be that person that advocates for them. I've experienced a lot of discrimination as a professional. I can only imagine the teachers who have quit their jobs...So, I can only imagine how many people are being discriminated against. Schools are not willing or administrators are not willing to see their worth, their value. They see them as a hindrance. So, people like me, need support. We need someone that's going to be willing to advocate for them.

When I asked Teresa how she found encouragement in her decision to pursue higher education, her answer was quite interesting. According to her, LISELL-B project was the main reason for her to be hopeful for a slow and sure change. "This is because I could see that I was making a difference with the students and parents and I could see that I can be a support to a lot of the people especially those Latino students that were going through a lot of struggles." At the time of the study, Teresa was in her first year of doctoral education while she maintained her teaching position in the River middle school. Right after the graduation, she was planning to work in educational and administrative policy department. This was one place to disrupt normalized deficit discourses centered on non-dominant students and families. She seemed to construct change as a possible scenario, but it required top-down transformation.

Bringing it All Together

In this section I examine the ways the STC workshops influenced Teresa's perspectives and practices in her work with her Latino emergent bilingual students and families in light of Freire's (1970, 1998, 2005) conception of dialogic education. I examine how the essential ingredients of dialogic education, humility, hope, care and critical thinking, is connected to Teresa's goals in attending the STC workshops and her changing perspectives and practices after attending the STC workshops.

Humility

As Freire (1970) asserted, "Dialogue cannot exist without humility" (Freire, 1970, p.78). Humility motivates human beings to be involved in a constant search for learning from others. It is the desire of learning that makes teaching profession dynamic and evolving considering that learning is always part of the teaching. In my work with Teresa, I found that her work with emergent bilingual students was accompanied by struggles and difficulties. In spite of the fact that Teresa's linguistic and cultural background were similar with her Latino emergent bilingual students, her contention that "I had to learn how to use scientific language in Spanish because you forget about using your second language in the science classroom" was testimony to her struggles but also her capacity as a science teacher for a constant learning. The problem of Teresa as a bilingual teacher who can speak two languages but disengaged from a second language in the science classroom was also reflected in the growing literature. Far too many emergent bilingual students continue to be disconnected with their home language in the United States (National Academies of Sciences, Engineering, and Medicine, 2017). Teresa was aware that her potential of using Spanish in her science classroom was stripped off during her own schooling years, but she was also aware that she can develop her bilingual skills to help her

emergent bilingual students build on their home language as an effective linguistic resource in their learning of science. In addition to developing her linguistic skills to use them in her science classroom, the STC workshops were also giving Teresa a channel to facilitate learning activities that build upon students' cultural knowledge in teaching the science curriculum.

Hope

In the *Pedagogy of Hope*, Freire wrote, "Hope is the natural, possible, and necessary impetus in the context of our unfinishedness. Hope is an indispensable seasoning in our human, historical experience" (Freire, 1998, p.69). Hopelessness is the underlying reason for passivity of human beings. Hope is what makes teachers keep on finding ways to fulfill the needs of their students. For Teresa, hope came in the form of resilience to anti-immigration climate in the River middle school. Rather than being driven to desperation, she had faith in her abilities as a bilingual and multicultural teacher and confidence in the new generation of students. Teresa did not want her students to experience the trauma that she had in her own schooling years. Her efforts to provide space for different ways of science knowing and thinking seemed to propel her to look for ways to accomplish that purpose. The alternative science education in the STC workshops was one place where her reserves of hope originated.

Another way Teresa demonstrated hope is through the realization of importance of working with families, which she was not aware previously. She was feeling tension as she negotiated with the strict rules of the River middle school. However, her observation of herself with families forced her to think critically about potential possibilities: "I could see that I was making a difference with the parents and I could see that I can be a support to a lot of the people especially those Latino students that were coming through a lot of struggle." Seeing the possibility of change seems to be main reason for Teresa to keep her resilience to oppressive

power relations in the River middle school. As Freire posited, we take action to the extent we believe that change would be possible. Hope is the essence of the courage (Nieto, 2003) and in the following sections I will provide examples of how this hope became catalyst for Teresa's attempts to restructure her work with her Latino students and families.

Caring

Caring attitudes manifested in Teresa's practices in number of ways. What did it mean to care in relation to pedagogy? For Freire (1992), caring involves cognitive and emotional aspects of teaching and learning. Caring requires teachers to attend to students' expressed needs, not the assumed needs prescribed by the curriculum. In this sense, caring teaching is a dialogical process that depends on the context of individual classrooms. Teachers structure opportunities for students to express their experiences and thoughts about given content and shape the learning environment accordingly. Making space for dialogue-based learning interactions in which students think and talk with their peers and their teacher, similar to what she observed in the STC workshops, was one way that Teresa demonstrated her caring teaching in her classroom. Her approach to teaching was influenced by her own experience as an immigrant student. As she expressed it, "I see that my students have a hard time being Latinos because they're so busy trying to be White." This awareness seemed to motivate her to implement LISELL-B teaching instructional strategies as a way of legitimating the variety of science knowledge students possessed in the classroom. Her efforts to recruit families to STC workshops by calling parents and organizing transportation for the program in River Middle School was another manifestation of her caring commitment to Latino students' active engagement and of her persistence in helping her students with their science learning in collaboration with their parents.

When a school conveys unintentional negative messages to students, teachers' caring efforts may result in disappointment. In a study of a bilingual teacher (Mr. Pott) and his students, Pimentel (2011) found that the possibility or impossibility of caring was greatly influenced by the power dynamics in the broader context. As a result of deficit-oriented school practices preventing Mr. Pott from implementing a dual language model in his classroom, he left the teaching position to find a school where he could receive support for a dual language program. Although this study pointed out the need for transformation in all schools and school districts, today's students do not have the privilege of waiting for a structural change to receive opportunities for equal education (Nieto, 2014). Teresa's proposal to conduct Latino science nights with Latino families at River Middle School adopting the content of STC workshops and her invitation to colleagues to support her proposal provide a compelling example of how teachers' caring attempts can also influence school-wide practices. As Teresa found, to be effective, teachers need to be involved in collective work as well.

Critical consciousness

As Nieto (2003) stated, "Teachers are not miracle workers" (p. 105). It is not the role of the teacher to solve sociopolitical and sociohistorical issues in schools to bring about positive change. However, teachers should not fail to recognize how these broader issues have been shaping students' educational experiences in the larger extent. For Freire (2013), this recognition is crucial, given the fact that "critical understanding leads to critical action" (p. 42). Only a growing awareness of the role of educational policies and practices in justifying what counts as legitimate knowledge can provoke teachers to challenge these injustices. Challenging injustices can mean many things depending on the context and the individual teacher.

The injustices that provoked Teresa's growing anger were the assimilationist practices of River Middle School. These practices framed Latino emergent bilingual students and Teresa as failures in her science classroom. Teresa had already gained critical consciousness regarding the role of these assimilationist school practices as she had experienced them first hand. It seemed that the STC workshops provided her with the courage to take the next step. Her indirect use of bilingual instruction and resources through collaborating with Latino parents in her classroom can be seen as an example of one critical action she took while breaking the rules of the school system while still playing the game. As Freire eloquently expressed it, "Thinking perceives reality as process, as transformation, rather than as a static entity-thinking which does not separate itself from action, but constantly immerses itself in temporality without fear of the risks involved" (Freire, p. 81). Teresa was aware of the potential risks of implementing indirect bilingual science education, even though she had been previously criticized for the TLE platform as an "ineffective" science teacher due to her direct use of Spanish in the classroom.

Another example of critical action Teresa undertook can be seen in her pursuit of a doctorate, a degree that would allow her to support immigrant students and families with the kind of authority that she could not acquire as a teacher. Teresa's individual attempts to support the science learning of her Latino students and her work with their families in their children's education that were repeatedly restricted by the River Middle School administration pressured her to find alternative ways. Her frustration as a teacher ("We need someone that is going to be willing to advocate for them") seemed to be the catalyst for her decision to pursue a career in administration and policy, a privileged position, to speak to different audiences to challenge relations of power and inequity in the education of children.

Summary

In this single-case study, I focused on the experiences of Teresa, who was the only bilingual and multicultural science teacher attending the STC workshops as a focal teacher in the LISELL-B project. I presented: (a) Teresa's experiences navigating the school system as a Latino student, (b) Teresa's progress as a bilingual and multicultural science teacher, (c) the challenges and tensions Teresa continued to face in her science classroom, and (d) the ways in which the STC workshops influenced Teresa's perspectives and practices regarding working with diverse students and families.

First, I demonstrated Teresa's struggles to effectively work with her Latino students and families even though she also came from a Latino origin. I illustrated that her struggles to integrate cultural and linguistic knowledge into scientific investigations stemmed from her personal schooling experience built upon the Western-based pedagogical model separating knowledge from people or context. Next, I presented the complex situation in which Teresa cultivated resistance and negotiated tensions between multiple roles and contexts. Teresa was committed to working with her Latino students and their families despite the many challenges that she faced, including her lack of teacher preparation in working with diverse students and families, increasing demands for testing and accountability, the negative messages of the River Middle School administration regarding the immigrant community along with the monolingual and mono-cultural school policies.

Then, I demonstrated that even though the school policies have been hampering Teresa's efforts to validate her students' linguistic and cultural resources, the STC workshops seemed to give Teresa a venue for achieving that purpose. The critical aspects of dialogic education, hope, humility, care, and critical consciousness were visible in Teresa's teaching perspectives and

practices in several ways. Her consistent participation in the STC workshops can be seen as an example of her humility, which was a crucial element in her learning of new strategies to support her students and their families. She demonstrated hope through her self-observations during the STC workshops where she realized her potential to make a difference with students and parents, which became catalyst for Teresa's attempts to restructure her work with her Latino students and families and kept her resilience to oppressive power relations at River Middle School. She demonstrated her caring for her students through her facilitation of dialogue-based science learning interactions by leveraging multiple ways for students to make sense of science concepts and through her proposal to establish Latino Science nights with Latino families adopting the format of the STC workshops. Her active work with Latino parents in using bilingual resources in the classroom despite being forbidden to speak Spanish in the classroom and her pursuit of doctoral program were powerful examples of her critical consciousness and her decision to challenge the dichotomization of culture and science in students' education.

CHAPTER 6

STORY TWO

A MULTI-CASE STUDY OF FOUR EUROPEAN AMERICAN SCIENCE TEACHERS

In this chapter, I provide my findings from a multi-case study that examined the impact of the STC workshops on perspectives and practices of four European American secondary science teachers—Donald, Jennifer, Julie, and Allyson—in their work with their Latino students and families. First, I present a case-by-case analysis illustrating each teacher as an individual case, including their own family background, prior experiences in working with immigrant families, experiences with attending the STC workshops, and how they thought their perspectives and practices changed after attending the workshops. After presenting the case of each teacher, I illustrate cross-case analysis by presenting the research findings around three categories in light of Freire's principles of dialogic education.

Case-by-Case Analysis

Donald

Donald's background. Donald was a physical science teacher in the Creek middle school in his forties with 15 years of teaching experience at the time of the study. As a European American, Donald was born in Georgia where he now resided and taught. He grew up with his sister, a mother who worked in the financial department of a local hospital, and a father who served in the Air Force as a supply sergeant. He defined himself as “living a military life” traveling around different states in the country and living for a few years in Japan during his childhood. In this time period, Donald was never exposed to the Japanese language since he was

able to communicate with his friends and teachers in English. However, the experience of living in another country seems to have motivated Donald to have interest in learning about other cultures and how this knowledge might influence his approach to culturally diverse students.

Teaching at Creek Middle School for ten years, Donald enjoyed working with Latino students. However, linguistic and cultural differences remained the most challenging factors he had to face in his science classroom. Donald had Latino students in the previous schools where he taught, but it was the first time for him to teach Latino students who spoke fluent conversational English but had more limited reading and writing ability, which he felt made it hard for them to make sense of academic science. Most of his Latino students' parents spoke Spanish and little English, and he spoke little Spanish, which made teacher-parent communication a challenging task.

Donald describes what he learned from the STC workshops. The STC workshops were a space for Donald to conceptualize science teaching from a different angle.

I'm a white male, middle class, whatever it is...so it's rare that experience [of] not being the predominant one. So, I think that, more than anything is what I get out of the workshops, is that being on the other side of the table. It gives you a different sense of just what the entire environment is. It gives you a feeling that we don't all see everything the same way. We don't always experience everything the same way. And just being slightly different can make it very difficult or very uncomfortable to be in that situation. As Donald articulated "being other side of the table" was a catalyst for him to better understand why and how his Latino emergent students easily disengaged with science in his classroom. He was aware that the students were struggling in comprehending scientific concepts. However, he was losing this awareness in the flow of teaching through the culture of accountability at Creek

Middle School. In the STC workshops, Donald observed as students worked on projects with their families as they were encouraged to approach science investigations in different ways. He observed the families situating themselves as users of scientific language while they helped each other in an engaged way. Donald was glad that his consistent participation in the STC workshops acted as a constant reminder to critique his own teaching practices, which mostly represent a dominant culture of science instruction in the classroom.

The STC workshops also became an arena for Donald to learn about his Latino students and families, since the families were rarely seen at Creek Middle School. Even though most of the conversations were conducted in Spanish, seeing parents' excitement to learn with their kids was an eye-opening experience for Donald. For example, *during the Bottle Car Derby Activity Donald worked with a family at a table as they were designing racecars using everyday recycled materials. The aim of the activity was to design the fastest possible racecar by experimenting with different weights and wheel sizes. While Donald was making holes in the center of bottle caps that would be used as the wheels of the bottle racecar, the mother was filling the bottle with beans and rice planning its weight to run it down the ramp fastest* (Participant observation in the STC workshop, February 2017). Reflecting on this experience, he commented:

I like watching the students taking the leading role. It wasn't that parent were sitting back and waiting for their kids to do it, but they were actually getting in there and working together. A couple of fathers in there that really wanted to have the winning cars. So, it was just fun to watch the interaction between the students and the parents. That, to me, is the most revealing and rewarding part of it that we provided some kind of an environment for them to interact on an academic level.

Donald was encouraged by his heightened awareness of the Latino parents' potential to help their children in scientific investigations. He also started to receive benefits of working with families outside of school environment as those Latino students engaged more easily in his classroom, both in terms of their behavior and their motivation. This change led him to question his own practices: "You focus on the student, you ignore the influences of the family has or in a lot of ways the support that the family could give." He was aware that families could be life-long supporters for their children in their engagement with science, given sufficient support and opportunities.

Donald's changing practices. Keeping this in mind, Donald planned prepared take-home science kits that students could use at home over the weekend to experiment with their families. His aim was to periodically design small science activities with a set of instructions that could potentially create more family interaction around science as a follow-up activity for certain science investigations that were implemented in his science classroom. Donald also influenced the Creek Middle School community to change the structure of the Latino Nights to engage students, parents, and siblings in hands-on science investigations in place of the typical school programs that mostly just informed parents about learning activities that were available for their children or programs in which parents only watched their children conduct science experiments. In the Spring 2017 semester, Creek Middle School used a LISELL-B science activity for the first time (LISELL-B science kits that were provided for focal teachers to be used in their classroom) in their Latino Science Night program. For example, Donald utilized the STC *Making Slushies Activity* that required very low-cost materials. He had students and their parents make their own slushies using rock salt and Hawaiian punch to explore the effect salt had on the freezing temperature of water. As Donald related it:

I think it worked very well and our administration saw that, and they brought that up in one of the overall school meetings that we had at the end of the year. He'd walked in and the kids were making slushies and saw that there were a lot of people involved and having a good time, and so he made a point of bringing that up.

Since the program received a pretty good turn-out, Creek Middle School decided to keep the new format of the Latino night that Donald re-structured.

Donald also noted a marked improvement in his ability to give students more agency in their practices to carry out science experiments in his classroom. Observing his students' efforts working together while he intervened less was a difficult experience for Donald, partly because of his accustomed way of providing students with direct instruction as to how to carry out science experiments. Observing the project researchers facilitating the science investigations with families in the STC workshops provided Donald with an alternative model for how to give students more control in his classroom. "My job here is not to jump and show them how to do this, my job is to say, "Here's your problem, here's all the stuff you need to work with. Let me support you but let me get out of the way, too." Donald also began to create spaces for his students to talk and work about science concepts with their peers, in small groups or in whole group discussions to give students opportunities to reflect on their learning process. He was, however, also aware of the time limitations and the need to keep on pace with the school curriculum, and that restriction created a tension for Donald between teaching for learning and teaching for testing.

Jennifer

Jennifer's background. Jennifer, a mother of two children, was born and raised in a small Georgia town within a one-hour drive to the Stonybrook School District where she now

resided and taught. She grew up in a European American, middle-class, two-parent household with extended family nearby. Having educators in her close family in this small town, Jennifer described her schooling years as “covered 24 hours,” receiving considerable support both in her education and in her extra-curricular activities. Jennifer’s strong sense of family-oriented life was also centered on the Southern Baptist church in a number of ways. She regularly attended church activities and took her children to Sunday school and midweek events and served the community by teaching at vacation bible schools during summers. She believed that her deep involvement with church shaped her identity and made her more sensitive to the needs of the students she taught: “They’re [the people in the church] such a good, solid foundation for me to be who I am with no judgement.”

Jennifer recently completed ten years of science teaching at Fall High School. She had a bachelor’s degree in biology and master’s degree in science education and more recently a specialist degree in forensics education. Remaining at Fall High School, Jennifer still knew little about the lives and experiences of Latino students either from her teacher preparation or from her personal experience. As the classroom dynamics have changed dramatically in the past few years with the influx of the Latino community, Jennifer felt frustrated with the school administration that she taught was too far removed from being in the classroom. Her frustration, “You don’t have administrators that are willing to come back into the classroom or listen to their teachers and say. That’s not the way it is anymore,” became an important motivation of her consistent participation in the STC workshops for her to find ways to support her Latino emergent bilingual students and families.

Jennifer describes what she learned from the STC workshops. Reflecting on her experiences in the STC workshops, Jennifer claimed that the workshops contributed to her own

professional growth in a number of ways. For example, Jennifer was also present in the *Bottle Car Derby Activity*. Unlike Donald who was involved in the process of making a racecar with a family, Jennifer was sitting at the back side of the room and watching the facilitation of the activity. According to Jennifer, these observations provided her a sense of how to facilitate a science investigation in her own science classroom, including the areas in which she needed to improve. It was difficult for Jennifer to understand most of the conversations that were conducted in Spanish, but when translation was available for her, the workshop sessions seemed to offer Jennifer important insights about the Latino families. For example, she found that her Latino students had strong family dynamics. She observed that the Latino students were highly engaged in science activities when they were allowed to make collective decisions, and they were interested in exploring and utilizing their parents' knowledge about the science concepts they were studying. Jennifer commented:

I kind of already knew a little bit. It's not just head knowledge it's...personal now, I know it in my soul. Someone can tell you something all day long but until you experience it it's not the same. They can tell you "That's cold" but until you touch, and you see it's cold. It's just something there and those family workshops really made it personal. That was huge because from my personal background, I didn't have a lot of that interaction with others.

As Jennifer articulated, it was an eye-opening experience for her to see how her students could use their multicultural and multilingual identities drawing from school science and their everyday science experiences, when given sufficient opportunities. She observed that it was beneficial for students to use multiple ways to display how they made meaning in the context of

solving problems, such as drawing pictures or using their everyday language to document their observations during the science investigations in collaboration with their family members.

Another crucial personal dimension emerged as Jennifer reflected on her experiences in one of the STC workshops that was conducted as a part of annual state-wide Latino Science Fair. *Jennifer was taking a tour across the science demonstrations along with her son and one of her student's family. They stopped in front of one science booth where Jennifer's son and her student were interacting with the college students and burning an old penny with 95 percent copper versus a new penny that is mostly zinc with only 2.5 percent copper. They used a torch to explore reactions of these two different materials* (Participant observation in the STC workshops, March 2017). According to Jennifer, language was not a barrier in that particular moment when she was able to communicate with the parent by watching their children conduct the science experiment.

That was really special. People give too much credit to once there is a legitimate barrier there in the language, but learning is so universal and it's just nice to be a part of that universal learning and it's nice to not have a barrier. When you can just make eye contact and you both are just loving it and benefitting. Nobody cares what language you speak at that moment, you're just people having fun with science.

According to Jennifer, Latino parents are part of their children's science learning, and the language barrier would not change that reality. However, she was aware that language still plays a crucial role in preventing parents from forming a full partnership around their children's science learning. This situation included her lack of language skills in Spanish as a teacher, who might otherwise be better able to guide parents to work with their children. Nonetheless, Jennifer seemed to learn the value of communicating her students' families at times other than parent-teacher conferences or phone calls that were conducted mostly during problematic situations as

she noticed the changing dynamics in her science classroom. Like Donald, Jennifer observed that her Latino students who attended the workshops started to attend her class ready to learn with more confidence in their abilities to conduct science experiments. Jennifer utilized the students' science experiences from the workshops by providing opportunities for them to share with their friends about the workshops during classroom discussions.

Jennifer's changing practices. According to Jennifer, she developed a greater sense of responsibility in attending to the needs of her Latino students since the inception of the STC workshops. Learning about her students' family dynamics, Jennifer indicated that she started to hold higher expectations for her Latino students to achieve in science.

Working with the kid just becomes more valuable. And like I had this one child and he's very smart but he was lazy. And his parents showed up to the family workshops a few times with his siblings and he didn't get away with being lazy anymore in my class, there was no...when he'd try to sit back and not do his work, I'd look at him and "I know where your value system is" and I wouldn't have to say much and he'd get back to doing it.

According to Jennifer, she also gained new insights from the STC workshops that led to changes in her current teaching practices, such as providing more time for peer work and peer discussions and addressing problem-solving skills that she noticed were critical components of science learning. "Watching the LISEL-B staff do it and implement it and watching how different it could be than what I was taught, that's what changed my lesson plans." As she articulated, readings and lectures might be valuable in some ways, but having facilitators modeling for the teachers was the most important element in her use of these practices.

Even though Jennifer's interactions with Latino families already influenced her current practices with her students in her science classroom, she explained that her attendance in the STC workshops was about the extent of what she could achieve with her Latino students' parents. Language barrier, time limitation, and lack of support from the school administration were the factors that created conflict between her intentions and her practices to extend her work with families beyond the STC workshops. Rather, she expected the Fall High School to take a leading role in working with families, including providing more engaging parent programs and providing classes for teachers to learn Spanish, so teachers can better communicate with their Latino emergent bilingual students and families.

Julie

Julie's background. Julie was a sixth-grade earth science teacher in her early thirties with nine years of teaching experience at Woodstone School District at the time of the study. Like Jennifer, Julie grew up around many educators, including her mother who was an elementary school teacher in her school and her father who worked in the technology department at the local board of education. Growing up in a European American and upper middle-class family in South Georgia, Julie described her parents as very supportive of academics and social aspects of education. Julie remembered herself always working with her mother in the afternoons or on the weekends to practice school content, going into the library and picking out books, going to local science and history museums, and conducting science experiments with her aunt in the backyard where, she believed, her love for science and math originated. Throughout her elementary and high school years, Julie also had extensive community service experiences, such as volunteering at women's homeless shelters, helping drug-addicted mothers in rehabilitation centers, and assisting with the reconstruction of houses after hurricanes. Julie described these

experiences as shaping her view of teaching as a community service: “What kind of students do you want them to be? ‘It doesn’t matter what you look like, it doesn’t matter what you smell like, we’re going to take care of you...school is a community.’”

Julie began teaching at Oak Middle School in the Woodstone School District, and she found herself having deep reflections on her personal schooling experiences in comparison to her students’ experiences at Oak Middle School: “Is this new?” Julie had a difficult time relating her own schooling and her teacher education program to teaching students who came from diverse linguistic, cultural and socioeconomic backgrounds: “This is crazy, this (Oak Middle School) is what the school systems look like but like the restaurants that I’m going to don’t reflect it and my college classes don’t reflect it.”

Julie describes what she learned from the STC workshops. Attending the STC workshops for seven years, Julie provided transportation for some of her students who would not have been able to come as their parents had to work during the weekends. During the workshops she worked with families on a wide range of science inquiry activities, such as the *Inverted Flask Activity* in which she assisted families as they recreated Jacques Charles’ candle and flask model in order to understand temperature and pressure relationships for contained gasses. Another example would be the *Earthquake-Resistant Building Activity* in which she helped families to create model buildings using gum drops, marshmallows and toothpicks to test how well their designs would hold up during an earthquake. Because she built very strong personal connections with her Latino students and families in the STC workshops, Julie has been called upon to help mediate conversations between other teachers and her previous Latino students’ parents at the Oak Middle School. Yet, Latino parents requested to have conversations with Julie about their children even though she has never taught them. According to Julie, her experiences with

families in the STC workshops restructured her thinking about the science education of any student.

It's just things like that that just kind of teach you that are things beyond the act of the success of a student that creates this whole student that I feel LISEL-B taught me especially when it comes to parents. I think the bigger goal there was just how to approach families in general and their success for their student.

Like Donald, Julie observed that in the STC workshops parents had opportunities to interact with their children around science experiments in ways that were contrary to the usual school-parent programs in the Oak Middle School, where parents were positioned as passive participants listening to the school's agenda much like Freire's banking model. These observations were crucial to her understanding of the value of "creating the whole student" within a science learning community where parents can participate in their children's science learning. Along with these observations, Julie experienced a language limitation that interfered with her involvement in the learning activities in the workshops, which was a powerful moment in her teaching career that caused her to feel how difficult it can be for parents to participate in education of their children if they don't know the language of the school, including that of the education system. This understanding led her to rethink her role as a science teacher in helping to accommodate her Latino students in the U.S. school system.

I guess to go beyond my background because my parents would sit with me and practice spelling words, practice with math problems, they would sit down with me and they knew how to do that. So, now with LISEL B it helps me understand that it's my job to make sure that parents are comfortable to interact with their child academically or I need to give them all the resources.

Julie realized her potential to provide a venue for her students to practice science with their families who are not familiar with the language of the school or the norms of the education system.

Julie's changing practices. With this understanding, Julie had modified her practices with her Latino students and families in a number of ways. For example, she sent text messages to parents on alternating days with dinner discussion questions to ask their children. The questions were related to the current science concepts that had been addressed in her science classroom, such as “How did tides impact Scotland in science class today?” What did you learn about volcano lab this week? Who was the guest speaker today and what did you learn from her/him?” She also started to send translated versions of the dinner discussion questions for Spanish speaking Latino parents with the assistance of a bilingual colleague.

I give them these prompts which surprises the kids because they didn't realize their parents knew what they did at school that day. It kind of shocks them when their mom or dad or aunts or grandmother ask them a question, “Well, how do tides affect Scotland?” but those questions are usually made a week before and then I ask somebody who speaks Spanish to make sure that my question translation is correct. And I learned that through LISEL-B that just because you translated it, that it doesn't necessarily make sense. So, not just in the esthetics of what I'm talking about was the way that the word is related but to make sure that they're comfortable with having these discussions with their child.

According to Julie, dinner discussion questions were beneficial by offering parents a sense of what kind of science knowledge was expected from their children within conversations that centered around science concepts. Yet, Julie situated Latino parents as active agents within the culture of science by leveraging their expert knowledge of the Spanish language with dinner

discussion questions. Julie also created a word game for parents to practice academic vocabulary of science and science concepts with their children by utilizing the Quizlet web-based study application. She developed two packets; one included paper-based flash cards with general science vocabulary terms/concepts derived from sixth-grade earth science standards, and the other packet included flash cards with definition and illustration of the terms. She printed the science terms in two colors; one matched the definitions and the other matched the illustrations. Before providing the matching word game, Julie also demonstrated to parents how they can practice this activity with their children during the parent-teacher conference. Beyond her own professional advancement, Julie elicited satisfaction from the process of sharing her practices with her colleagues and influencing the broader agenda of sixth-grade science at Oak Middle School. Currently, all three science teachers in the sixth-grade are sending home dinner discussion questions and science word games.

Julie also changed her teaching practices by providing students with more opportunities to reflect on their learning of science in the classroom. She observed that in the STC workshops, students were “doing some hands-on activities, some sort of reflection piece and then some sort of application from a different science careers.” According to her, these observations were critical to her understanding that learning takes place when students hold conversations with others in relation to scientific concepts, when they engage with science in varied ways, and when they connect scientific and everyday practices. Modifying her teaching practices in her science classroom, Julie started to ask students reflective questions to talk with their peers in small groups or whole group discussions, such as “How does this impact your idea of science?” Julie felt that asking reflective questions gave students the confidence to share their knowledge with the whole class without fear of giving a wrong answer. In this way, she was also establishing

grounds for alternative ways of meaning making of science for students from various cultural perspectives. The Oak Middle School administration seemed to give Julie agency in her work with her Latino students and families, but she was aware that her personally-developed practices were taking a great deal of personal time and energy without careful planning. However, she was able to adjust her time and integrate these practices into the common core science standards that she had to address in her science classroom.

Allyson

Allyson's background. Allyson, in her late thirties, was born in a Midwestern state, and her parents were divorced as she grew up. According to Allyson, going back and forth with her sister to each parents' house made her highly independent in nature with an internal drive to explore outside world. Allyson had a varied educational background and entered the teaching profession via an indirect pathway. She went to a college in Arizona to study anthropology, which she believed was a good fit for her independent personality. During this time, Allyson studied in Mexico for a semester as a program requirement. Allyson was able to fully immerse herself in Mexican culture by living with a Mexican host family and taking advanced Spanish language classes in addition to classes about Mexican culture and history. Allyson was very confident in her Spanish language abilities, and she passed an upper level Spanish class. Graduating in anthropology, Allyson transitioned to education, and gained teaching certifications and a masters' degree in education. She started her teaching profession as a fourth-grade teacher in a highly multicultural classroom in a midwestern city, and she served predominantly Latino students, including refugee students. In this period, Allyson enjoyed working with a diverse student population and used her bilingual skills to effectively work with her Latino emergent bilingual students with the support of the school's administration. Allyson also lived in rural

France for two years due to the business opportunities for her husband. She offered periodic basic conversational English classes in a local one-room primary school that served mixed age children.

Moving to Georgia four years ago as an ESOL and a seventh-grade co-science teacher at the Spring Middle School, Allyson found the Woodstone School District to be culturally and linguistically segregated compared to the schools where she had previously worked in which multiculturalism was a more mainstream educational framework.

Allyson describes what she learned from the STC workshops. Allyson was aware that many of her Latino students' families were reserved about leaving their communities and did not venture out to learn about the cultural and social structures in the United States, including the educational system. Many of the parents had limited educational backgrounds along with limited English language proficiency, which they believed hindered their ability to help their children to acquire academic success. Yet at the same time, Allyson was aware that Spring Middle School was insensitive to the immigrant students and families and did not do enough to promote their integration into American culture.

And I hate to say it but there are teachers...you hear in the hallways saying, "Stop speaking Spanish, speak English" ...and the children would come to me and tell me stories about teachers. And it's definitely a hard place to be because I feel like not all teachers are as accepting or understanding of multicultural students and lives.

According to Allyson, the school administration was losing touch with the changing dynamics of the classrooms and the local community, which hindered the potential of establishing a school climate that would be conducive to the learning of students who come from diverse backgrounds.

For Allyson, the STC workshops provided a vehicle for her to spend time with her Latino students and their family members outside of the school setting, and she was able to get to know them on a more personal level. The program served as an intermediary place between Latino families and Spring Middle School for Allyson.

That was a new space, it wasn't me just having to go to a house or the family coming to the school. It was an outside, third kind of party location for everybody to feel like a little vulnerable because it wasn't necessarily comfortable to us as teachers either because it was a new setting.

In this "third space," Allyson was able use her bilingual skills to interact with her students' parents as the conversations flew back and forth between English and Spanish. She built a rapport with parents as well as with students who became more comfortable talking with her in the classroom. Interacting with students and their family members during the hands-on science experiments, Allyson had a chance to see parents from a different point of view.

Especially those parents that came to the LISEL B family workshops... they were pushing themselves to get out of their comfort zone to come to the university setting and meet these professors and grad students and teachers. So, I think that helped me understand more about the variety of Latino parents that we have here and as a teacher thinking about what we need to do to help families that don't have such a strong background in literacy.

Allyson was able to observe that parents were strongly tied to agricultural and life science topics. For example, she remembered herself visiting a local Vidalia onion research facility on a university campus with the families, where graduate students and university faculty discussed how to plant and grow healthy Vidalia onions with a certain flavor. Parents also shared their

knowledge about growing onions, including conditions, such as PH level and nutrients required in the soil to make it grow in particular regions.

And the fathers and mothers were like, “Oh, yeah, we understand that, that’s something that we’ve done” maybe not in the same exact way. So, I thought that was great to have all those connections made between the families and their prior experience in background knowledge and what we were seeing here in the lab.

Allyson found that the Latino families were excited about learning science as they found an opportunity to discuss scientific ideas that were connected to their everyday lives. She observed that engaging with science in real-life contexts made the students and families feel more confident about participating in scientific discussions. This understanding led Allyson to question her role of science teaching in students’ science learning process.

So teaching science in the school year is somewhat abstract for our kids cause it’s just like one more class that they go to in a day and it is not always life relevant or we try to make it but you know they only see it in one way so the field trips that we take in the program and also all the hands on lessons, I think it really sparks more of that inquiry, curiosity, that will help our children be more life-long science learners and wanting to progress their knowledge.

Families’ scientific knowledge was legitimized by incorporating it into the process of science inquiries in the STC workshops, in which cultural neutrality of science was challenged. This understanding led Allyson to modify her practices to help her students use their cultural and linguistic resources in their learning of science.

Allyson’s changing practices. Observation of her students’ interaction with their parents and younger siblings at science activities seemed to help Allyson better understand each of them

as whole people, not just as a student at the margins of a classroom. Understanding that learning was embedded in students' everyday lives and communities was catalyst in her changing practices.

I talk with them about some of their leadership skills because a lot of them were the oldest sibling and they take care of six little kids at home every day after school and that helped me have a better picture of what they were going through and how I could talk to them to gain respect and let them know that I know a lot about them, cared about them.

So, I think overall being able to say, "Your dad has this experience because I saw this at the onion workshop where he was talking about how he enriches his soils." And then help them think about the skills that they have and how they can apply those skills.

Allyson leveraged her students' cultural knowledge on agrarian and animal science topics in relevant science lessons. She helped her students to make personal connections with school science concepts and encouraged them to share their knowledge in the classroom, and validated their home language by teaching them to be proud of their bilingualism. Like the other three focal teachers, she structured a debriefing session in which students could have a dialogue about their learning process and reflect on what they have learned from the lesson that she believed improved students' understanding as they learned from each other. According to Allyson, the debriefing sessions became a powerful tool in her science teaching that all students could find a connection with.

During parent-teacher conferences and other school parent events she attended, Allyson also became an attentive listener for parents to share their concerns and ideas with.

At school nights we don't really encourage the parents to like talk about themselves, it's more like, "Here, this is what we do at school, here's all this information, here, watch

your student do this thing” whereas at LISEL-B it was like “Tell me about you. What’s your background? Do you have experience in this? Okay, let’s learn this together. What do you think about what you just learned?”

For Allyson, building new relationships with parents within the school, by means of interacting with parents as active agents rather than passive participants, became an opportunity for her to use her students’ realities as a scientific resource.

Despite of her professional growth, Allyson came to the realization that her modified teaching practices in her ESOL and science classrooms, including her use of LISELL-B bilingual teaching materials often received little recognition at the Spring Middle School. She did not receive any good evaluations of her new teaching practices since they were regarded as outside of the school mandated teaching philosophy, which was mostly concerned with standardized curricula. In my last meeting with Allyson, she was disappointed by the termination of the STC workshops. According to her, there was not any reason to stay at Spring Middle School without the presence of the LISELL-B program. She left her teaching position at Spring Middle School and started in another urban school where she could be part of a network of like-minded teachers and administrators. Allyson was committed to continuing personally as a teacher to look for possible university-based community outreach programs to help families involve in learning opportunities beyond what she could do in a normal school setting.

I don’t know if a school can just do it by itself, it’s like...it’s adding the community component. So, I guess I just want to advocate for these kind of university partnerships with the school to help provide like that third component of the triangle...angle, to provide a more holistic rounded educational experience for our students.

Understanding the role of families in their children's science learning experiences was crucial for Allyson's plans in taking ownership on her practices to help families to be part of community-based science learning programs like STC workshops, so they can be life-long science learners with their children and well-informed, active participants for their children's pursuit of science career pathways.

Cross-Case Comparison: Bringing it All Together

Looking across the four secondary science teachers, I found characteristics which made each teacher's practices unique, as well as similarities in teachers' developing understandings of their work with their Latino emergent bilingual students and families. In the following sections, I present the research findings around three categories in light of Freire's (1970, 2005, 2013) principles of dialogic education. Similarities and differences among the cases were scrutinized with respect to categories of (a) *recognition* of student resources outside of the classroom, (b) *adaptation* of the STC practices in working with Latino emergent bilingual students and families, and (c) self-initiated *proactive practices* that focal teachers personally developed to extend their work with Latino families in the context of science education (see, figure 9).

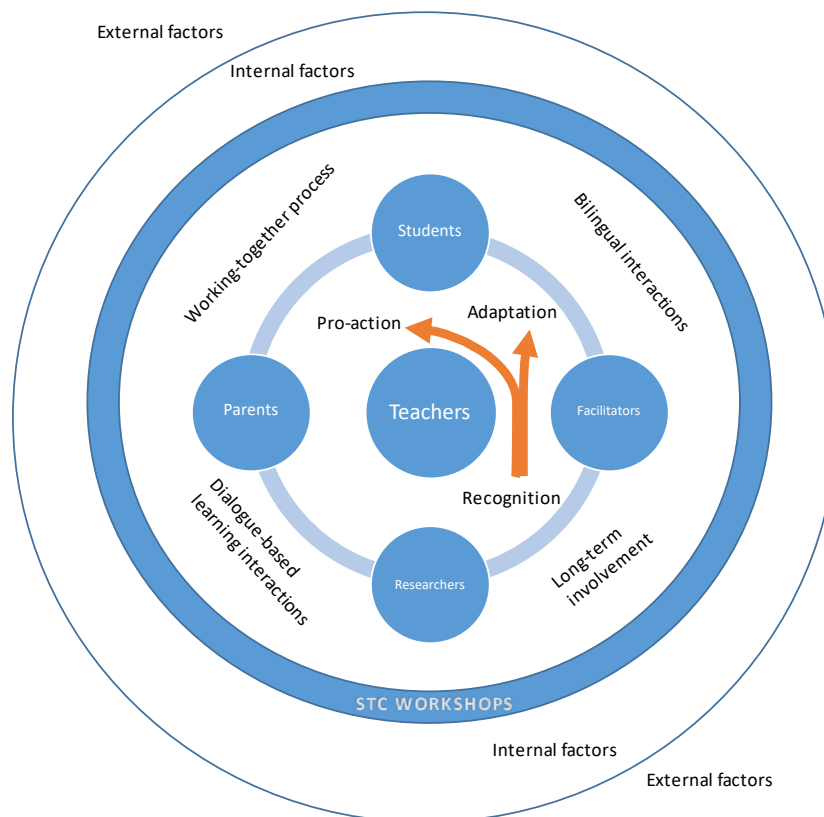


Figure 9: Visual representation of research findings for the multi-case study of four European American science teachers.

Recognition

Despite the additional work that was required by their participation in the community-based science learning program, the focal teachers thought that their professional growth outweighed the costs in terms of their time and energy in a number of ways.

The value of working with the community. Each of the teacher participants seemed to understand the value of seeing students beyond the classroom doors as they started to work more effectively in their classrooms with students who attended the program. Donald and Jennifer saw benefits regarding student behavior and motivation. Julie and Allyson witnessed that their students who attended the STC workshops became more comfortable with talking and asking questions in the classroom. Regardless of how each focal teacher experienced a change in their interactions with these Latino students, they understood that learning is a process of becoming

across multiple dynamics that are not always tied to a time and place, such as a school building. This critical awareness manifested in their recognition of changing classroom dynamics along with their consistent participation in the STC workshops.

According to Freire (2013), critical awareness emerges from a real harmony between human beings and the world around them without a dichotomy between the two. Thus, teachers can develop a critical awareness of their teaching practices only when they have direct involvement with contexts and experiences that challenge conventional wisdom of education. Such an awareness must question education as a neutral activity that is based on unified and reliable foundations and perfect certainty and question whether this type of education centers teaching around standardized curricula and standardized performances and engage in serious dialogue about their own way view of education. Confronting different perspectives, including different ways of looking at knowledge and truth, teachers can develop a more nuanced understanding of complex issues in education. Freire expected that teachers can reflect upon their long-held assumptions about what actions constitute learning and teaching and whether they limit their effectiveness on student learning by involving themselves in consciousness-raising dialogues in diverse communities and learning contexts. In terms of the four focal teachers, their participation in the STC workshops with Latino students and families seemed to help them to question their own view of teaching that had focused heavily on the student in the boundaries of classroom, ignoring the importance of making connections with their families and communities that they observed as an essential element for students' learning motivation. For example, Donald recognized that, "You focus [only] on the student, you ignore the influences the family has or in a lot of ways the support that the family could give." Jennifer realized the need of "understanding their [students'] family dynamics, which helps a lot [in] how to best be with them

in the educational setting.” Julie stated that “the workshops really taught me to go beyond what I think of a student and what I think of a family.” Allyson changed her thinking on the role of teachers “to build community with our students and their families to be a safe space for a student to come to when they're troubled or need guidance.” As Julie indicated, teachers understood that “it takes building a relationship with those kids and families on an individual basis to give them [students] the confidence to make learning attempts in the classroom,” and teachers saw working with families as key to improving their work with individual students. The focal teachers recognized that students’ science learning is always part of social relations and arrangements, including their families and communities and schools that they saw as crucial elements in students’ learning motivation in the classroom.

Parents are learners of science with their children. Another way the teachers demonstrated critical awareness was through their recognition of Latino parents' potential for involvement in their children's school science learning but also in the school community. Although Donald, Julie, and Allyson still articulated concerns about the parents of their Latino students' abilities given their sense of many parents’ limited educational and English language backgrounds, they recognized the possibilities for parents’ involvement in their middle and high school aged children’s learning, given sufficient opportunities and resources. For example, Donald was intrigued by “watching students work with their younger siblings or with their parents trying to figure out and solve the science problems. It makes me think about we should have [more] available for them.” For Julie, “LISELL-B helps me understand that it’s my job to make sure that parents are comfortable to interact with their child academically or I need to give them all the resources.” Each focal teacher reported the value of providing some kind of an environment for students and family members to interact on an academic level in their

corresponding schools. As Allyson termed it, "very similar to what has been done with the family workshops where we could all be interactive and learn from each other." Observing that parents can practice science inquiry activities with their children in the STC workshops was a catalyst in their thinking about their abilities as teachers to establish a more supportive approach for parents to be life-long learners of science with their children.

Teachers are learners of multiple ways to engage students in science. In terms of the focal teachers, another critical awareness came in the form of examination of their own teaching practices by comparing them to what they observed during the science investigation sessions in the STC workshops. The four teachers began to question their own views of science teaching and how they had been failing to include cultural values and experiences in science learning. However, the process of working together through dialogic-based science inquiries seemed to broaden the teachers' view of science teaching and learning and connections to students' and families' language and cultural practices. Observing students and parents who were highly engaged with science activities that built on multi-cultural and multi-linguistic experiences, by means of reflecting, questioning and sharing, were critical in the teachers' understanding of the value of leveraging other ways of doing and knowing in their science classrooms. For example, Donald realized that, "We don't all see everything the same way. We don't always experience everything the same way." Allyson was impressed that in the STC workshops the facilitators "gave them [students and families] time to dialogue, gave them time to reflect so that they can hopefully have more truer science learning that is with long standing." In the case of Jennifer, she observed "a huge spark in a lot of students. The drawing and then writing it and describing their drawing using their vocabulary cards [written in English and Spanish with an illustration] seem to help a lot." This critical awareness offered focal teachers with new views of science

teaching, drawing from the experiences of learners by situating students at the center for their teaching practices. Learning from and with students and families seem to widen teachers' views of possibilities in making instructional decisions in their science classrooms. As Freire indicated "by our capacity to register facts and occurrences, we become capable of intervention" (Freire, 1998, p.73). When we have a critical awareness of the worlds in which we are immersed, we can have a possibility to transform them. Thus, critical awareness leads to action, and in the following sections, I present how teachers' recognition of new possibilities in their work with their Latino students and families turned into adaptive or/and self-initiated proactive practices in a number of ways.

Adaptation

The focal teachers adapted some practices that they observed in the STC workshops to their instructional approaches. They embodied a science teaching leveraging multiple ways for students to make sense of science concepts. As they participated in the STC workshops, four of the focal teachers created spaces for students to think, talk, and work about science concepts with peers, in small groups or in whole group discussions. Each focal teacher reported establishing debriefing sessions, giving students a chance to reflect on their learning process. Additionally, Donald and Jennifer started to give students more agency to carry out science investigations, making minor interventions compared to their previous science labs where students carried out experiments following the procedures with explicit direct instruction. As Donald termed it "letting the thought process happen" during the science investigations without showing students what to do was a crucial lesson gained from the STC workshops. Julie and Alyson also started to provide opportunities for students to make connections between school science concepts and real-life science experiences students acquired in their homes and communities by asking them

to share their prior experiences in the classroom. The teachers found this to be very powerful aspects of their professional learning, observing in the family workshops that students not only learned the subject matter but also learned from one another.

I view teachers' openness to new instructional strategies they saw modeled by the program instructors upon their consistent participation in the STC workshops as a demonstration of their *humility* and their adaptation of these above strategies that they observed in the program as a testimony of their *caring* for their Latino students. Considering Freire's caring principle of dialogic education, it became visible in teachers' practices by putting aside the view of science as an isolated system of knowledge that is free of cultural values. Creating spaces for debriefing sessions, implementing labs with minor intervention and connecting school science with students' real-life science experiences can be evidence of the focal teachers' caring for their Latino students and families. According to Freire (2005), caring is not about "coddling" (p.25), reducing teaching to merely a therapy process. Caring in education entails teaching practices based on the learning needs of students in the classroom. In this sense, caring is about designing learning environments based on the changing dynamics of the context in which learning took place, and students' articulations of their needs and interests, rather than standardized school curricula. Donald's adaptation of STC workshops' science inquiry format in his school's Latino night eventually influencing the school community, Jennifer's heightened expectations for her Latino students by pushing them harder in the classroom, Allyson's efforts to help students use their bilingual skills and her efforts to become an attentive listener for the parents, and Julie's strong ties with Latino parents including her voluntary participation in the mediatory conversations between Latino parents and other teachers can be further examples of their

adaptive practices from the STC workshops to care for their students and families in their corresponding schools.

According to Freire (2005), caring in the context of dialogic education positions humility at the center of teaching. Teachers interact with human beings, not with objects, which makes teaching a very relational process. Humility is a very crucial aspect of caring in education, to respond to the expressed needs of students, because one cannot listen to and learn from others without that humility.

If the structure of my thinking is the only correct one, accepting no criticism, I cannot listen to anyone who thinks or elaborates ideas differently from me. Neither can I hear the person who speaks or writes outside the norms of the accepted standard language (Freire, 1998, p.107).

In terms of Freire's humility principle of dialogic education, I saw that was what kept focal teachers listening to and learning from their students and families and facilitators in the STC workshops. That understanding seemed to enable the focal teachers to re-structure a science learning environment where Latino emergent bilingual students began to perform as stakeholders voicing their own scientific sense-making in the classroom. This understanding also helped the focal teachers to re-structure their work with their students' families by including them as active participants in their children's science learning. Without that humility, focal teachers would not have learned and adapted these practices to their work with their students and families.

Pro-active Teaching

Although Donald, Jennifer, Julie, and Allyson embodied some practices that they observed in the STC workshops, they differed in terms of proactive practices in personally developing ways to extend their work with families in the context of science education. These

differences may be accounted for by divergences in the contexts of individual schools where they were working. For example, Donald and Julie were most encouraged by their heightened awareness of the possibilities for creating a dialogue-based cross-cultural science learning community by including their students' families in their children's science learning. Donald was personally planning to send take-home science kits for students to practice science inquiries with their family members. Julie was working with families around dinner discussion questions and science word games to help family members to learn science concepts with their children. These two teachers were also receiving support from their school administration for their enactment of these proactive practices and were able to influence their school communities in this regard. Even though Julie and Donald were having conflicts due to pressure regarding state-mandated standardized assessments and lack of time for family engagement, they were able to align those practices to the relevant science standards preventing those practices from becoming overwhelming tasks. I view Julie's and Donald's pursuits of proactive practices with their students' families as their demonstration of *hope* in their abilities as teachers to make a difference with their students in the classroom. Hope, Freire (1994) wrote, is an essential asset in human beings in that we can intervene in the world to the extent we believe that change would be possible. Hope is "looking at things as if they could be otherwise" (Greene, 1988, p.3). It was the hope that mobilized these two focal teachers, despite constant inspection of their job and standardization pressures that they could not control. As Nieto (2003) wrote, "hope can conquer many fears, and it can endure even when there is little cause for optimism" (p.61). These two teachers reported that students, families, and colleagues who constituted a dialogue-based cross-cultural science learning community in the STC workshop was one place where their great reserves of hope originated. They were hopeful about the roles they could play in their students'

pursuit of science education and science-related career pathways and their role in supporting parents to become active participants in those pathways.

For teachers, like Donald and Julie, who have some kind of support from the school administration, these proactive tasks may be more manageable. For those who do not have this type of support, taking up proactive actions may seem overwhelming or even impossible to move forward. For example, Jennifer and Allyson were not receiving school administrative support for their work with Latino families. Allyson was not appreciated for her modified practices in the classroom, since they were evaluated outside of her school's teaching framework which was mostly concerned about standardized school curricula. Receiving a poor evaluation from the school administration led her to quit her job and find another teaching position in a different school to work with more like-minded school personnel. Nevertheless, Allyson did not give up altogether. She was committed to making personal effort to find school-university partnership programs to continue to support her students' parents in their engagement with science inquiries to help them to be active supporters of their children in their pursuit of science learning and scientific careers. She was still hopeful in her capacity to make a difference with her students, which stimulated her to search for new cross-cultural science learning programs after the STC workshops ended.

Jennifer was the least encouraged by the heightened awareness from the workshops for the potential for continued work with Latino parents in their children's learning of science among the four focal teachers. She was thinking that her engagement with families were the level of what she was able to do with families. In addition to the language barrier, lack of time and lack of administrative support, the grade level she was working may be given a reason for the absence of her proactive practices to personally develop ways to extend her work with Latino families

after the STC workshops project ended. Compared to other three teachers who taught at middle school levels, Jennifer taught at high school level. Especially, being an 11th and 12th-grade science teacher can be a strong factor partly because (although it is helpful) family-school interactions weaken as students transition to high school level where they experience more independence in their educational endeavors (Daddis, 2011). These barriers seemed to give Jennifer little optimism in her potential to implement and sustain personal work with her students' families without outside support like community-based science programs or schoolwide family science events, considering the above institutional and social forces she was embedded in.

Although Donald, Jennifer, Julie, and Allyson functioned differently in terms of proactive practices and the hope that they placed in their capabilities to personally develop ways to extend their work with Latino families in their corresponding schools, I have seen evidence that all four teachers developed a critical awareness with a broadened view of science education and responsibility in their work with Latino students and families and in turn adapted practices that they observed in the STC workshops as demonstration of their humility and caring. It is interesting to note that these European American teachers came from somewhat similar backgrounds. They had already engaged with cultural immersion or community-service experiences in the past prior to their participation in the STC workshops, and all participated in the program on a regular basis that provided them ground to cultivate their vision and enactment of new science teaching practices. For example, Donald and Allyson had lived in several parts of the United States and resided overseas for a few years. Donald reported not experienced difficulty regarding language during the period he lived in Japan since he was able to communicate with his friends in English. However, he was exposed to Japanese culture, which

he thinks set him to be more open-minded about his students coming from diverse racial, ethnic, and linguistic backgrounds. Alyson had diverse experiences studying Mexican culture and language as a requirement of her Anthropology degree and teaching in France for two years. Being bilingual, Allyson defined herself as a very “empathetic and sympathetic person and having good listening skills.” In the case of Julie and Jennifer, community-service was an essential part of their lives- Julie with her consistent volunteering activities in women’s shelters and disaster services and Jennifer being a dedicated volunteer in church-oriented summer camps. These life experiences seemed to lead these four teachers to be regular participants in the STC workshops with an open mindset that was influential in their increased understanding and enactment of science teaching practices with their Latino students and families. Thus, the STC workshops may have had a more transformative effect for these four teachers than others who have not been exposed to such a range of diverse experiences beforehand and who had not regularly attended the STC workshops.

CHAPTER 7

CONCLUSION

This qualitative case study examined a three-year-long community-based science learning program that examined ways to support secondary science and ESOL teachers, their Latino emergent bilingual students, and their families in learning science inquiry practices. Building upon the Freirean notion of dialogic education (1970, 2005, 2013), the purpose of this study was to explore what happens when secondary science teachers come together with Latino families for their children's science learning in the context of Steps to College (STC) bilingual family workshops. The overarching question guiding this study was: How did secondary science teachers conceptualize the ways in which their participation affected their perspectives and practices about working with their Latino students and their families?

In chapter 5, I analyzed a single-case study of Teresa and presented her experiences in navigating the school system as a Latino student, her progress as a bilingual and multicultural secondary science teacher, the challenges and tensions she continued to face in her science classroom, and the ways in which the STC workshops influenced Teresa's perspectives and practices regarding working with Latino emergent bilingual students and families. First, I examined Teresa's struggles to effectively work with her Latino students and families even though she also came from a Latino origin. I illustrated that her initial struggles as a teacher to integrate cultural and linguistic knowledge into scientific investigations stemmed from her personal educational experience built upon the Western-based pedagogical model separating knowledge from people or context. Next, I presented that Teresa was committed to working with

her Latino students and their families despite the many challenges that she faced, including her lack of teacher preparation in working with diverse students and families, increasing demands for testing and accountability, and the negative messages from the River Middle School administration regarding immigration as well as the monolingual and mono-cultural school policies.

Then, I demonstrated that even though the school policies have been hampering Teresa's efforts to validate her students' linguistic and cultural resources, the STC workshops seemed to give Teresa a venue that helped her to achieve that purpose. The critical aspects of dialogic education, hope, humility, care, and critical consciousness were visible in Teresa's teaching perspectives and practices in several ways. Her consistent participation in the STC workshops can be seen as an example of her humility and commitment to continuous learning as a teacher, which was a crucial element in her learning of new strategies to support her students and their families. She demonstrated hope through her self-observations and reflections during the STC workshops where she realized her potential to make a difference with students and parents. This became a catalyst for Teresa's attempts to restructure her work with her Latino students and families and helped her to maintain her resilience to oppressive power relations at River Middle School. Teresa demonstrated her caring for her students through her facilitation of dialogue-based science learning interactions by leveraging multiple ways for students to make sense of science concepts and through her proposal to establish Latino Science nights with Latino families adopting the format of the STC workshops. Her active work with Latino parents in implementing bilingual instruction in her classroom despite being forbidden to speak Spanish in the classroom and her pursuit of doctoral studies were powerful examples of Teresa's critical

consciousness and her decision to challenge the dichotomization of culture and science in students' education.

In chapter 6, I focused on four European American teachers, Julie, Donald, Allyson and Jennifer, and I illustrated each teacher as a case by including their different backgrounds in relation to their experiences with cultural and linguistic diversity, their lack of preparation in working with immigrant families, different levels of support they received from their school administration regarding changing classroom dynamics, their continued anxiety about state-mandated standardized assessments, and how they thought their perspectives and practices in working their Latino students and families had changed after attending the workshops. After representing each case of teacher participants, I carried out cross-case analysis presenting the research findings around three categories in light of Freire's principles of dialogic education. Similarities and differences among the cases were scrutinized with respect to the three categories of *recognition*, *adaptation*, and *proactive practices*.

In this multi-case study, I demonstrated that the four secondary science teachers functioned differently regarding *proactive practices* and the hope that they placed in their capabilities to personally develop ways to extend their work with Latino families in their corresponding schools. I argued that the individual schools where they were working were a salient factor in this distinction. However, I have seen evidence that all four teachers developed a critical awareness with a broadened view of science education and responsibility in their scientific work with Latino students and families as they *recognized*: (a) the value of working with the community/ receiving benefits in terms of student behavior and motivation for learning in the classroom; (b) parents as learners of science with their children/ observing parents as active participants who engaged in science inquiry activities with their children in the program;

(c) themselves as learners of multiple ways to engage students in science, and they understood their views of science teaching better by seeing their teaching confronted with the science inquiry model they observed in the STC workshops. I also found that the four European American teachers *adapted* some practices that they observed in the STC workshops as a demonstration of their caring by providing a dialogic science learning environment and leveraging multiple ways for students to make sense of science concepts in the classroom. Donald's implementation of Latino science nights in his school adopting the science inquiry format from the STC workshops, Allyson's efforts to help her Latino students to draw from their bilingual resources in the classroom, Julie's emerging culture broker role with Latino families, and Jennifer's higher expectations for her Latino students to achieve in science were another demonstration of their adaptive practices to care for their students and their families. I also demonstrated that without the dimension of humility (as discussed by Freire, 2013), these four focal teachers would not regularly have attended STC workshops and learned and adapted these practices to their work with their students and families.

Using Freire's (1970, 2005, 2013) conception of dialogic education, I demonstrated in chapter 5 and chapter 6 ways to bring new perspectives and practices for pre-service and in-service teachers and school administrators to enhance their work with their emergent bilingual students and families in secondary schools. The conception of dialogic education allowed me to learn about Latino families' cultural resources that I argued enabled these secondary science teachers to build on these resources recognized in the workshops in their working with their Latino students and families. Dialogic education is significant for teachers and researchers to understand and act on in the current educational context in the United States where education is often characterized as a neutral activity that separates learning from cultural and contextual

values through standardized curricula, high-stakes testing, and high levels of teacher accountability. To counterbalance a false neutrality in teaching and learning, Freire (2013) emphasized certain important aspects of dialogic education for teachers to take up: (a) critical consciousness, questioning reasons for and consequences of viewing education as neutral activity; (b) humility, situating oneself in a sustained openness to learning from others; (c) care, being careful and attentive to individual student needs without supposing to know what the students' needs are; (d) hope, having faith in self-capabilities to contribute to the possibility of change. From the perspective of dialogic education, true science education is the creation of a safe space for co-construction of knowledge among teachers, students, and their communities and having faith in the self-capabilities to achieve that purpose. That is, the notion of dialogic education may help us to inspire and excite other educators to design alternative contexts for science education that can disrupt aspects of the current dominant discourse in education (Giroux, 2014). Such environments should be oriented to consider differences not as a problem to be solved but as rich resources to engage students' science learning in the classroom.

The purpose of this study was not to romanticize and overly idealize the notion of dialogic education. The purpose of this qualitative case study was to support Freire's (1970, 1998, 2005) dialogic education perspective, yet provide a realistic portrayal of how teachers can use a dialogic education given the necessary support, despite a school climate that privileges a Western-based pedagogical model. Drawing on dialogic teaching and learning perspectives, I wished to address a heretofore neglected area as I provided a portrait of in-service teachers' experiences with immigrant families at the secondary level. Nevertheless, this dissertation study showed that the possibility or impossibility of dialogic education in the hands of individual

teachers are influenced by powerful discourses, including school context, educational policies, teacher support networks, and individual teacher backgrounds (Pimentel, 2011).

In the following sections, I provide a brief description of how findings of this study contributed to the previous literature related to teachers' work with cultural and linguistically diverse students and families in the context of school science by including references throughout my argument. Then I ground my discussion on the broader implications of this study for future teacher education, policy, and educational research by connecting disciplinary learning with family-school relations. Finally, I briefly explain the limitations of the study and conclude with a synthesis of the key points made throughout this dissertation study.

Answering the “So What?” Question

The findings of this dissertation study re-confirmed the recent research literature that asserts the need for teachers to have access to contexts and experiences that challenge the mainstream view of science teaching; what Hammond (2001) called “textbook-based education” (p.993) and what Freire (1970) called the “banking model of education” (p.72) with passive transmission of knowledge and objective facts. The dominant view within science education critiqued science as a “culture of exclusion” (Calabrese Barton, 1998) that was disconnected from the multiple perspectives that students bring from their homes and communities. Much has been written about the disservice that has been made to non-dominant students by minimizing their possibilities of richer science learning through the exclusion of their personally and culturally constructed ways of knowing (Aikenhead, 2014; Calabrese-Barton, Tan & Greenberg, 2017). Rather than perpetuating views of science education as free of contextual values, the findings of this dissertation study support the idea that non-dominant students would benefit

from a dialogic science education in which they can find a voice in their science learning process.

The findings support Freire's (2005) and Nieto's (2005, 2014) view that teachers who are engaged with contexts that are constructed outside of the institutionalized discourses of learning and teaching are more likely to examine their own professional identities and restructure their teaching practices. The secondary science teachers in this study felt empowered in the context of collective practice by reconstructing their identities as learners of multiple ways to engage with science. Observing Latino students and families as active agents in their science learning in the STC workshops drawing from multicultural and multi-linguistic experiences challenged the focal teachers to engage in deep reflection and serious dialogue about their knowledge of science and science curricula that they teach. The focal teachers observed that Latino students and families were highly engaged when they displayed how they make meaning in the context of solving scientific problems. Observing that Latino students and families benefitted from dialogue-based learning interactions in this cross-cultural learning community became a catalyst for teachers to incorporate some aspects of the science inquiry practices they observed in the STC workshops. They created spaces for students to think, talk, and work with science inquiry concepts with peers, in small groups or in whole group discussions. Each focal teacher reported that they established debriefing sessions and gave students a chance to reflect on their learning processes. This approach enabled teaching and learning to be developed as an interaction between ways of knowing rather than a dictation of one overarching knowledge approach. In addition to learning these practices in LISELL teacher professional development sessions and LISELL professional learning institute, The STC workshops provided the focal teachers an arena in which to experiment with that knowledge and mentally practice how they could apply these strategies in

their science classrooms. It is important to note that Teresa, the one bilingual, multicultural science teacher in the study, was already cognizant of the value of helping students make cultural and linguistic connections with the science content, but the program provided her a venue for achieving that purpose.

This dissertation study also illustrated that it takes time and personal experience for teachers to expand their vision of science teaching and eventually restructure their teaching practices with their students and families. Especially, long-term community-based science learning programs with cross-cultural learning can have powerful effects on pre-service and in-service teachers' science instructional strategies with their students and with their families. This finding is consistent with Hammond's (2001), Chinn's (2006, 2015), and Ramirez, McCollough and Diaz's (2016) findings that teachers who had in-depth understanding of the communities in which they teach have a greater potential to create opportunities for production of science knowledge that was integrated with the cultural knowledge of students and families. Through in-depth cultural immersion programs or out-of-school family science learning events, these previous research projects created spaces for teachers and families to involve science inquiries that integrated traditional knowledge of students and families into a school science curriculum. The research suggested that sharing various cultural ideas about science, scientific reasoning, and problem-solving in these authentic learning spaces enabled the negotiation of intercultural understanding. Becoming active participants in the community of students and learning students' and families' linguistic and cultural resources helped these teachers to design culturally relevant and standardized-based lesson plans (Chinn, 2005, 2015; Ramirez, McCollough & Diaz, 2016) or community generated science materials that complement standards-based curricula (Hammond, 2001).

In the STC workshops, learning about and from Latino emergent bilingual students' lived experiences seemed to allow the secondary science teachers to make connections with their students' science learning. This learning helped teachers develop new relationships within the classroom, utilizing students' realities as a scientific resource. Julie, Alyson, and Teresa provided opportunities for their students to make connections between school science concepts and real-life science experiences that students acquired in their homes and communities by asking them to share their prior experiences that were relevant to science concepts covered in the classroom. The teachers found this to be very powerful aspects of their professional learning; the students not only learned the subject matter but also learned from one another. Teresa was occasionally implementing that practice in her classroom before attending the STC workshops, but this became her classroom routine after regularly attending the program. Through learning about Latino students' family dynamics and observing parents' strong interest in their children's science learning, Jennifer developed higher expectations for her students to achieve on state-mandated exams. She started to push those students harder by complicating the nature of the tasks posed for the students and their scientific difficulty. All five focal teachers also understood the value of working with the community as they observed a salient improvement in terms of their students' learning motivation and their comfort level with talking to the teacher and asking questions in their classroom. This observation seemed to help the focal teachers to take a more holistic approach toward science education of their students.

This study also showed that the power of learning through dialogic education was enhanced when the science inquiry practices included students' family members who have often been excluded from active participation in school contexts. In family-oriented after-school programs, such as Latino science nights or curriculum nights, parents are usually positioned as

passive actors who watch their children being involved with learning activities or who simply listen to school agendas. This is especially crucial in contexts like that of Stonybrook and Woodstone school districts where an important portion of the student body comes from immigrant families, and these families do not have much knowledge regarding the education system in the United States (Hill & Torres, 2010; Arellanes, Viramontez Anguaino & Lohman, 2018). Often, these immigrant families are regarded as not concerned about the education of their children and unqualified to contribute academically (Elberly, Joshi & Konzal, 2007; Adair, 2013; Soutullo, Sanders-Smith & Navia, 2016).

This findings of this dissertation study reconfirmed Hammond's (2001), Upadhyay's (2009) and Flecha and Soler's (2013) findings that a "working together" process created a common ground among teachers, students, parents, and other members of the community. When families participated in educational activities with their children and their teachers, this has a great potential to create a bridge between home and school cultures. The focal teachers involved in the STC workshops and the teachers who participated in these previously documented research projects learned about parents' abilities to work on science inquiry activities with their children. The parents who came to those learning spaces began to understand the school culture and academic science expectations that were placed upon their children. In the case of the STC workshops, some of the focal teachers, Donald, Julie, and Allyson, still had doubts about the parents' abilities to help their children with their school tasks because of what they perceived to be parents' limited educational backgrounds and language difficulties. However, all five teachers started to see its possibility when given necessary resources and guidance. Four out of five focal teachers realized their potential to provide a more level playing field for these Latino parents to practice science with their children, so they can be life-long science learners and well-informed,

active participants for their children's pursuit of science career pathways. Donald's adaptation and Teresa's proposal of adopting the science inquiry format from the STC workshops to Latino science night in their corresponding schools; Donald's plan of sending home science-kits for students to work with their families; Teresa's collaboration with parents in the classroom utilizing their linguistic resources during science experiments; Julie's work with parents around dinner questions and science word games; and Alyson's commitment to search for community-based science learning programs for her immigrant students at the termination of the STC workshops were examples of how this working together process moved the transformation of teachers' science teaching outside of the school walls.

Lastly, this study contributed an understanding that the possibility or impossibility of transformation in teachers' orientations and practices with culturally and linguistically diverse students and families are influenced by powerful discourses. Teachers' daily practices are greatly influenced by educational policies and individual school administrators and individual teacher background. I discuss the influence of policy and individual school administrators on teachers' practices in later parts of the chapter 7. Regarding teacher background, the four focal European American teachers came from somewhat similar backgrounds. They all grew up in middle-class families, had insufficient training in working with immigrant students and families, and had previously known little about the lives and experiences of their Latino students and families. However, they had already engaged with cultural immersion (Donald and Allyson) or community-service experiences (Jennifer and Julie) in the past prior to their participation in the STC workshops, and all participated in the program on a regular basis, which provided them a common ground to cultivate their vision and enactment of new science teaching practices and extend their work with families on a variety of levels. The fact that the Latino teacher, Teresa,

grew up experiencing injustices and difficulties in her own education no doubt influenced her to become a regular participant of the program and to be advocate for her Latino students and families and to extend her practices with her students and families, which even meant going against the English-only rules of the school where she was working. However, it is not to say that teachers should grow up in certain conditions to lead to a change in their perspectives and actions; rather the STC workshops may have had a more transformative effect for these five teachers than others who have not been exposed to such a range of diversity experiences beforehand and who had not regularly attended the STC workshops.

What Can This Study Offer to Pre and In-service Teacher Professional Development?

The experience of the secondary science teachers in the STC workshops had implications for work of teachers with immigrant families from a diverse range of cultural and linguistic backgrounds in the United States and around the world. The first implication of my work directly relates to professional development in pre-service and in-service teacher education in a broader context across the grade level spectrum and specific subject areas.

In-depth Cultural Immersion Experience

Preparing teachers to meet the needs of culturally and linguistically diverse students remains a critical issue for teacher educators today, especially in societies similar to the United States where a huge cultural and linguistic discrepancy exists between the teacher force and the student body (U. S. Department of Education, 2017). Teachers who do not share a cultural background with their students and have not been equipped with knowledge, tools, and resources to work effectively with diverse students and their families cannot be regarded as qualified to work in socially and culturally complex classrooms (Nieto, 2014).

The literature in teacher education cautioned that teachers' familiarity with cultural foods, dress, and dance of their non-dominant students and a few words in their language is very superficial and does not provide a deep understanding about the learning needs and resources of diverse learners in the classroom (Hernandez, 2013; Zeichner et al., 2016). When family-school relations are mediated superficially in field placement schools or cultural immersion programs, they often produced negative effects on the teachers, including reinforcement of stereotypes about immigrant families and communities common in public policies (e.g., The White House, 2017) and mass media (e.g., Dixon & Williams 2015).

Cultural immersion experiences have been proven to be successful in shifting teachers' perspectives and practices in this dissertation study and in previous literature (Schester & Sherri's, 2009; Zeichner et al., 2016). In-depth and long-term exposure to cultural immersion experiences and out-of-school learning contexts with students and family members is beneficial for teachers to cultivate a broader vision of teaching that is driven by students' lives and communities. Programs alone that utilize discussions and required readings to convey information are not enough to transform teachers' vision of teaching and expand their understanding of family diversity (Nieto, 2005). Teachers can become "culturally literate not by learning about culture indirectly through books and classes, but from a position within a culture, from members of that culture" (Chinn, 2006, p.371). In this sense, pre-service and in-service professional development programs should provide teachers sustained opportunities to have direct interaction and build relationships with non-dominant families. Immersing prospective and practicing teachers in diverse communities over an extended period outside of firmly structured school tasks would provide them more understanding of students and their families' strengths and potential than teachers are able to understand if they remain inside school walls. Displacing

prospective and practicing teachers out of their comfort zones could remove them from the position of the authority figure and could allow them to visualize alternative ways of working with students and families. Through carefully designed pre-service and in-service teacher education programs, this learning could be elevated.

Working Together Process

This study also suggests that schools and outside-of-school learning spaces construct learning environments in which students, family members, and teachers can learn together and engage in interactions and dialogues around specific subject areas that enable each party to gain new insights academically and socially. Inside- and outside-of-school learning spaces that require the active involvement of students, family members, and teachers have a great potential to serve as professional development opportunities for prospective and practicing teachers. The findings of this dissertation study demonstrated that these kinds of learning settings with a specific subject area focus in science helped the focal teachers to better understand their students and their families' ways of thinking about related academic concepts, allowed them to recognize multiple ways of doing and demonstrating understanding of particular content, and offered teachers ideas about how they can efficiently work with students and their families. In this sense, these kinds of opportunities should be available for both teacher candidates and experienced teachers and for teachers across the grade level spectrum and subject areas to unite the school, the community, and the curriculum. Each of these variations in teaching context influences how teachers engage with families, yet each will also benefit from more holistic approaches to K-12 education that legitimize the critical role of family and community engagement to promote student learning motivation and success.

Consistent Teacher Support

The findings of this study also demonstrated the importance of sustained support for pre-service and in-service teachers in their work with diverse students and families. Taking a one-semester long university course or attending a one-shot workshop is not enough to lead to change in teachers' thought and action. However, a lack of emphasis remains regarding pre-service and in-service training of teachers in family-school relations in the United States (Weiss & Stephen, 2009; Mapp, 2012) and international contexts (e.g., Bruine et al., 2014). For example, Mapp (2012) reviewed the evolution of policy narratives on parent involvement in the United States and their potential efficacy for non-dominant populations. Through interview data and analysis of policy documents, Mapp concluded that state, district, and school staff are provided little or no training for supporting in-service teachers to partner with families from non-dominant communities.

I think that providing teachers with sustained professional learning opportunities is vital, especially when teachers are evaluated by students' standardized performances. In the face of pressure to cover standardized curricula, teachers in this study, like other teachers in similar contexts, are pressured to narrow what they can actually do in the best interest of their students and families. Julie explained in this way: "We are just surviving and staying afloat when it comes to assessments and a lot of times teachers have to make up decisions on whether they want to teach for success only for these assessments or teach success in life." My analysis of teachers' experiences in the STC workshops pointed out tensions but at the same time changes in their actions that are possible when teachers were provided sustained support and guidance. While the focal teachers were under constant pressure of high stakes testing which controlled how they used their time and space, through consistent participation in the program, over time,

some of them were able to personally create spaces in which to work with their students' parents in meaningful ways by finding strategies to align their work with the state-mandated content standards. All of the focal teachers spoke about the pressing need for such learning opportunities in their professional development programs to be spaced out throughout the year, so they will not lose awareness of these important ideas as they get caught up by individual district routines in their corresponding schools. If teachers cannot receive constant nurturing and guidance, they are more likely fall back on traditional approaches that may be not well-suited for their students and families from diverse cultural and linguistic backgrounds

As Nieto (2005) articulated, "Those who enter teaching need to be encouraged to delve into life before, during and after their teacher preparation" (Nieto, p. 218). The teaching profession involves an unending process of becoming. It requires its actors to consider "a new knowledge as subject to be created rather than as created subject" (Loughran, 2014, p.4). Teachers' ideas and practices should evolve based on changing classroom dynamics; otherwise, improvement is not possible. In this sense, teacher preparation should be ongoing and persistent across longer periods of time and across other settings to bring about deep change. Ongoing and organization-wide professional development opportunities were demonstrated to be highly beneficial in order for teachers to sustain their commitment to find valuable ways to work with their students and families of diverse backgrounds (Ferrara, 2009; Tirell-Corbin & Cooper's, 2014). Such professional development programs should be applicable for teachers and helpful for the needs of their students in their classrooms. Simply providing continuing learning opportunities and professional development programs in which the agendas do not grow from the needs of the teachers and learners in the particular context, no matter how consistent and well-intentioned, is likely to be unsuccessful in this regard.

Bilingual teachers. In chapter 5, I demonstrated Teresa's struggles to effectively work with her Latino students and families even though she also came from a Latino origin. Her initial struggles to integrate cultural and linguistic knowledge into scientific investigation stemmed from her personal schooling experience that was built upon a Western-based pedagogical model that separated knowledge from people or context. Bilingual teachers, as a matter of fact, have been shown to have a broader view of education as they are able to negotiate linguistic and cultural differences in their teaching (Quinones, 2015). And it is possible for teachers from non-dominant backgrounds to reconcile their past and present to cultivate a pedagogy based on dialogic principles to help their students become successful. However, this current study and the prior research studies (e.g., Freire & Valdez, 2017) have found that many teacher education programs and educational policies tend to narrow bilingual and multicultural educators' teaching abilities and practices, so implications of this study become more significant. There should be no assumption that bilingual teachers just naturally know what to do and are able to act on that knowledge; they also need support and resources to use their additional linguistic/cultural knowledge and skills effectively.

What Can This Study Offer to Policy Makers?

The second implication of this dissertation study has a bearing on educational policies. Despite teachers' personal attempts to utilize multiple cultural and linguistic resources of their students and families inside and outside of the classroom, the outcomes may not always align with their intentions. Policy makers should create conditions and foster environments that are conducive to the accomplishment of teachers' goals. Policy makers should require that the school climate (e.g., attitudes of school administrators) should be encouraging and there should be

sufficient school resources and enough non-teaching time to allow teachers to put their knowledge into action.

Changing the Conditions for School Administrators

The struggle of finding a space to act upon their learning from the STC workshops was evident in teachers' accounts and actions in this study. Despite the same structural limitations that all five teachers shared in this study — lack of time and school resources, pressure on testing and accountability — the teachers were, nevertheless, able to incorporate some aspects of practices of the STC workshops in their work with students and families. However, the focal teachers differed in planning and implementing personally-developed practices with families that they thought were valuable to pursue in order to support the science learning of their students. The role of school administrators was crucial in this divergence. Receiving support from the school administrators in their individual schools empowered Donald and Julie to personally develop ways to extend their work with the immigrant families. Jennifer, Allyson, and Teresa, on the contrary, did not have agency in their own practices in their corresponding schools. This situation led Jennifer to avoid personal work with families, referring to the limitations of the system; forced Allyson to quit the school and find another teaching position in which she could have more agency to work with diverse students and families; and guided Teresa to submit ostensibly to the “game” of the school but covertly to challenge the system and its limitations.

Many school administrators, for instance, although they make educational decisions that affect the academic community, rarely enter classrooms after just a few years teaching (Miller & Martin, 2015). However, communities change, and public schools do not serve the same students that they were serving ten years ago. As we consider the immigrant student populations that are increasingly filling k-12 classrooms in the United States and around the world (United Nations

Department of Economic and Social Affairs [UN DESA], 2015), school administrators should receive professional development programs as well to renew and update their teaching and educational philosophies in response to changing classroom demographics, so that they can be supportive of teachers' innovative practices.

Changing the Conditions for Teachers

Another concern is that, in spite of family-school-community partnership emphasis in current policy documents (Every Student Succeeds Act [ESSA], 2015) and many teacher professional associations (Kroeger & Lash, 2011), the increasing demands on performance measures of learning likely contribute to lack of common ground between schools and families in the first place in terms of everyday practice. In addition to promoting family-school partnerships with official documents, policy makers in the United States should also consider developing enough grounds that can facilitate these partnerships. This is especially significant because, without the necessary conditions, strong policy narratives will likely not have effective results.

When standardized testing, for instance, is the driving force in schools, teachers' agency is already narrowed in terms of what they can do with diverse students and families. This mindset actively counteracts the kind of teacher learning experiences that are embedded in richer and more complex educational practices. It is not to say that without the necessary conditions, teachers alone would not be able to work with students and families of non-dominant communities in an effective manner. Teachers, indeed, cannot wait for these structural changes to take place. As Cochran-Smith (1991) stated, teachers should be prepared to "teach against the grain" (p. 280); they should be prepared to challenge these potential problems rather than justifying why they cannot efficiently work with diverse students and families. Focusing on

alternative opportunities rather than limitations of the system should be the first step in this regard (Planas & Civil, 2009; Buxton, Kayumova, & Allexaht-Snider, 2013). Teachers in this study demonstrated the possibilities of teaching against the grain despite the systematic limitations that they faced in their corresponding schools. They exemplified that even in a tightly controlled curriculum, some space still exists for creating a dialogue-based cross-cultural learning community among themselves, their students, and families.

Directions for Future Research

The STC workshops were a dynamic collaboration among the research team, approximately 50 teachers, their Latino emergent bilingual students, and their accompanying families in five middle schools and three high schools (Buxton et al., 2017) to enhance students' science learning and college preparation. The STC workshops started in Fall 2014 and recently ended in May 2017. Right after the program ended, I was able to investigate the five focal teachers' changing perspectives and practices in their work with their Latino students and families upon their regular participation over the course of three years. However, it would be interesting to make a follow-up study after two years to explore how changes in the focal teachers' perceptions and practices were sustained and maintained over that period of time in order to assess the long-term impact of their attendance in the STC workshops.

The focus of this study has been on teachers as learners rather than on the families' experiences. Analysis of the Latino families' experiences in the STC workshops warrants further study. It is important to note, however, that all of the focal teachers reported receiving benefits from attending the STC workshops regarding student behavior and learning motivation for those students who attended the program. It would be interesting to conduct research with those students and families to investigate how their experiences with teachers changed after the STC

workshops and how these experiences influenced their science learning motivation from their points of view as well. This research can also be extended by investigating the impact of the five focal teachers' new practices on family-school relations on their students' science learning and school success for students who have never attended the program. Investigating the relationship between teacher-family interactions and student learning is indeed a crucial research area to pay attention to as there have been very few studies focused on this issue (e.g., Flecha & Soler, 2013). Questions that might guide future research include: What is the relationship between teacher practices that nurture family-school relations and student learning? What kind of teacher-family interactions are more beneficial for students and families? How can we use that knowledge to improve teacher education and professional development programs across all grade levels and disciplines? This kind of research is needed to not only inform teacher education practices but also to further underscore the significance of family-school-community interactions in students' social-wellbeing and academic development.

Another area of need in future research is more long-term intervention projects to determine ideal strategies for teacher education in relation to family-school interactions. These intervention projects should be conducted with both teacher candidates and experienced teachers and with teachers across the grade level spectrum and specific subject areas to contribute to more holistic approaches to K-12 education. Content-based community learning programs are good intervention-based research contexts that can involve pre-service and in-service teachers across grade levels to support their work with families in a particular content area focus. These kinds of intervention projects are rare and still require more research attention, so we can learn their transformative effects for teachers. Future research in diverse settings can incorporate teachers in a similar way that this research did in the context of science with Latino families, as Hammond

(2001) did with Mien families; Ramirez & McCollough (2012) did in the context of math with Latino families; and Schester and Sherri (2009) did in the context of language and literacy with Asian and Middle-Eastern families. Examinations of diverse settings that reflect the demographics of education in a range of schools would help researchers and educators to make transferability judgments for their contexts. Questions that might guide future research include: What types of experiences did have the most long-lasting impact on teacher participants and how did these experiences relate to student learning? What happens when these learning opportunities cease to exist? These are the questions that can frame future research, as they have great potential to contribute to the field of community-school-family interactions in terms of research and practice.

Future research should also examine a spectrum of diversity from dominant to non-dominant student bodies and teachers. For example, in chapter 5, I examined experiences of a bilingual and multicultural teacher, Teresa, with her students and families from similar cultural and linguistic backgrounds to hers. I analyzed how her experiences in the STC workshops as a Latino secondary science teacher influenced her perspectives and practices in working with her Latino students and families. However, I did not examine Teresa's experiences with her European American and African American students and families. It would be interesting to conduct research to examine the impact of the STC workshops on her interactions with the mono-cultural and monolingual student body. Questions that might guide future research include the following: Are teachers of color working with students and families from dominant communities able to make connections with them to the same extent they can make with non-dominant students and families? What about teachers of color in relation to students and families who come from other minority groups?

Future research might also examine the difficulties that are involved in accomplishing progress with pre-service and in-service teachers. Perhaps, pushing pre-service and in-service teachers, having them re-think many things that they are very certain about, and affecting a deep change in their thinking—this is not an easy task. I think we should also ask questions that can frame future research: What are the challenges to changing teachers' perceptions and practices on family-school-community relations? And what are the circumstances that make teachers resistant to change? These questions, along with many others, require further study and will help us to provide guidance for pre-service and in-service teacher training, community outreach, and educational policy.

Methodological Implications

From a methodological perspective, I found case study as a powerful research methodology when aiming to gain an in-depth understanding of a research phenomenon. Following Merriam's (2009) case study approach, I was able to provide a rich and holistic account of what happens when teachers come together with Latino families in the STC workshops, which illuminated each teacher's experience as an individual case, including their family background about cultural and linguistic diversity, prior experiences in working with immigrant families, their experiences attending the STC workshops, and how they think their perspectives and practices changed after attending the workshops. When writing this dissertation study, I attempted to refrain from the role of summarizer. Instead, I made an effort to describe the cases in their own diversity and allowed the story to come through from the complexities that I observed, and research participants have told me. This research approach helped me to focus on the intricacy within each case, their uniquenesses, and their relations to the broader sociocultural and sociopolitical contexts of which they are a part.

Contrary to the beliefs of researchers who considered the impossibility of reaching generalizations with case studies because of their small sample size, case study researchers found that this approach played a crucial role in moving forward a field's knowledge base (Flyvbjerg, 2006; Merriam, 2009). For example, Flyvbjerg argued for the central role of case studies in human learning. According to him, "predictive theories and universals cannot be found in the study of human affairs. Concrete, context-dependent knowledge is, therefore, more valuable than the vain search for predictive theories and universals" (p. 7). In this sense, researchers who analyzed individual cases might not prove anything but do gain in-depth learning and understanding. Particularly, in research projects that investigated the effects of educational innovations or intervention programs like the STC workshops, the case study research has proven to be a very helpful research methodology for informing educational policy and practice (Merriam, 2009). This case study research investigated a context-dependent experience, the experiences of teachers in a bounded system of the STC workshops; however, the study also illuminated a general issue in the field of family-school-community relations. Through an in-depth and longitudinal examination of this unique informal school-based science learning environment, this study was able to provide possible applications for teacher education programs and K-12 settings with similar demographic characteristics. The insights gained from this study can be a starting point for other researchers to design their future studies in analogous circumstances.

Limitations of the Study

An important limitation of my study is that I did not interview teachers as they started to participate in the STC workshops. Thus, I relied on their accounts of how their perspectives changed over the course of three years as they worked with their Latino students and families in

the program. It would have been interesting to make a comparison between the opinions that they provided when they started the program and three years later when the program ended. This comparison would have allowed a more in-depth understanding of the impact of the STC workshops on their perspectives regarding their work with Latino students and families.

Another limitation is that I observed the focal teachers while they were working with Latino families in the STC workshops, but I did not observe the teachers when they were working with their students' families in their corresponding schools. Thus, I relied on their accounts of how they changed their practices in their work with their Latino students' families. For example, it would be interesting to observe Teresa's classroom when she invited the Latino parents to help her in term of providing bilingual instruction during the science experiments. It would also be interesting to observe Donald when he worked on the *Making Slushies* science activity with Latino families on Latino science night and review Julie's dinner questions and science word game materials that she has been sending to her students' homes. It would also be interesting to observe Allyson and Jennifer during the parent-teacher conferences to examine their interactions with Latino families. Conducting participant observations at teachers' school sites could have yielded additional new information.

This study did not address the question of a bilingual and multicultural teacher in relation to students who come from other non-dominant racial and linguistic backgrounds, and it did not address the bilingual and multicultural teacher's practices in relation to European American students. In a similar vein, this study did not answer the question of European American teachers in relation to students coming from non-Hispanic backgrounds. I cannot, therefore, discuss the focal teachers' opinions and practices regarding their work with student population other than Latinos.

Even though the LISELL-B project worked with 50 secondary teachers, I do not regard the sample size of this study, five secondary teachers, as a limitation because a limited number of teachers in the LISELL-B project met study participant selection criteria. As many scholars criticize the external validity of case studies, because of small sample size, I believe that no qualitative research, regardless of chosen methodology and study sample, can be generalizable to a broader population but instead can be a reference point for studies in a similar context. As I indicated earlier, I believe that this study has potential to achieve that purpose.

I also wondered how my role in the STC workshops, being a research assistant in the program, affected the focal teachers' responses to my interview questions even though I have never attempted to guide their responses in a certain direction. The focal teachers were certainly considering me as an insider person of the LISELL-B project as I was involved in the process of design and implementation of the STC workshops. This was apparent in their conversations when they always responded to me as "you guys" referring to the program. Besides, we developed relationships over the course of three years, and our conversations were not limited to individual and focus group interviews; we also had informal conversations throughout the other programs of the LISELL-B project. Even though there was a possibility that their responses to my interview questions were influenced by my position as an insider of the STC workshops, based on my informal conversations with teachers, I am aware that this possibility is small. To me, it was evident that the five focal teachers were really disappointed due to the termination of the STC workshops. Especially, for Allyson, the termination of the program was one of the reasons why she quit her teaching position at Spring Middle School. Julie represents another example of someone who was seriously thinking how she would fill the gap between school and Latino families in the absence of the program. Nevertheless, it would be interesting to learn how

teachers would react to the same interview questions if a researcher were an outsider of the program.

Final Words

This dissertation study called into question the current educational discourse that is built on mono-cultural instructional strategies, text-based lessons, and social distance in favor of boosting students' scores in high-stakes standardized testing. This study challenged the notion that schools are places of businesses where students are filled with information and deficiencies are fixed but with no intention of understanding of who the students are and where they come from (Nieto, 2013). Rather, this dissertation study suggested a counter-narrative to the prevailing wisdom of learning and teaching in the public schools: learning and teaching as embedded in social relationships, built upon students' interests and grounded in students' lives and communities that view the differences not as a problem to be solved but as rich resources to engage students' learning in the classroom. This study suggested learning interactions occurring among peers but also between students, teachers, parents, and other members of the community that unites the school, community resources, and the curriculum, and their characteristics.

The experiences of teachers in this dissertation demonstrated that Freire's (1970, 2005, 2013) principles of dialogic education— humility, critical awareness, care, and hope— are very helpful for imagining ways of alternative contexts for teacher education to accomplish that purpose. We rarely find words, such as humility, critical consciousness, care, and hope in current educational discourse, yet these terms are the essential features of dialogic education that partially led the focal teachers to adapt a more broadened view of teaching by including the voice of their Latino students and parents in their science teaching. The dialogic learning interactions in the STC workshops opened a space for a new meaning making and new discourse for teachers

who engaged in science inquiries with their students and families, exploring together a variety of cultural and linguistic resources that were valuable in Latino students' making sense of school science concepts and envisioned parents as co-learners of science with their students and understood the value of working the community as they recognized the changing the dynamics of classroom. This critical awareness, then, turned into caring practices for teachers as they adapted the practices they observed in the workshops in their work with students and families. Without humility, the teachers would not be open to learning from their students and families and building their work upon what energized their students and parents in the program. And the level of hope in their capabilities as teachers either helped or prevented them to personally develop ways to extend their work with Latino families in their involvement in school science but also in the school community given the systematic limitations that teachers were exposed to. Yes, as Nieto (2013) said at the beginning, it is easy for teachers to be hopeless in their capabilities to work in the best interest of their students and families as their agency is being narrowed by increasing demands for testing and accountability. Yet it is important for teachers to be hopeful despite all these challenges. The words of Freire (2007) described this powerfully, "The educator's biggest problem is not to discuss whether education can or cannot accomplish, but to discuss where it can, how it can, with whom it can, when it can; it is to recognize the limits his or her practice imposes" (Freire, 2007, p. 64). As Nieto reminded us "The limits are real, but so is the power of hope" (p. 18). Keeping up with the contradictions, though burdensome, is an indispensable asset for both teachers and teacher educators.

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APPENDICES

Appendix A

First Individual Interview Protocol

INTRO: This is Mehtap, the date is.... I was an elementary teacher in Turkey in a community with a diverse population of Kurdish and Turkish students and I found that my work with families was influenced by my personal experiences. I am going to ask some questions to learn about your experience with your own family, your personal history and past educational experiences up to the time you got involved in the LISELL family workshops. With all of my questions, you should feel free to let me know if you don't want to answer a question or if you want to elaborate further on any question. This recording will not be shared with anyone outside of the study team or with UGA. In addition, I will not quote any teacher by name due to the small group of teachers I am interviewing. I will use these questions as a starting point and then see where you want to take the interview. For ease of transcription purposes, I would like to record our conversation. May I have your consent to record this interview?

Let's start then...

FAMILY BACKGROUND

1. Why don't you start by telling me a little about yourself – how would you describe your parents, siblings and other relatives. Tell me about them
 - Where are you from?
 - Occupation of parents and siblings?

- I would like to have you go back to a time in your personal life that you have probably not thought about for some time. Remember when you were at secondary school age. Suppose I were present with you at home after you come from school. What would I see happening? What would be going on?
 - How would you spend your time with your family in your childhood years? Describe for me a typical weekend day with your family. Could you describe for me a typical weekend day with your family when you were a teenager?
2. Where did you go to k-12 school and could you tell me about your schooling experience?
- Rural, urban or suburban school?
 - Public school or private?
 - Was attending extracurricular activity, such clubs, sports etc., part of your experience? If yes, tell me more?
 - Tell me about your memories of your own parents' or other relatives' involvement in your education, what role did they play in your education?
 - Give me some specific examples
 - What was the relationship like between your parents and teachers?

PERSONAL EXPERIENCE with DIVERSITY

3. To what extent were you familiar with socioeconomically, racially, ethnically, and linguistically diverse people in your neighborhood and school when you were in middle /high school?
- Did you have friends coming from diverse backgrounds?
 - If yes, tell me more
 - If no, why you did not racially diverse friend?

- What beliefs and assumptions did you have about culturally and racially and linguistically diverse friends?
- What about in your college years?
 - If yes, tell me more
 - If no, why you did not have racially diverse friend?
 - What beliefs and assumptions did you have about culturally and racially and linguistically diverse friends when you were in college?

EDUCATIONAL and COMMUNITY EXPERIENCE in WORKING WITH DIVERSE FAMILIES

4. Tell me about your experiences in your pre-service teacher education related to working with families?

- Give me some specific examples
- I am going to ask you about your satisfaction and dissatisfaction with your pre-service coursework to work with socioeconomically, ethnically, racially, and linguistically diverse families? Lets begin with ways in which it was satisfying for you.... In what ways it was unsatisfying for you?

5. What kinds of experiences have you had in your community in working with diverse families? At your church? In a community program designed to support diverse students and their families?

5. What is your last degree of education? If masters degree, could you tell me your experiences in your grad school related to working and partnering with families.

- Could you tell me specific examples?

- During your grad school coursework what left an impression on you about your preparation to work with diverse families?
6. Are there things your school does to support teachers in making connections with families?
- If yes, give some specific examples. In what ways is this teacher support helpful for you? In what ways is this teacher support not helpful?
 - If no, what do you think about this? What would you suggest?
7. Tell me about your experiences in your in-service teacher professional development programs (apart from LISELL) related to working with diverse families?
- Give me some specific examples.

SCHOOL PRACTICES FOR PARTNERING WITH FAMILIES

8. What types of things does your school do to make connections with families? (any programs or event?)
- If applicable, give me some specific examples/ what do you think about these school practices in connecting with diverse families? In what ways are these organizations useful or effective for connecting with diverse families. In what ways they are not effective or useful?
 - What are your suggestions to improve those?
 - Are you attending those events? What are your goals in attending, if you do attend?
 - If not applicable, what do you think about that?
9. What are the school's expectations for you as a teacher in partnering with your students' families?

- If applicable, do you feel you are meeting these expectations?
 - If yes, I am going to ask you now about your satisfaction and dissatisfaction with those expectations. Let's begin with the ways in which it's helpful or useful for you.
 - If no, why you are not implementing them?
- If not applicable, what do you think about this?

10. What challenges do you face in working with your students' parents/families and especially with your ELL students' parents/families?

- What is the role of language
- local, state and federal policies
- broader family concerns with food, housing, health and safety
- your personal history and
- the school administration in those challenges?

INFORMATION QUESTIONS

11. How many years you have been teaching? How long you have been teaching in this school district? Where else did you teach?

12. What languages you speak?

13. Do you have children? Ages ?

14. Where are you living? Are you living within your school zone where you are working?

Is there anything you wish to add to our conversation today? Do you have any questions you would like to ask me?

Probing tips

Is there anything more you would like to add to this?

Summary of what you heard and then did I understand you correctly?

I am not sure I got that straight. Would you please run that by me again?

Tell me more...

Who, where, what, when

When did it happen? Who else involved? Were were you during that time? How did that come about?

You mentioned..... Tell me about that.....”

You mentionedDescribe a specific example of that.”

Appendix B

Second Individual Interview Protocol

Research Questions:

1. In what ways did their participation affect teachers' perspectives and practices in relation to working with their Latino emergent bilingual students' families?
2. What experiences do the teachers see as pivotal to changes in their perspectives and practice?

INTRO: This is Mehtap, the date is.... This our second and last interview. Today I am going to ask some questions to learn about your experiences in the LISELL family workshops, your learning from the workshops and your recommendations for teacher education programs to support teachers in their working with families. With all of my questions, you should feel free to let me know if you don't want to answer a question or if you want to elaborate further on any question. This recording will not be shared with anyone outside of the study team or with UGA. In addition, i will not quote any teacher by name due to the small group of teachers I am interviewing. I will use these questions as a starting point and then see where you want to take the interview. For ease of transcription purposes, I would like to record our conversation. May I have your consent to record this interview?

Let's start then...

EXPERIENCES in the LISELL WORKSHOPS

1. How did you become involved in LISELL family workshops?

- How long you have attended the LISELL family workshops
 - Why you kept coming workshops regularly?
 - What do you think your goals were in participating in the LISELL family workshops?
 - Did the program meet your expectations?
 - If yes, give me some specific example?
 - If no, why?
 - Imagine that we have still workshops going on, what would you tell your colleague about why he/she attend the workshops?
2. If somebody observed you in the LISELL family workshop, what would she/he see you doing during the program? Could you tell me what you would do in a typical workshop day?
- Registration
 - Science investigation
 - Family conversation session
 - Lunch
 - Could you tell me what you valued most in these workshops?
3. During your attendance in LISELL family workshops what left an impression on you about working with Latino parents?
- What was it like for you personally interacting with the families of your students?
How did you feel about it?
 - Could you tell me one interesting experience you had with families in the LISELL family workshops?

- Have your interactions with Latino families in the workshops influenced your working interactions with these students in the classroom?
 - If yes: How? Give me a specific example

LEARNING FROM THE LISELL WORKSHOP

4. What would you tell one of your colleagues about why they should attend a family workshop?
5. What do you think you have learned from family workshops about working with racially/linguistically diverse parents in children's science learning?
 - Give me specific example?
6. What do you think differently about Latino parents after attending the workshops?
 - What do you think differently about Latino parents' engagement in their children's science learning?
 - What do you think differently about teachers' role in working with racially/linguistically diverse parents in their children's science learning?
7. What strategies have you learned or skills you have gained at LISELL family workshops about working with diverse students and their parents?
 - Give specific example
8. Are you using or planning to use those strategies in your classroom?
 - If yes: Could you give example of a ways you partner or planning to partner with families that you learned after attending the workshops?
 - If no: what challenges you face that prevent you to use those strategies?
9. What experiences in the LISELL workshops was most helpful in gaining these skills in working with diverse parents? **Give me an example**

- What specific part or parts of the program informed those changes in your perspectives and/or practices in this regard? **Give me an example**

10. What do you do or planning to do differently in your current classroom practice to improve your partnerships with families?

SCHOOL SUPPORT

11. I am going to ask you about your satisfaction and dissatisfaction with your school administration in providing you support to implement these strategies you learned from the workshops. In what ways school administration is helpful for you to implement those strategies. In what ways it is not helpful?

- What extent school provide you time in working with parents?
- What kind of support you would like see from your school to implement those strategies to learn from the LISELL family workshops?
- Does your school have homework policy?
 - If yes: what it says?
 - How parents are informed about the policy?

12. What do you think about participation ratio of Latino families in the LISELL family workshops compared to parent events in your school?

- If applicable: What do you think makes parents to come STC workshops more than other events in school?
 - Do you think parents coming to workshops started to more involve in school parent events? If yes, why?
- What makes LISELL family workshops different from other parent events?
- How would your school better connect with racially/linguistically diverse families?

- Give me a specific example

RECOMMENDATIONS for PRESERVICE and IN-SERVICE PROGRAMS

13. Are there any areas about family engagement that teacher candidates do not learn about in their studies at their pre-service education that you think they should learn about?

- What family engagement knowledge and skill(s) do you think teacher candidates need to work effectively with families?
- What kind of support and training do you think in-service teachers need

to work effectively with diverse parents?

- What would teachers need that can help them to connect families with resources in their community?
- What types of school policies would you review, change, or implement to better family-school-community partnerships?

Is there anything you wish to add to our conversation today?

Probing tips

Is there anything more you would like to add to this?

Summary of what you heard and then did I understand you correctly?

I am not sure I got that straight. Would you please run that by me again?

Tell me more...

Who, where, what, when

When did it happen? Who else involved? Were you during that time? How did that come about?

You mentioned..... Tell me about that....”

You mentionedDescribe a specific example of that.”

Appendix C



LISELL-B Teacher Focus Group Interview Protocol June 2016



In the LISELL-B project, we are interested in strategies and practices that are useful for all students and especially for English learners and bilingual students as they try to make sense of academic science and academic language. We are also interested in how your school policies and context influence what you do in the classroom. We'd like to ask you some questions in your school teams to hear about your experiences this past year.

Science Investigation Practices

1) What do you think your students understood by the end of the year about science investigation practices, such as controlling variables or using observations as evidence to test hypotheses?

Probe: What do you think helped your students learn these practices the most?

2) What do you see as the value of students developing these science investigation practices?

Probe: Where do you believe that these science investigation practices fit within your current science standards and curriculum?

3) Do you think that your participation in the LISELL-B project supported students in developing these science investigation practices? If so, in what ways?

Probe: What experiences, if any, did you have this past year using LISELL resources to develop your students' science investigation practices?

4) What policies, initiatives, or resources in your school this past year influenced how you taught science?

Probe: What new policies, initiatives, or resources do you expect for next year that will influence how you teach science?

Language of Science

5) What do you think your students this past year knew by the end of the year about the language of science, such as how to write and speak in ways that clearly express scientific understanding?

Probe: Where do you think your students learned about the language of science?

6) What do you see as the value of students developing these science-specific language skills?

Probe: Where do you believe that these science-specific language skills fit within your current science standards and curriculum?

7) Do you think that your participation in the LISELL-B project supported students in developing these language of science skills? If so, in what ways?

Probe: What experiences, if any, did you have this past year using LISELL-B resources to help your students develop these language of science skills?

8) What policies, initiatives, or resources in your school this past year influenced how you incorporated reading, writing and other language skills into your science teaching?

Probe: What new policies, initiatives, or resources do you expect for next year that will influence how you incorporate language skills into your science teaching?

English Language Learners

9) How would you describe the English learners and bilingual students in your school and in your classes?

10) We often think about challenges that English learners face in school, but what strengths or resources do you see in the English learners and bilingual students in your school?

11) What challenges do you think that English learners and bilingual students in your school face specifically related to science learning?

12) This past year, is there anything you did differently in your science teaching when you were working specifically with English learners and bilingual students? If so, please describe what you did.

13) What challenges do you as a teacher face with instructing English learners and bilingual students? What supports would you like to help in this instruction?

Assessments

13) Overall, for all your students, what aspects of science assessments do they find most challenging and why?

14) For your English learners and bilingual students in particular, what aspects of science assessments do they find most challenging and why?

15) Do you think that the LISELL-B project can support your English learners and bilingual students in being successful on science assessments? If so, how?

16) What would make it easier for you to use LISELL-B resources in your teaching next year?

STC Family Workshops

17) What do you think your goals are in participating in the LISELL family workshops?

18) What do you think you have learned from family workshops about working with parents in children's science learning?

19) How do you think you apply what you learn(in the workshops) in your classroom and at school.

Thank you for taking the time to think about these questions together. Do you have any questions or other thoughts that you'd like to share at this time?