"We are all in this together": Equitable mathematics teaching and implications for Social Justice in the case of Ms. Lara

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

Manjula Peter Joseph

Graduate Program in Education

The Ohio State University

2013

Dissertation Committee:

Dr. Diana B. Erchick, Advisor

Dr. Michael D. Dornoo, Co-advisor

Dr. Cynthia A. Tyson

Dr. Binaya Subedi
Abstract

Students from low socioeconomic status (SES) and English Language Learner (ELL) populations continue to perform poorly in mathematics, calling for a greater focus on equity (NCTM, 1989, 2000) and social justice. But teaching for equity and social justice is a complex lifelong process that requires not only content and pedagogical knowledge, but also effort and reflection (Darling-Hammond, 2002, p. 201). Moreover, there is ambiguity in meaning within the field of mathematics education around what equitable and social justice mathematics instruction looks like in the classroom (Cochran-Smith, 2009).

An invited classroom intervention provided me access to an experienced teacher whose pedagogy seemed to exemplify culturally relevant (Ladson-Billings, 1995) mathematics pedagogy. On further investigation, I found in her an “information-rich” (Patton, 1990, p. 169) vignette, useful for the field of mathematics education. Using case study interpretive ethnography, I built “the case of Ms. Lara”.

I collected data in Liberty Elementary School’s (pseudonym) culturally, ethnically, and linguistically diverse fifth grade mathematics classroom, where nearly 90% of students were low SES. The school's academic reports showed low levels of student achievement. I analyzed video-recorded classroom observations, student work samples, teacher and researcher field notes; and interviews with Ms. Lara (pseudonym) in
Key findings from my study led me to develop a framework of teaching mathematics for equity and social justice, the “Clarity, Compassion, and Integrity (CCI) Triangular Model”. Clarity (स्पष्टता) includes a teacher’s continuous informal and informative assessment of students and students developing critical thinking as a personal process. Compassion (करुणा) is a call to action with for teacher intentionally seeking to understand students’ hopes, dreams and aspirations; and providing a safe environment for students to build their mathematical and social identities. Integrity (अखंडता) places students and mathematics at the center with students as the locus of authority and decision-making in knowledge co-construction, and with the teacher facilitating a connected understanding of mathematics across content areas, using multiple representations, and making real-world connections.

Implications for the field of mathematics education are in building a theory and seeking clarity about what it means to teach mathematics for social justice. The CCI model is meaningful in its entirety, to identify “particular practices” (Boaler, 2000, p. 239) that enhance social justice objectives in mathematics education. The model provides a framework to investigate what it means to teach mathematics for proficiency, equity as well as social justice.

Implications for research and practice are in the context of teacher preparation: a) study provides a vision of what teaching for social justice looks like, making it accessible to teachers and teacher educators; b) study points to considering aspects of Montessori,
special education, and educational philosophy traditions (in Ms. Lara’s background) to be integrated in teacher preparation; c) study showed importance of teacher intentionality, but how it is related to changing practice needs to be studied; d) study points to role of teacher’s experiential knowledge in decision-making, so experiences as a part of teacher preparation programs to equip them to teach for equity and social justice might be considered.
To my parents, my first teachers –

For being inspiring examples.
Acknowledgments

Several exceptional people supported me through this journey and made it possible.

Thank you, Dr. Erchick, for being my rock, for believing in me and ensuring I had the experiences I needed to learn and grow in a new and different environment. You inspired me with your optimism and fortitude when I came running to you for help on so many challenging occasions. You urged me to push my limits every day and undergirded my effort with your counsel and encouragement.

Thank you, Dr. Michael Dornoo, for your careful reading of my drafts, helping me fine-tune my thoughts and improve my writing. I learned a great deal from your thoroughness as a co-investigator on a research study, and from your mentorship as your student. Dr. Cynthia Tyson and Dr. Binaya Subedi, thank you for your willingness to give your time to serve on my committee and provide insightful and invaluable feedback. Your commitment to excellence continues to urge me to reflect and learn more about issues facing present day education research. I feel incredibly blessed to have had such a scholarly and supportive committee who helped me grow as an aspiring researcher. In this context, I would also like to thank the outstanding faculty at The Ohio State University for the opportunity of learning from them. Thank you, OSU, for providing me with such a rich educational experience!

Dr. Patti Brosnan and Dr. Azita Manouchehri, thank you for nurturing all of us at
the Mathematics Coaching Program; I am truly grateful for your care. Besides supporting me financially, my work with MCP informed my research, and enriched my understanding of teaching and learning. I know I will continue to draw on everything I learned here for my future work. All my wonderful friends and colleagues, thank you for helping me make it through some of my most difficult days. Jenna, Ravi, Jenn, Gilbert, and Amanda, thank you for your valuable feedback and help. I will miss our times of fun and togetherness, and hope that we can keep in touch and collaborate in the future.

My wonderful family, both far and near, thank you for standing with me through this journey. Being separated by time and distance was not easy, but knowing you were rooting for me kept my spirits up and my will unwavering. You listened to my complaints, comforted me, and prayed for me, and I am grateful beyond words.

Last but by no means the least, “Ms. Lara”, thank you for being the person you are – compassionate, caring, loving, and strong. Without you, this study could not have been conceived. I know there are several others like you, Lara, doing their work in small yet extra-ordinary and significant ways, to make classrooms ‘havens’ for our children. Thank you, Ms. Lara!
Vita

1981.........................B. S. Mathematics, Physics, Chemistry, Osmania University
1983..............................M. S. Mathematics, Bangalore University, India
1988...............................B. Ed. Mathematics, Annamalai University, India
1996...............................M. Ed. Mathematics, Annamalai University, India
2007...............................M. Phil. Mathematics, Madurai Kamaraj University, India

June 1986 to May 1991.................................High School Mathematics Teacher,
                                          High Schools in India

June 1991 to April 1998..............................Department Head, Mathematics,
                                          Bishop Cotton School, Bangalore, India

May 1998 to May 2005....................................................................Principal,
                                          Baldwin Women’s Methodist College, Bangalore, India

August 2005 to August 2009..........................Vice Principal and Dean of Academics,
                                          Bethany High, Bangalore, India

September 2009 to present ............................Graduate Research Associate,
                                          Mathematics Coaching Program, The Ohio State University
Publications


Field of Study

Major Field: Education

Specialization: Mathematics Education
Table of Contents

Abstract ................................................................................................................................. ii

Acknowledgments ................................................................................................................ vi

Vita ......................................................................................................................................... viii

Publications .......................................................................................................................... ix

Field of Study ......................................................................................................................... ix

Table of Contents .................................................................................................................. x

List of Tables ........................................................................................................................ xix

List of Figures ......................................................................................................................... xix

Chapter 1. Introduction ........................................................................................................ 1

Chapter 2. Theoretical Perspectives and Literature Review .............................................. 10

  Theoretical perspectives: CCI Triangular framework ......................................................... 10

  Clarity: Critical view of power structures influencing education ................................. 12

  Compassion: Foster relationships, empowering, and liberatory .................................... 17

  Integrity: Participant voice and agency, and reflexivity .................................................. 22

  Summary ............................................................................................................................ 24
Review of relevant research literature .......................................................... 25

Key Concepts.................................................................................................... 26

Diversity ............................................................................................................ 26

Equity ................................................................................................................ 28

Equity Pedagogy .............................................................................................. 29

Social Justice ................................................................................................... 30

Social justice pedagogy .................................................................................. 31

Teaching mathematics for social justice ......................................................... 34

Student self-empowerment ............................................................................ 35

Real-world perspective .................................................................................. 36

Collaborative learning ..................................................................................... 38

Low SES and ELL students’ engagement ...................................................... 39

Collaborative learning opportunities ............................................................ 41

Critical pedagogy ............................................................................................ 43

Multicultural perspective ................................................................................ 45

Culturally relevant pedagogy .......................................................................... 47

Challenges in teaching for equity and social justice ....................................... 49

Teacher perspectives about the field of mathematics .................................... 51

Teacher perspectives about mathematics content ........................................ 52

Teacher perspectives about mathematics pedagogy ....................................... 56

Revisiting the research questions ................................................................. 57
Chapter 3. Methodology ........................................................................................................ 61

Methodological principles................................................................................................. 62

The CCI Triangular Framework......................................................................................... 63

Qualitative paradigm ........................................................................................................ 65

Case Study Method........................................................................................................... 66

Interpretive Ethnography ................................................................................................ 68

Researcher roles................................................................................................................ 72

Teacher-Observer............................................................................................................. 73

Participant-Observer ........................................................................................................ 74

Issues of credibility........................................................................................................... 76

Prolonged engagement...................................................................................................... 76

Triangulation..................................................................................................................... 76

Referential adequacy........................................................................................................ 77

Transferability.................................................................................................................. 78

Research Context: Liberty Elementary School................................................................. 78

Research Participant: Ms. Lara......................................................................................... 82

Data sources..................................................................................................................... 89

Data collection procedures............................................................................................. 90

Data collection: Initial in-depth interviews.................................................................... 92

Data collection: Classroom observations....................................................................... 93
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data collection: Follow-up interviews</td>
<td>94</td>
</tr>
<tr>
<td>Data collection: Final Interview</td>
<td>96</td>
</tr>
<tr>
<td>Data collection: Time line</td>
<td>96</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>98</td>
</tr>
<tr>
<td>Data analysis: The codebook</td>
<td>100</td>
</tr>
<tr>
<td>Data analysis: Initial interviews</td>
<td>103</td>
</tr>
<tr>
<td>Data analysis: Classroom observations</td>
<td>105</td>
</tr>
<tr>
<td>Data analysis: Follow-up interviews</td>
<td>106</td>
</tr>
<tr>
<td>Data analysis: Final interview</td>
<td>107</td>
</tr>
<tr>
<td>Integrated Coding scheme</td>
<td>107</td>
</tr>
<tr>
<td>Summary of methodology</td>
<td>109</td>
</tr>
<tr>
<td>Chapter 4. Results</td>
<td>111</td>
</tr>
<tr>
<td>Summary of lessons</td>
<td>113</td>
</tr>
<tr>
<td>Data analysis</td>
<td>116</td>
</tr>
<tr>
<td>Interviews</td>
<td>116</td>
</tr>
<tr>
<td>Coding Scheme</td>
<td>116</td>
</tr>
<tr>
<td>Observations from code counts</td>
<td>120</td>
</tr>
<tr>
<td>Summary of code counts</td>
<td>120</td>
</tr>
</tbody>
</table>
Social justice objectives codes maximum ........................................ 122

Contextual elements codes minimum ........................................ 124

Content and pedagogical codes balanced .................................. 125

Summary of observations from code counts ............................... 126

Teaching episodes: lesson goals mapped with codebook ............ 127

Lesson 1: Measurement & Data .............................................. 128

   Lesson 1 Summary ...................................................... 130

Lesson 2: Place value .......................................................... 132

   Lesson 2 Summary ...................................................... 133

Lesson 3: Fractions ............................................................. 134

   Lesson 3 Summary ...................................................... 136

Lesson 4: Decimals ............................................................. 136

   Lesson 4 Summary ...................................................... 138

Lesson 5: Review ............................................................... 139

   Lesson 5 Summary ...................................................... 141

Goals and intentions of Ms. Lara’s practice and pedagogy .......... 142

Category I: Content objectives (Attention to mathematics) ........ 142

   Making connections with language and multiple representations ... 143

   Integrating procedural and conceptual understanding ............ 148

   Adopting continuous informal assessment .......................... 152

xv
Summary of attributes of content objectives ......................................................... 155

Category II: Pedagogical orientation (Support students as learners) ........ 155

Positioning students at the core of decision-making................................. 156
Inviting student diversity to support each other’s learning...................... 160
Paying attention to individual students’ needs during group activities .. 161
Summary of teaching attributes for pedagogical objectives ................. 164

Category III: Contextual Relevance (Awareness of instructional context). 165

Making connections with students’ lived experiences............................. 165
Having high expectations for all students.............................................. 168
Undergirding and commending student effort.................................. 171
Summary of teaching attributes for contextual objectives.................. 175

Category IV: Social Justice objectives (Student self-empowerment) .... 176

Recognizing and building student potential...................................... 176
Providing student leadership opportunities...................................... 180
Helping students develop critical thinking as a personal process....... 183
Summary of teaching attributes for social justice objectives ............ 187

Towards addressing the research questions ............................................. 188

Research Question 1 .................................................................................... 188

“You decide”: Student ownership and participation.............................. 189
“Ask around”: Student leadership and knowledge co-construction ...... 194
“Think about it”: Student mathematical and social identities .......... 197
List of Tables

Table 1. Student demographics of Liberty Elementary in the year 2010-11 .................. 80
Table 2. Summary of data sources and collection ..................................................... 90
Table 3. Sample follow-up interview protocol ......................................................... 95
Table 4. Summary of data collection and analysis .................................................... 98
Table 5. Using mathematics to teach for equity and social justice codebook (abbreviated) ............................................................................................................. 101
Table 6. Summary of lessons ..................................................................................... 113
Table 7. Total counts of codes ................................................................................... 121
Table 8. General format of lesson models ................................................................. 127
Table 9. Model of Lesson 1: Measurement & Data ..................................................... 129
Table 10. Model of Lesson 2: Place Value ................................................................. 132
Table 11. Model of Lesson 3: Fractions .................................................................... 135
Table 12. Model of Lesson 4: Decimals .................................................................... 137
Table 13. Model of Lesson 5: Review ....................................................................... 140
Table 14 : Key findings and the CCI framework ....................................................... 251
Table 15. Using mathematics to teach for equity and social justice codebook (elaborated) ............................................................................................................. 293
List of Figures

Figure 1. CCI Triangular Framework for research informed by equity and social justice 11

Figure 2. CCI Triangular Framework for methodological perspectives 63

Figure 3. Development of "Using mathematics to teach for equity and social justice" codebook 103

Figure 4. Data Analysis Flowchart 115

Figure 5. CCI Triangular Framework for teaching mathematics for equity and social justice 253

Figure 6. Representative model of mathematics teaching 268

Figure 7. Representative model of mathematics teaching with attributes 271
Chapter 1. Introduction

Where the mind is without fear and the head is held high
Where knowledge is free,
Where the world has not been broken up into fragments
By narrow domestic walls;
Where words come out from the depth of truth,
Where tireless striving stretches its arms towards perfection,
Where the clear stream of reason has not lost its way
Into the dreary desert sand of dead habit;
Where the mind is led forward by Thee
Into ever-widening thought and action -
Into that haven of freedom, my Father, let my country awake!

(Tagore, 1916)

Rabindranath Tagore’s prayer for India’s awakening is a cry for a world free of division, discrimination, and untruth; a world where justice is not murky and where all have opportunity to strive and succeed. Dare we dream of the same for all children? And demand schools where the dream of ‘quality education for all’ is kept alive (Ladson-Billings, 1994)? And create classrooms that are safe ‘havens of freedom’?

Imagine a classroom with no barriers to learning, where all children can let their imaginations run wild, to explore and discover. Their world, where they determine what they learn and how they learn. Imagine a classroom where their voice is heard, their thinking valued, and their questioning safe, accepted for who they are and respected for what they bring, even when or, perhaps, especially when, some of what they bring is pain and struggle. Imagine a classroom where “how” matters as much as the “what,” and
where learning is collaborative rather than unidirectional. Imagine a world where children can determine their path, follow their dreams, and make their destiny.

Is this a vision of reality in our classrooms and our world today?

The answer is a resounding NO!

Unfortunately, not all students have the opportunity to learn in the manner described above, and not all students are able to determine their destiny by pursuing careers of their choice. Certain groups of students, such as low SES students have been, and continue to remain, disadvantaged, especially when it comes to mathematics. Mathematics continues to serve as an important “gate-keeper” (Stinson, 2004, p. 8) and “gateway” (Bryk & Treisman, 2010) for many careers in today’s technologically advancing world, requiring students to be proficient in it. As such, students from groups that do not have access to high quality mathematics education remain underrepresented in such professions (Martin, 2009). In comparing student performance in national and international assessments by their demographics, one can see the glaring disparity.

National Assessment of Educational Progress (NAEP) and Trends in International Mathematics and Science Study (TIMSS) show that students from racial and ethnic groups other than White and Asian continue to perform poorly (Ferraro, 2006). Students from low SES backgrounds, and English Language Learners (ELLs) have also been identified as low-performing, and are the matter of discussion for several studies in recent times (Bartell, 2011; Esmonde, 2009; Gutiérrez & Lubienski, 2008). Therefore, students from poverty and students from marginalized racial, ethnic, and language groups need our attention now and will continue to do so, as statistical projections would indicate.
The racial mix of classrooms across the United States is becoming more diverse. According to the National Center for Education Statistics (NCES), between 1980 and 2008 the White population declined from 80 to 66 percent, and will continue to fall to 57.8 percent by 2025. All other racial and ethnic minority populations and mixed race and ethnicity will continue to rise. A similar pattern is observed in public school student enrollment. In contrast, teacher demographics have remained largely female and white (National Center for Education Statistics Home Page, U.S. Department of Education, 1995). Hence the matter of achieving equity for these diverse groups needs to be addressed.

In the past, there have been several attempts to right the wrong. Since the early 1900s, federal departments of education and forums for mathematics education initiated policies and programs to make education more accessible and equitable for all learners. The “New Math” era of the mid-1900s ushered in pedagogical changes shifting the focus from direct instruction to discovery learning. The shift in focus, unfortunately, only deepened the chasm between dominant and marginalized groups due to issues of access to resources that advantaged a privileged few. Subsequently, failure of the New Math era resulted in the “Back to the Basics” movement in late 1970s and 1980s (Herrera & Owens, 2001). Later on, reports like Agenda for Action (1980), Nation at Risk (1983) and Everybody Counts (1989) provided fresh impetus for the reform period promoting equity and excellence in education (Sleeter, 2007). In 1989 and again in 2000 National Council of Teachers of Mathematics (NCTM) came out strongly through their Standards documents to position equity as a major goal and principle, proposing reform-based

One of the key causal factors identified for this unfortunate state of affairs is that low socio-economic status (SES) and urban students are disadvantaged by having teachers with less experience, lower mathematics test scores, and lower Mathematics Knowledge for Teaching (MKT) (Hill, Rowan, & Ball, 2005; Lubienski, 2008). Hence the need to focus on teacher preparation.

As I will show in this dissertation, the findings from the study exemplified in Ms. Lara’s case, can help us make progress in the right direction. I have framed the findings using three key attributes - Clarity, Compassion and Integrity. I am therefore proposing the “Clarity Compassion Integrity (CCI) framework” as a model for equitable mathematics teaching. Attributes that define the model are: Clarity (स्पष्टता), Compassion (करुणा), and Integrity (अखंडता). Clarity (स्पष्टता) has two aspects – first, a teacher’s continuous informal and informative assessment of students in order to better understand how they think and learn; and second, students developing critical thinking as a personal process in order to better understand their world. Compassion (करुणा) is a call to action that has two objectives – first, a teacher’s intentionally seeking to understand
the students, their hopes, dreams and aspirations; and second, providing a safe environment for students to build their mathematical and social identities. Integrity (अखंडता) in the teacher’s work places students and mathematics at the center – students are the locus of authority and decision-making in the process of knowledge co-construction, and the teacher facilitates a connected understanding of mathematics across content areas, using multiple representations, and making real-world connections.

I undertook the investigation by asking the following three questions:

a. What instructional decisions does the teacher make that contribute to equitable teaching practices for students from low SES and ELL populations?

b. How does the teacher's disposition towards mathematics content and pedagogy influence her instructional and pedagogical choices for student self-empowerment in mathematics?

c. What goals are central to the teacher's pedagogy for equity and social justice?

My goals were two-fold: a) to trace the work and practices of one experienced teacher in her mathematics classroom with low socioeconomic and ELL students, and b) to investigate the teacher’s goals and intentions towards a pedagogy for equity that have implications for social justice. To that end, my case study was designed to provide rich descriptions of the teacher’s practice, reveal patterns of equitable mathematics teaching, and provide insight into the teacher’s own perspectives, goals, and intentions. Her perspectives about the field of mathematics, its content and pedagogy, her goals for teaching mathematics, and her intentions in making instructional choices were explored in-depth. Through this case study, I wanted to particularly examine those practices of the
teacher that enhance student self-empowerment and improvement in mathematics understanding.

The above questions were conceptualized based on the work of scholars and researchers in the field of education in general, and mathematics education in particular. As early as the 1900s, education philosophers like John Dewey criticized traditional teaching for not taking into account student experiential knowledge and posited an education that provided for equal participation of all members, for the ‘common good’ (Dewey, 1964). Another influential scholar, Paulo Freire posited a system of education that positions the student at the center of a “problem-posing” model instead of the teacher depositing knowledge in the “banking” model of education (Freire, 1973, p. 72).

Multicultural education theorists also argue that equitable teaching is dynamic, by virtue of being strongly student-centered and flexible in being able to cater to individual student needs (Banks & Banks, 1995). Ladson-Billings (1995a) proposed CULTURALLY RELEVANT PEDAGOGY: “specifically committed to collective, not merely individual, empowerment” (p. 160); a pedagogy that places high expectations on all students, and helps them achieve academic excellence, cultural competence and critical consciousness. Consequently, equity pedagogy demands mathematics classrooms to be like learning communities (Boaler, 2002) in which children engage with the material in ways that best suits their ways of learning, feel safe to ask questions, express views and exchange ideas.

Drawing from the foundations laid by equity and social justice education scholars, the goals of equitable mathematics education are: a) having strategies that cater to a diverse range of student ability and understanding, and b) providing opportunities to
stimulate students to challenge inequities in society (Gutiérrez, 2002; Gutstein, 2006). In other words, equitable mathematics teaching needs to provide all students access and opportunity to engage with the content of mathematics, as well as prepare informed citizens.

All of the above arguments for equity and social justice in teaching mathematics are relevant and have proven successful in different environments and settings. Unfortunately, creating such classrooms is an overwhelming endeavor. Besides having fairly in-depth content and pedagogical knowledge, teachers also need to be familiar with real-world contexts (Ball, Lubienski, & Mewborn, 2001) and be able to facilitate ‘bringing the world into the classroom’ (Gutstein, 2006). This is not easy for most teachers, since there is ambiguity regarding what social justice teaching really is and what it looks like in a classroom (Fives & Buehl, 2009; Grouws, 1992; Gutiérrez & Lubienski, 2008; Sowder, 2007). Teachers often reject the idea because social justice education is about “teachers being nice, [and] students feeling good” (Cochran-Smith, 2004, p. 627) at the cost of rigorous mathematics content. For many teachers, paying attention to equity and social justice issues in the mathematics classroom means moving away from the goal of their students’ learning of mathematical content, for which they are held accountable (Erchick & Tyson, 2011).

Furthermore, both in-service and pre-service teachers bring their own perspectives about mathematics content and pedagogy that influence their instructional and pedagogical choices. Their perspectives about content range from purely conceptual or procedural to an integrated conceptual-procedural, and their perspectives about pedagogy
from a teacher-directed to a learner-responsive approach (Erchick, Dornoo, & Joseph, 2011). Often these perspectives are rigid and hard to change. For example, those who perceive mathematics merely as a rigid set of procedures will view learning mathematics merely as acquisition of skills through practice and memorization. Such perspectives can negatively influence student learning. Complicating the matter further, sometimes teachers might profess a certain standpoint whereas in practice follow a different perspective altogether (Brewley-Kennedy, 2005; de Freitas, 2008; Erchick & Tyson, 2011).

Given the variety of challenges in preparing teachers for equity, studies on good and effective teaching practices with vivid descriptive information are needed in order to inform teacher preparation and practice. Research needs to delve into core characteristics of best practices that lead all students being able to participate and achieve in mathematics, be critical of knowledge and society, and begin to erase inequities globally (Esmonde, 2009; Gutiérrez, 2002). While studies on mathematics teaching focused on proficiency suggest strategies that can help students from diverse backgrounds learn mathematics (Boaler, 2002), there remains a gap in the research of vignettes portraying teacher pedagogy for equity and social justice. Even though researchers of late have begun to explore this from a practitioner perspective (Gutstein & Peterson, 2005; Leonard, Brooks, Barnes-Johnson, & Berry, 2010), the need for rigorous classroom-based research (Gutiérrez, 2013) remains.

In the chapters that follow, I present a detailed account of how I went about my investigation. In the next chapter, I present the theoretical perspectives that informed my
investigation, followed by a review of relevant literature. In chapter three, I will discuss methodological considerations and provide a detailed description of my study design and analytical procedures. I report the key findings and answers to my research questions in chapter four. In my concluding chapter, I provide a discussion of my key findings with the broader goal of conceptualizing teaching mathematics for equity and social justice in the context of ELL and low SES students, who are marginalized due to low levels of mathematics learning. I will also point to future directions for teacher preparation and research.
Chapter 2. Theoretical Perspectives and Literature Review

The objectives of this chapter are: a) to describe the theoretical perspectives guiding this research study, which is informed by equity and social justice in the context of marginalized communities, and b) to review relevant research literature. The study is set in a school with a high population of recent immigrant and low SES students who are disadvantaged due to various factors. Hence, it is appropriate to review literature relating to students from marginalized communities as a whole. Furthermore, this study investigates a teacher’s equity and social justice pedagogy in the context of a mathematics classroom setting. Hence literature around issues of equity and social justice in mathematics education are reviewed.

Theoretical perspectives: CCI Triangular framework

In order to frame this discussion that summarizes theoretical perspectives of my study, I have developed a model, which I call “CCI Triangular framework” (Fig.1). The framework comprises of three key concepts: Clarity (स्पष्टता), Compassion (करुणा), and Integrity (अखंडता). The terms in the Devanagari script, which I will expand upon, are derived from the Indian language, Hindi. The idea for the framework originated from a coffee-table book published by Glenn Furuya, (2011) in which the author mentioned the three “ritys” as attributes a leader requires to build trust - clarity, charity, and integrity.
Although I borrow the terms, I use them otherwise, to base my argument from the perspective of education and add the dimension provided by the related words from my own Indian culture. I use the “CCI Triangular Framework” to also help develop a model for methodological considerations in researching for equity and social justice, which I will elaborate in the next chapter.

Figure 1. CCI Triangular Framework for research informed by equity and social justice
The “CCI Triangular framework” for research informed by equity and social justice in the context of marginalized communities outlines three primary characteristics – clarity (स्पष्टता), compassion (करुणा), and integrity (अखंडता). The word “स्पष्टता”, or clarity signifies clear vision, clear understanding, and flawlessness. Clarity in research is engaging in critically viewing power structures in today’s society and how they influence education (Giroux, 2004) and a striving for a system free from the blemishes of oppression and injustice. “करुणा”, or compassion is an active word, and embedded in it is an intention for action. Compassion undergirds the research by fostering relationships of mutual respect and trust, liberation, and self-empowerment of both the participants and their communities as well as the researcher (Denzin & Lincoln, 2008). “अखंडता, or Integrity” stands for solidarity and strength as well as honesty and truth. Integrity privileges participants’ voice and agency and engages the researcher in reflection and reflexivity (Tomaselli, Dyll, & Francis, 2008). An integration of the three attributes in research for equity and social justice has the potential for transformation of all those involved in the study (Denzin & Lincoln, 2008). I will now proceed to elaborate on these concepts.

**Clarity: Critical view of power structures influencing education**

Research with a social justice lens necessitates a critical view of power structures influencing society in general and education in particular, while also paying attention to student needs and aspirations. William Ayers calls this a teacher’s, and one might add a researcher’s, “dialectical stance” (Ayers, 1998), with
one eye firmly fixed on the students – Who are they? What are their
hopes, dreams, and aspirations? Their passions and commitments? What
skills, abilities, and capacities does each one bring to the classroom? – and
the other eye looking unblinkingly at the concentric circles of context –
historical flow, cultural surround, economic reality. (p. xvii)

Every educational endeavor for equity, whether in research, teacher preparation,
teaching, or working with communities in adult literacy, requires a dialectical stance –
one eye on context, one on students. The purpose of research besides building knowledge
is both pedagogical and political, moral and ethical (Denzin & Lincoln, 2008). Hence,
education, both teaching and research, is a political enterprise; it prepares individuals to
participate in public life competently, and to that end, teachers and researchers play a
crucial role in shaping the sociopolitical fabric of a country (Giroux & Giroux, 2008). It
is also a pedagogical enterprise as education researchers attempt to unpack what
‘teaching and learning for social justice’ looks like in the classroom. While many suggest
that strategies like collaborative group work opportunities, multiple representations,
integrating aspects of other cultures, etc. have the potential for disadvantaged students’
learning (Boaler, 2008; Parsons, 2005; Reed & Oppong, 2005; Boaler & Staples, 2008),
one cannot ignore the sociocultural factors that influence their students’ lives. Therefore,
those viewing schools and classrooms with a critical lens (Brown, 2009; Gutiérrez, 2000;
Kozol, 1992; Martin, 2009) propose creating environments for students to think critically
and question power structures in society (Gutstein, 2006). One of the key considerations
would be, therefore, how these power structures influence both how and what we teach. What knowledge is being disseminated in schools today?

Researchers are called to critically examine knowledge that is made available to students in schools today. Apple (1979) contends that information is selective, parsed through “selection tradition” by which “certain meanings and practices are chosen for emphasis, certain other meanings and practices are neglected and excluded” (p.6). Moreover, the information selected is “reinterpreted, diluted, or put into forms which support or at least do not contradict other elements within the effective dominant culture” (p.6). Apple (1979) argues that knowledge that gets selected thus, and taught in schools, becomes “socially legitimate knowledge” (p.6), often continuing hegemony and discrimination. Thus, a researcher’s critical view formulates questions about knowledge, its selection, and its presence in school curriculum (Apple, 1979).

Besides selected knowledge, schools tend to ignore issues of difference and oppression, thus authenticating certain mainstream ideologies and stereotypes (Kumashiro, 1999; Subedi, 2008). bell hooks (1994) regrets that “the traditional role of the university in the pursuit of truth and the sharing of knowledge and information… uphold(s) and maintain(s) white supremacy, imperialism, sexism, and racism” (p. 29). Not only is this true of education, it can be said about certain kinds of research as well. In traditional positivist research, one ‘inquires’ like Apple suggests we teach students to inquire – into a “consensus ideology” (p.7) only to confirm that which is already legitimized, instead of thinking critically and inquiring as to “why a particular form of social collectivity exists, how it is maintained and who benefits from it” (Apple, 1979,
By following the positivist path, researchers also continue a colonial tradition thus continuing oppression, unless it is what Smith (1999) calls a “decolonizing” effort. Smith posits a research that does away with Western positivist methods trying to make sense of humans and realities, and instead one that takes into consideration the perspectives of the researched – their lives, their questions, seeking their answers. Hence, at the heard of ‘decolonizing’ research is social justice. Consequently, research for equity and social justice intends to break free from the positivist approach, break free from imperialistic colonial traditions, and challenge accepted status quos.

In the field of mathematics, one of the generally accepted status quos is that mathematics as a rigid skill-based, value-free discipline. This understanding impacts the goal of teaching mathematics. Traditional teaching in mathematics often focuses on students acquiring knowledge of skill-based procedures. Breaking free from this traditionalist view, an important theme that is emerging in mathematics education research literature is that about understanding and creating spaces for students to engage in critical thinking without compromising mathematics rigor. Researchers are investigating how classroom environments can provide opportunities for students to fully engage and participate in their learning and grow as critical thinkers. The key question is: do mathematics classroom conditions provide the knowledge, skills, and culture of questioning necessary for students to engage in critical dialogue with the past, question authority and its effects, struggle with ongoing relations of power, and prepare themselves for what it means to be critical, active citizens in the
interrelated local, national, and global public spheres? (Giroux & Giroux, 2008, p. 187)

In recent years, several mathematics education researchers and practitioners are centering their work around social justice themes (eg. Bartell, 2011; Esmonde, 2009; Gutstein, 2006). Teacher-researcher Eric Gutstein focuses his work on developing students’ sociopolitical consciousness by “reading the world” with mathematics (Gutstein, 2006). Work for social justice in mathematics classrooms is geared towards providing students opportunities to learn to question previous understanding and knowledge, a process of “de-codification” (Freire, 2005), and develop attitudes that will bring about “a common striving towards awareness of reality and towards self-awareness” (Freire, 1973, p. 107). Lubienski’s (2002) study of her own practice in a seventh grade classroom focusing on socioeconomically diverse students provides an important perspective. Researching differences between SES groups’ classroom participation Lubienski (2002) posited that sociocultural factors outside the classroom influenced student readiness to fully participate and engage in open classroom discussions, giving various differences in the way low and high SES students’ preferences in the way they learned and how they viewed classroom discussions. While low SES students preferred direct instruction and viewed group discussions as a means to find the right answer, high SES students preferred collaboration, and viewed group discussions as a means to engage in critical thinking. Merely reforming classrooms from traditional teacher-directed instruction to student-led inquiry is therefore not enough;
research needs to critically view larger socio-historical, cultural and political factors that influence students of low SES backgrounds (Lubienski, 2000).

Hence, research should be asking pertinent questions: firstly, are classrooms spaces for critical pedagogy linking “learning to social change, education to democracy, and knowledge to acts of intervention in public life” (Giroux & Giroux, 2008, p. 186)? Are students encouraged to “critically look at structures”, “not tolerate the intolerable”, but rather “build conditions for individual and social agency” (Giroux & Giroux, 2008, p. 186)? Secondly, can environments in classrooms successfully provide opportunities for all students’ full participation?

**Compassion: Foster relationships, empowering, and liberatory**

A humanistic approach to research recognizes the participants for who they are and what they bring, to learn from them and co-construct knowledge along with them. A humanistic approach values the participant as a person who brings to the research her/his own knowledge, culture, and beliefs, and also recognizes the sociocultural factors that individual brings. It is, therefore, about understanding the individual’s needs, hopes and dreams as well as the larger contextual issues that impact those needs, hopes and dreams. Unfortunately, many education studies are counter examples of a humanistic approach. Many researchers have pointed out that studies scrutinizing the achievement gap, for instance, are usually ‘deficit’ models, to find out what the problem is with those students who are low-achieving and how one might go about fixing the problem (Bartolomé, 1994; Denzin & Lincoln, 2008; Lubienski, 2008; Sleeter, 2007). Education research proposes instruments to assess the so-called *deficits* in students and model instructional
strategies that could be used as standards to fix them. Solutions offered are usually methodological and disconnected from the sociocultural reality that shapes the problem. Kumashiro (2004) critiques such strategies for having the potential to perpetuate oppression of minority students if used unreflectively. Students are commonly grouped into categories and studies generalize about particular cultural groups, without considering socio-historical factors that might have had a role to play (Bartolomé, 1994; Sleeter, 2007). Bartolomé (1994) observed that just as research studies have attempted to identify strategies and methodologies that suit the needs of culturally and linguistically different and at-risk students, student teachers tended to do the same. In one sense, what (Bartolomé, 1994) criticizes in both education and research is the one size fits all solution, as though all minority students are alike and will succeed with the same instructional model, and suggests a shift in perspective – from “a narrow and mechanistic view” to a broader more “humanistic” approach (Bartolomé, 1994, p.173).

Humanistic researchers propose a “methodology of the heart” that embraces the ethic of “truth grounded in love, care, hope, and forgiveness” (Denzin & Lincoln, 2008). Paris (2011) posits that ‘humanizing’ research by building around relationships of care and dignity and dialogue is particularly important in working with marginalized and oppressed communities. Research that fosters relationships has the potential and power to improve the lives of others through understanding, commitment, care, patience, and passion (Hostetler, 2005). In humanizing research among the marginalized, an important issue is that of stereotyping, commonly prevalent in schools. Kumashiro (1999) argues that stereotyping creates feelings of inferiority in the ones who are targeted and feelings
of superiority in the ones who stereotype, and that stereotyping gets iterated and exaggerated over time. Subedi (2008) provides another perspective of stereotyping that leads to alienating oneself from one’s culture in order to align oneself with a dominant culture. The need for a humanistic approach is especially relevant in the context of today’s demographically changing environment. Research needs to bring about transformation through healing (hooks, 1994; Denzin & Lincoln, 2008), needs to be therapeutic (Tomaselli et al., 2008), and beneficial to the researched (Hostetler, 2005).

Humanistic research leads to a closer look at methodologies used in the research to make them culturally relevant. Although participant observation and interviewing has been the norm for gathering social and cultural information, many researchers argue that such methods are sometimes risky as they are not culturally relevant (Ladson-Billings, 1995a; Parsons, 2005). Parsons, (2005) argues that culturally relevant caring requires engrossment (giving full attention to and acting in the best interest of the cared-for), receptivity (non-judgmental acceptance of the cared-for), and vision (of best possible outcome for the recipient of care) (Parsons, 2005, p. 25), which are absent if research is not culturally relevant. Furthermore, culturally relevant caring goes beyond what one perceives as the best interest of the researched to being willing to allow the individual to seek his/her own best interest and being willing to stand by that individual (Parsons, 2005). Hence, good education research is not just about good procedures, Hostetler (2005) reasons, but also about having beneficial goals. “Good” is generally the term used to qualify procedures but Hostetler proposes that it should be applied to questions of how
the research contributes to the well-being of the education community and community at large. In other words, good educational research should lead to human well-being.

If the goal of research is human wellbeing, then, humanizing research is critical in education, particularly for research with marginalized and underrepresented communities. Denzin & Lincoln (2008) suggest that one needs to ask the questions Smith (1999) proposed – “what research do we want done?”; “whom is it for?”, and most importantly, “what difference will it make?” and “who will benefit?” (Denzin & Lincoln, 2008, p. 9).

There needs to be a re-visioning of Freire’s liberatory model (Freire, 1973) for local contexts based on critical and social justice principles by valuing the “transformative power of indigenous, subjugated knowledges” (Denzin & Lincoln, 2008, p. 136). Several researchers working with indigenous communities position their work for liberation and transformation, and their work informs this discussion. “(T)he history of research from many indigenous perspectives is so deeply embedded in colonization that it has been regarded as a tool only of colonization and not as a potential tool for self-determination and development” (Smith, 2005). While traditional research has been oppressive privileging the researcher through ‘colonial’ methods, inquiry that seeks to decolonize such practices is empowering for both the researcher as well as the researched (Denzin & Lincoln, 2008). Critical indigenous inquiry begins with a concern for indigenous people, to benefit the participants, promote their self-determination and empowerment (Denzin & Lincoln, 2008). Arguing from the standpoint of an African American woman, leader, and scholar, Cynthia Dillard asks what particular perspectives in educational inquiry might “assist the entire research community in conceptualizing (our) work beyond often
simplistic, biological, and didactic notions of identity, politics, and the like to more useful cultural ones?” (Dillard, 2000, p. 671). In other words, in what ways can research inform, empower, and liberate the community, and extend both “historically in time and outward to the world?” (Dillard, 2000, p. 676).

Humanistic research is empowering and liberatory, akin to Paulo Freire’s (1973) model of liberatory education, which exemplifies power in the hands of the oppressed. Freire (1973) asserted that “(o)nly the power that springs from the weakness of the oppressed will be sufficiently strong to free both” (p.44). Moreover, “(i)t is only when the oppressed find the oppressor out and become involved in the organized struggle for their liberation that they begin to believe in themselves” (p.65) (Freire, 1973). Similarly, in emancipatory research, power is in the hand of the researched, making it beneficial and liberatory for the researched as well as the researcher. Not only does a humanistic approach to research build and foster relationships of understanding, it also enriches the work of the study by providing richer and more valuable results (Paris, 2011).

In summary, humanizing research is empowering and liberatory, it questions mainstream knowledge, attitudes, and stereotyping that discount the knowledge and influence of other cultures. Schools tend to authenticate conceptions of what is normal, authentic, and mainstream, often discounting knowledge and influence of other cultures and traditions (Kumashiro, 1999; Subedi, 2007). Researchers need to question “unexamined common sense” … and “see our givens as contingencies” (p.23). “(T)hen we may have an opportunity to posit alternative ways of living and valuing” (Greene, 1995).
Integrity: Participant voice and agency, and reflexivity

Participant voice and agency are central to research with a social justice framework. Research, in order to be more worthwhile, needs to position participants at the helm of affairs. Researchers in the past excluded discussions with the participating communities, leading to discovering, appropriating, and commodifying knowledge about the “other” (Bishop, 2005). This legacy of helping the “other” needs to be resisted (Denzin & Lincoln, 2008) and instead, research needs to be a combined enterprise of learning in which the researcher collaborates with the researched. Even critical interpretive methods need to be reconsidered, because the theory’s self-determination and empowerment objectives also could perpetuate neocolonial attitudes (Denzin and Lincoln from Bishop, 2005). Bartolomé (1994) argues for a pedagogy that respects and uses perspectives of the learners (in the case of research, participants) as an integral part of the educational/research practice.

Subjects and researchers need to be engaged as equals, collaborating to produce not just knowledge, but also sharing their beliefs and values (Tomaselli et al., 2008) and perspectives. Dillard (2000) study, comprising of women’s narratives of their feminist struggles is a classic example. The study posits an “endarkened feminist epistemology” (p.661) that positions Black feminist thought from their own standpoint, as against that of the researcher’s. Another example is Smith's (1999) position of “decolonizing the academy” that creates spaces in which indigenous people are empowered to question and confront colonizers. Decolonized academy honors difference, promotes healing, is interdisciplinary, and politically proactive. It seeks social justice, and research models
that are “not based on positivist assumptions”, but rather “spaces for indigenous and nonindigenous scholars to interact with mutual respect”. In such a model, there is no presence of need for control, but collaboration and compassion (Denzin & Lincoln, 2008).

Theorists proposing a decolonized perspective posit that even designing the study should be a collaborative process. In their study, Tomaselli et al. (2008) share how their methods developed as they conducted research, based on participants’ (informants) lives and their own reflexive practice. In designing studies, researchers working marginalized groups seek methods and standards of inquiry grounded in the community’s practice, principles, and culture (Denzin & Lincoln, 2008; Dillard, 2000; Smith, 1999). Participatory research that privileges the voice and agency of participants is a collaborative effort, in which “both researchers and participants seek to push against inequities not only through the findings of research but also through the research act itself” (Paris, 2011). Researchers are asked to be proactive and craft their own version of science and empirical activity; develop a participatory model; use theory proactively, as agents of change; and resist new forms of colonization (Smith, 2005). All these require a high degree of reflectivity and reflexivity on the part of the researcher.

Reflexivity is primary to education and research for social justice. Without reflexive practice, research simply becomes a data-gathering mechanism that treats participants as objects for study and generalizations. Humanizing research does not leave the researcher untouched. Sharing from their own field experience, Tomaselli et al. (2008) posit that indigenous ethnography cannot leave the researcher unchanged
Reflexive practice in research allows the researcher to acknowledge what she/he brings to the research through her/his background (Apple, 1979; Subedi, 2008; Tomaselli et al., 2008). Several researchers’ writing reflects this acknowledging of “the baggage” one carries into one’s work. Researchers use personalized narratives as tools to reflect on interactions (as opposed to scientific inquiry methods where the researcher is considered a mere ‘observer’). Subedi (2006) reflected on his “halfie-researcher” status as he interacted with Asian American teachers. Kumashiro (1999) reflecting on his own experiences, was led to research how intersectionality doubly oppresses queer Asian Americans in mainstream American society. Smith (1999) reflects on her challenges as an ‘insider’ while also being an ‘outsider’ in conducting research within one’s own community. Reflectivity about one’s own positioning, biases, and practice therefore is an integral part of research for equity and social justice.

**Summary**

To summarize the section on theoretical perspectives, I propose that a research study informed by equity and social justice must be characterized by clarity, compassion and integrity. *Clarity* gives the study clairvoyance about the sociopolitical context that shapes education today. Knowledge made available to students in school is often selective and parsed to privilege and reinforcing hegemony. Social justice education and research need to provide a space to critique these power structures and allow students to do the same. Secondly, *compassion* humanizes the study, where relationships are built on mutual respect and sustained even after the research is over. The goals of the research are
empowerment and liberation of individuals and communities. Research in the framework of social justice allows the researched and the researcher to question and challenge accepted norms, making it a liberatory endeavor. Thirdly, _integrity_ gives the study character. A strong emphasis of the research is participant voice and agency. The research privileges the participant, her aspirations and voice, and the needs of the community. It is also a place where the researcher is reflective about her position and biases, paving the way for transformation.

The theoretical framework described in this chapter also guides the research methodology. In the following chapter, the study’s methodological framework is used to describe the context, data collection procedures, and data analysis.

**Review of relevant research literature**

The next section of this chapter is a review of research literature relevant to my study. The purpose of my study was to investigate teacher practices and intentions in teaching mathematics equitably to students from disadvantaged communities, especially those from low SES families. The intent was to gain insight into the teacher’s goals and intentions while she makes instructional decisions particularly as a means to provide opportunities for students’ self-empowerment as learners and doers of mathematics. This review of literature begins by defining key constructs that are relevant to the investigation: _diversity, equity, equity pedagogy, social justice, and social justice pedagogy_. Then, a review of literature on teaching for social justice, a pertinent topic in the field of mathematics education will be provided. Next, since the context for the study is among students who are marginalized by virtue of being ELLs and from low SES
populations, literature focusing particularly on engaging students from these groups in meaningful mathematics will be reviewed. The reader will find that there is a significant overlap between the two sections since so much of the work of social justice education is focused on marginalized and low SES communities. After this, challenges to teaching for social justice as they appear specifically pertaining to teacher perspectives will be identified before I reiterate my research questions.

**Key Concepts**

In attempting to provide a background for my study, I will first define some key concepts that are relevant: diversity, equity, equity pedagogy, social justice, and social justice pedagogy.

**Diversity**

Diversity is commonly understood in terms of race and ethnicity, but also in terms of religion, socio-economic status, gender, ability, sexual orientation, etc. The definition offered by Hodge (2006) uses “culture” to characterize diversity as

…relating to situations in which students and teachers of different cultural backgrounds and experiences come together in educational institutions. In this view, diversity can be described as *cultural* diversity with culture encompassing race, ethnicity, home life, economic class, gender, the interaction among these dimensions and categories, and how these categories are defined and come to life through lived experience. I describe culture, not in terms of race, but rather in terms of common practices within groups. (Hodge, 2006, p.374)
The above definition tends to blur defining lines between various subgroups, since culture can be fluid and changing, primarily due to increasing migration around the globe. Moreover, one might also belong to multiple cultures at the same time, and negotiating those cultural experiences is a natural phenomenon of life in society today. Besides these cultural experiences, children in classrooms experience another kind of culture, created largely by the teacher. Students are also immersed in the school culture and the culture of their homes and communities, giving rise to what Ayers (1998) calls the “concentric circles of context (p.xvii)” that they are negotiating constantly. Hence, one view is to use the term diversity as a means to describe differences or variety of cultural experiences of people living in a society.

Another view of diversity found in the literature is one that uses the term not as a means of distinction, but instead as something to be achieved (eg. Herzig & Knott, 2005). Diversity is valued as a mathematical goal, a pedagogical goal and a social justice goal. As a mathematical goal, diversity provides a different view of mathematics that is fluid and changing, with multiple perspectives on problem solving, connections to the real world and knowledge from cultures around the world. As a pedagogical goal, diversity creates a learning environment that is equitable for all children by encouraging independent thinking and richer interaction in the classroom (Herzig & Knott, 2005). As a social justice goal, diversity provides equitable opportunities for all members of a democratic society. Diversity seen in this light accepts difference and provides environments that help all students succeed, rather than grouping, categorizing, or
labeling students into subgroups. For this study, the understanding of diversity is embracing difference and providing learning opportunities for all students.

**Equity**

Equity is often understood to mean ‘equality’ and such an understanding would lead one to believe that equity could be achieved by providing equal opportunities. According to this definition, equity in education might mean equal access to good teachers, resources and meaningful learning opportunities, but this would ignore the fact that different students need different resources and experiences (Gutiérrez, 2002) in order to be successful. Lipman (2004) defines equity as “equitable distribution of material and human resources, intellectually challenging curriculum, educational experiences that build on students’ cultures, languages, home experiences, and identities; and pedagogies that prepare students to engage in critical thought and democratic society” (p. 3). So while equality is based on equal distribution of resources, equity takes into consideration diversity and is followed by strategies that accommodate diversity. NCTM (2000) emphasized equity as one of its guiding principles by stating that “Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students” (p.12).

Achieving equity in mathematics education, therefore, has to do with creating opportunities for all students to access high quality mathematics by providing resources that they need, high quality teaching and pedagogy that supports all learners. Creating such environments has been the topic of research in order to inform practice, and Jo
Boaler (2002) contends “investigations into equitable teaching must pay attention to the particular practices of teaching and learning that are enacted in classrooms (italics in original)” (2002, p. 239). Hence the need to look at the role of pedagogy in achieving equity in mathematics.

**Equity Pedagogy**

Banks & Banks (1995) posits that “equity pedagogy within a pluralistic democratic society should help students to gain the content, attitudes, and skills needed to know reflectively, to care deeply, and to act thoughtfully (pg.152).” Banks and Banks (1995) describe equity pedagogy as teaching that is dynamic, by virtue of being strongly student-centered and flexible by virtue of being able to attend to individual student needs.

Further, equity pedagogy addresses the needs of the society of which students are seen as an integral part, which makes the goal of equity pedagogy to help students not only understand society, but also become agents of social change (Banks & Banks, 1995). Hence, equity in mathematics education not only accommodates a diverse range of student abilities and understandings, but also provides opportunity to promote the ability to question and change social practices through mathematics (Gutiérrez, 2000; Gutstein & Peterson, 2005). Teaching for equity involves engaging all students in opportunities to learn in a way the students want to learn and in a way that prepares them for their place in the world. Therefore, equity pedagogy emphasizes bringing the world into the classroom (Gutstein, 2006; Sheldon, Woodhead, & Light, 1991), for teachers to know these real-world contexts (Ball, 2000) and building environments in which children feel safe to ask questions, express views and exchange ideas.
In spite of the emphasis on equity in the past, researchers are still apprehensive about exactly how equitable environments are to be created in classrooms (Hodge, 2006). While some laud the efforts of NCTM for pushing for reform, researchers caution against reform for reform’s sake without paying attention to the larger societal issues that influence student interaction and learning (Carter, 2009; Lubienski, 2002) or how race and a racialized society have contributed to inequities in mathematics education (Carter, 2009; Martin, 2009). Some mathematics education researchers are critical of reform-based strategies suggested in the standards documents because the focus on equity as equal opportunity does not attempt to address social inequalities, or give direction as to how mathematics can be used as a tool to address them (Gutstein, 2006).

Social Justice

Social justice holds different meanings for different people. On the one hand there are two theoretical approaches – the deductive and inductive approaches. The first approach employs the idealistic concept of justice, while the second, a more realistic concept, takes into consideration socially unjust structures. Any endeavor for social justice cannot ignore that social injustice exists (Tyson & Park, 2008). Researchers in education are asked to pay attention to social justice in education precisely because social injustices exist as marginalization and oppression based on issues of race, color, gender, SES etc. Any work for social justice in education must necessarily acknowledge the existence of social injustice as a reality and begin there.

For some, social justice is synonymous with distributive justice, where equality is primary for fairness. With this view, equal access, equal opportunity, and equal
distribution of resources are considered important for social justice. Others view social justice as more than distributive justice; as a part of social justice but not an end in itself.

Some researchers use egalitarian notions to argue for the distributive version of justice that seeks to create equality of opportunity in education for all students (Boyles, Carusi & Attick, 2009). They contend that making all students, irrespective of race, socioeconomic background or ethnicity, learn the same content and using the same methods of assessment is working for social justice. On the other hand, progressivist thinkers like contend that this narrow approach reifies what Freire calls the “banking concept” (Freire, 1973, p. 72), which perpetuates the wider injustices like sexism, racism, homophobia that exist in society and that are reflected in the curriculum (Howe, 2009; Ladson-Billings, 1994). John Dewey is one of the most influential progressive theorists of the twentieth century. In his view, “schools were important in the degree to which they assisted students in becoming critical social beings who worked to create a more egalitarian society” (from Kliebard, 1995 in ibid.). Dewey (1964) believed that schools should be agents of social justice to right the injustices in society, while most conservatives argue for assimilation and equal access.

Social justice pedagogy

As a consequence of the varied views of what social justice is, there are also contrary views on what social justice pedagogy is. Whereas most scholars and practitioners agree on the importance of social justice education as crucial for holistic education, its critiques have pointed to the complex meaning and ambiguities, as well as
its “contested ideological significance” and implications for teaching content (Balch, 2006, p.1).

Social justice pedagogy includes, though not limited to providing spaces for ‘counter-narratives’ (Greene, 1998), making inter-textual connections by locating themselves in the texts and ‘knowledge’, as well as to look out for, and critique the gaps between the knowledge and lived experiences. As a catalyst for social change, social justice pedagogy enables students to appreciate “multiple perspectives, respect for cultural differences, understanding that people must not be discriminated against on the basis of race, gender, religion, sexuality, political affiliations, age, disability, location, social background or group membership (Tyson & Park, 2006, p. 25).”

Educators define education for social justice as a process, a style and a pedagogical stance that aims for “lifting the veil of ignorance” about issues of injustice that students face in their everyday lived experiences (Tyson & Park, 2006) to use their agency to challenge and transform their lives.

The primary focus of social justice education is hope, and “teaching what we believe ought to be” (Greene, 1998, p. xiv). Social justice mathematics pedagogy questions the accepted narrative in mathematics education. Stress on objectivity and neutrality in mathematics education literature has positioned mathematics as a discipline free from color, culture or social experience (Tate, 1995). Furthermore, traditional mathematics classrooms are characterized by their silence, insistence on procedure and rote-learning (Boaler, 2008; Spielman, 2008). However, mathematicians do their work by collaborating, communicating, sharing ideas and using multiple interpretations to solve
problems. Problem solving through collaboration to produce multiple possible solutions is at the heart of a mathematician’s work. While school mathematics emphasizes individual work, one right answer and one correct method, “real-world mathematics” is collaborative, rather fallible, having multiple representations, interpretations, and solutions (Burton, 1998). Students are rarely exposed to this rich and colorful view of mathematics. Mathematics taught through collaboration has the potential to challenge the curiosity of students, enhance the learning environment, and generate a positive attitude for the subject (Boaler, 2008; Burton, 1995; Ernest & Steffe, 1996).

Extensive empirical research exists on the usefulness as well as the challenges of collaborative learning strategies (Boaler & Staples, 2008; Esmonde, 2009; Fennema, 2000; Gupta, 2008; Lubienski, 2002; Martin, 2009; Van Petegem, Aelterman, Van Keer, & Rosseel, 2008). Esmonde (2009) details strategies suggested by some researchers for teachers to promote an environment supporting equity such as using socio-cognitive student roles such as manager, recorder, questioner, and mediator, although, these strategies do not always work. Another view is to design content that allows for multiple approaches and procedures, so that all students have opportunities to participate and contribute to the discussion. While there is general agreement that sharing of ideas, communicating, and argument are successful ways to learn, researchers also alert educators to be cautious as they plan student group work. Some studies show that socially constructed identities influence mathematics learning in group-work, often marginalizing the already struggling students (Esmonde, 2009; Lubienski, 2000).
Teaching mathematics for social justice

Teaching mathematics for social justice is more than teaching for mathematical proficiency. It is also more than ‘just good teaching’, using Ladson-Billings' (1995) term. While the primary goal of good mathematics teaching is proficiency, teaching for social justice aims at individual and community transformation and liberation. I elucidate by referring back to what William Ayers calls teachers’ “dialectical stance” (Ayers, 1998), with one eye firmly fixed on the students – Who are they? What are their hopes, dreams, and aspirations? Their passions and commitments? What skills, abilities, and capacities does each one bring to the classroom? – and the other eye looking unblinkingly at the concentric circles of context – historical flow, cultural surround, economic reality. (Ayers, 1998, p. xvii)

In other words, there are two aspects of a mathematics teacher’s work that reflect the practice of social justice teaching. One is to “fix one eye on students” to help them gain mathematics competency for individual empowerment, and the second is to “fix one eye on the context” to encourage students to become critical thinkers and agents of social change. Cochran-Smith (2004) contends that both academic and critical goals of teaching require that teachers need to make inequity, power and activism an explicit part of curriculum. Students need to be encouraged to think critically about information, and helped to name and deal with individual instances of prejudice as well as structural and institutional inequities.
Key characteristics of social justice education relevant to this study include: a) a focus on student self-empowerment, b) teaching with a real-world perspective, and c) providing a collaborative learning environment.

I begin the discussion of these three key aspects of social justice teaching with hooks' (1994) reminder that the goal should be that of hope:

My hope emerges from those places of struggle where I witness individuals positively transforming their lives and the world around them. Educating is always a vocation rooted in hopefulness. As teachers we believe that learning is possible, that nothing can keep an open mind from seeking after knowledge and finding a way to know. (hooks, 1994, p. xiv).

Social justice education literature reflects a pedagogy of hope, especially in places of inequity and struggle as in the case of high-needs populations. It is arousing a heightened social consciousness in students, as a result of reflectivity, and a sense of agency, as they become engaged in social change.

**Student self-empowerment**

Teaching for student self-empowerment is “to teach for enhanced perceptions and imaginative explorations, for the recognitions of social wrongs, for sufferings, of pestilences wherever and whenever they arise” (Greene, 1998, p. xiv). Freire calls this “conscientização”, (Freire, 1973, p. 67); helping students move beyond self-interest, and helping them feel self-empowered to think critically.

In teaching mathematics for self-empowerment two aspects of a teacher’s work are emphasized. While one aims to help students build confidence in their mathematical
competency by developing *mathematics literacy*, the second results in their self-empowerment with regard to *critical* and *community* literacies that engage learners to become critical thinkers engaged more responsibly with their communities (Spielman, 2008). The result is a transformative curriculum, in which content is adapted to help students analyze social inequalities, critique and work for social change (Giroux, 2004; Gutstein & Peterson, 2005).

**Real-world perspective**

Another significant feature of teaching for social justice is that it is taught with a real-world perspective (Burton, 1998; Giroux, 2004; Gutiérrez, 2002; Gutstein, 2003). Freire (1973) emphasized the value of the social experience as part of a systematic way of learning. The content they learn needs to be significant and meaningful for the student. Students often think that the mathematics they learn in school is disconnected from the world of experiences outside the classroom (Spielman, 2008). Although they realize that mathematics, with its “gate-keeper” (Stinson, 2004, p. 8) status is useful for their future professional life, students often question the usefulness of the content presented to them, especially in a traditional classroom, typically driven by a set of rules and formulae, memorization, skill and rigorous practice.

Miller & Gildea's (1987) study about the English language highlighted the relevance of what students learn in the classroom to their experiences outside it. Children in the study who were taught vocabulary from dictionary definitions did not convey the correct meaning as when they learnt the language by participating in the everyday use of the language. Another seminal study from mathematics education is that by Nunes,
Carraher, & Schliemann (1993) documenting their observation of Brazilian street vendors’ children performing mathematical manipulations while they helped their parents sell their wares. The study found that as the children helped their parents sell coconuts on the streets, they were able to negotiate the cost of coconuts with mathematical fluidity and ease. On the other hand, the same children were unable to do the same kind of computations in an academic setting. It seems critical therefore, to connect the material to students’ everyday lives in order to increase their engagement in the mathematics classroom.

Making connections with the real world also engages students to think about their lives more critically. In describing his work among students from low-income families, Gutstein (2006) unpacks what it means to read and write the world with mathematics. Reading the world involves using mathematics as a lens to develop sociopolitical consciousness among students, while writing the world is developing a sense of social agency. Students learn to question previous understanding and knowledge with the objective to create a better world for themselves and their communities (Gutstein, 2006).

Teaching for social justice therefore, involves teachers doing significant work among communities, making connections between the world of the classroom and the world outside it. As classrooms get more diversified especially in the urban context, teachers use social participation and projects that help students make those connections by building on students’ knowledge and interests, and cultural and linguistic resources to co-construct knowledge (Cochran-Smith, 2004).
Collaborative learning

A third aspect of teaching for social justice is learning through collaboration: sharing authority with the objective of “knowledge construction” (Banks & Banks, 1995) where students are provided with opportunities to co-construct meaningful knowledge. Based on the principles of constructivism, this involves students collaborating in social groups to construct knowledge (Ernest & Steffe, 1996). By being willing and open to the idea of knowledge co-construction, teachers recognize that students come with their own body of knowledge and experience, and have the potential to contribute to collective knowledge (Cochran-Smith, 2004). In doing so, the teacher necessarily needs to forfeit her or his authority in the classroom and enable shared responsibility for knowledge construction (Esmonde, 2009). Freire (1973) suggests there is virtue in “understanding and experiencing the beauty of exposing ourselves as teachers to the wisdom of our students.” By doing so, the teacher assumes that all students are makers of meaning and all are capable of dealing with complex ideas (Cochran-Smith, 2004).

Effective collaboration is characterized by inquiry as Freire recommends, a “pedagogy of questions” rather than a pedagogy of answers (Freire, 1973, p. 72). Opposing the “banking” model of education in which the teacher “deposits” knowledge into the empty minds of students, Freire (1973, p. 72) posits a ‘mining’ model in which the teacher ‘draws’ from the wealth of knowledge the students bring. Through dialogue and exchange of ideas, the teacher challenges the students to find their voices, and express their thoughts (Freire, 1973), while the teacher moves little by little into the background as a facilitator of student-centered learning (Leedy, LaLonde, & Runk,
2003). The teacher also follows up by making informed decisions about using the knowledge of the cultural and ethnic backgrounds of the students when making pedagogical decisions.

**Low SES and ELL students’ engagement**

Socioeconomic status has been defined in different ways in education. Mueller & Parcel (1981) suggest a definition that has since been used by researchers to ground their work:

The term ‘social stratification,’ ….. is used to describe a social system (usually a society or community) in which individuals, families, or groups are ranked on certain hierarchies or dimensions according to their access to or control over valued commodities such as wealth, power, and status. A case's relative position (and associated score) on a particular hierarchy (or combination of hierarchies) may be referred to as its SES. (Mueller & Parcel, 1981, p. 14)

Researchers use parental income, parental education, parental occupation, and home resources as indicators of this hierarchical status. In a meta-analysis of research published between 1990 and 2000 relating socioeconomic status and academic achievement, Sirin (2005) reported that the studies suggest that parents’ location in the socioeconomic structure has a strong impact on student achievement. This is not surprising since family SES helps determine the type of school, classroom environment, resources and quality of instruction accessible to the student. Besides family SES, the review also showed that the magnitude of the relationship between SES and student
achievement depended on factors like the type of SES measure, and student characteristics like grade, minority status, and school location. Moreover, studies have shown that low socio-economic status (SES) and urban students have teachers with less experience, lower mathematics test scores, and lower Mathematics Knowledge for Teaching (MKT) (Hill, Rowan, & Ball, 2005; Lubienski, 2008). This is a matter of concern since knowledge of mathematics is key to success in today’s technologically advancing world.

The latest concern for teaching for equity is accountability through standardized testing, which some view as creating further divide (Sleeter, 2007). Mathematics, often identified as the queen of disciplines, privileges students with high achievement in mathematics, and considers them to be gifted. Such an absolutist view, according to Martin (2009) privileges some and produces and maintains inequity. Although established to promote equity and excellence, the No Child Left Behind (NCLB) (2002) policy has some teachers more focused on achievement tests rather than on improving student understanding and learning. This focus on teaching to the test could continue to marginalize those from historically marginalized communities (Sleeter, 2007), since the goal of teaching is standards-based (which is often minimal) rather than understanding.

While research offers strategies to support all students’ mathematics learning, there are also studies that report the challenges of teaching students from disadvantaged communities. Gutiérrez’s (2000) study examining aspects of the work of teachers and leaders in a successful mathematics department offers strategies for teachers and teacher educators to support all students (Gutiérrez, 2000). Bell (2007) offered a technology and
self-regulated learning lens to support culturally diverse students’ mathematical understanding. While successful stories offering steps towards better supporting all students (Gutiérrez, 2000) keep teachers and teacher educators optimistic, reports like Bartell’s (2011) study, documenting challenges teachers face as they balance social justice and mathematics goals provide caution. In the following section, perspectives from the field on supporting all students learning in mathematics will be presented.

**Collaborative learning opportunities**

Research on low SES student participation in mathematics classrooms is limited (Esmonde, 2009). Researchers suggest two aspects of teaching that provide a context for equity: helping students see the usefulness of mathematics beyond calculations and having each member of the group contributing something useful. Here I consider the second aspect. Helping students assume positions of authority has been proved to support group collaboration. All students can be positioned as competent learners and engage in meaningful mathematics. This enables students move from peripheral to central participation (Lave & Wenger, 1991). Esmonde’s (2009) review identified gaps in the literature on how to structure activities to support students who were English Language Learners (ELLs), and how the composition of classrooms having ELLs impact cooperative activity. Studies on ELLs participation in mathematics classrooms seems limited.

In an effort to understand equitable mathematics teaching, especially for low SES and ELLs, by having students working in groups, Boaler & Staples (2008) conducted a five-year longitudinal study covering three high schools. The study reported that teachers
engaging in reform-based practices in the school with the greatest amount of low SES and ELL students showed the greatest gains. One of the key elements of reform-based teaching is having students’ collaborative group-work opportunities. Teacher practices identified besides having students working in groups were asking questions covering a range - procedural, conceptual and probing questions, and posing longer more conceptual problems. As a consequence, students spent more time on each problem and covered less problems than those in traditional classrooms (Boaler & Staples, 2008). Therefore, as the study showed, student collaborative group work is closely linked with other reform-based practices.

Some researchers provide words of caution. While Esmonde's (2009) review of literature offers ways in which collaborative learning might be used to support low SES students, Lubienski's (2002) study cautions those who might readily accept cooperative learning as a successful instructional strategy. Lubienski’s (2002) study offers a different perspective on high and low SES student participation in a mathematics classroom. The study examined seventh grade students’ experiences in the mathematics classroom using problem-based curriculum and pedagogy with particular focus on the differences between high and low SES students’ reactions to learning mathematics through problem solving. The study was conducted by the researcher/pilot-teacher in her classroom over a period of one year. The Connected Mathematics Project (CMP) curriculum used open contextualized problems in the classroom, and the phenomenon examined by the researcher was how students from the different SES levels respond to it. The findings suggested that while higher SES students preferred contextualized problem-solving to
traditional lessons, lower SES students preferred a more directive teacher role. Both groups agreed CMP made them think more, although higher SES students said they were personally helped by the curriculum, while lower SES students talked about the benefits more from an external standpoint – what they should be learning or what others said they were learning. Most higher SES students expressed the view that class discussions “exposed them to different mathematical ideas” and that their role was to “analyze those ideas”, most lower SES students said discussions helped them in “obtaining or giving right answers to specific problems” (Lubienski, 2000, p.113). Another critical point made from the study is that lower SES students were more likely to mistrust and ignore the data while problem solving, and preferred to reason in personalized and common sense terms. They were more contextualized in their orientation and offered personal stories. In contrast, higher SES students tended to look at the data to find loopholes, with a more mathematically focused and impersonal perspective. Although the findings from the study might not be generalizable, they point out that special considerations need to be given while researching students from low SES backgrounds (Lubienski, 2000).

**Critical pedagogy**

Critical theorists (eg. Freire, 1985; Giroux, 2004) concur that while educational opportunities are unequally distributed on the one hand, pedagogy in classrooms on the other has the capacity to perpetuate inequity. Studies have shown that students of color and students from families with low SES status do not show as much success in mathematics as their white counterparts or those from higher SES (Ferraro et al., 2006). Reasons for this are many. While on the one hand, policies, curricular decisions and
standardized testing might have a negative impact, on the other, it might be because of the way mathematics is being taught. Choices that teachers make regarding instruction and pedagogy could potentially marginalize some students (Giroux, 2004).

Researchers influenced by critical theory posit a pedagogy that explicitly uses mathematics as a tool to critique social injustices and work towards social change. The goals of critical mathematics pedagogy is two fold: mathematical competency and social justice (Gutstein, 2003). The first results in helping students feel empowered with mathematics competency and developing what Spielman (2008, p. 651) calls “mathematics literacy”. The second results in their empowerment in regard to two other literacies recommended by Spielman (2008) – “critical literacy” (p. 652) and “community literacy” (p.653). Critical and community literacies in curriculum and instruction have overlapping objectives that engage learners to become critical thinkers, while also engaging them more fully, more meaningfully, and more responsibly with their communities (Spielman, 2008).

Gutstein's (2003) work among students mostly from low SES populations is strongly influenced by the works of Freire (1985, 2005) who argued that the oppressed hold within them the power for not only their own liberation, but also that of their oppressor. Gutstein (2003) reasoned that “students themselves are ultimately part of the solution to injustice, both as youth and as they grow into adulthood (p. 39)”. Thus, the goals of critical mathematics pedagogy are in helping students become aware of the true conditions of their lives and become agents of social change. When teachers accept these goals, according to Gutstein (2003), it is possible to teach mathematics so that students
“read the world” (p.44) with math, “develop math power” (p.44), and change their “dispositions toward math” (p.60). Gutstein (2003) hypothesized that integrating mathematics and social justice goals have the potential of building students’ self-empowerment and sociopolitical consciousness.

**Multicultural perspective**

Multicultural education literature offers a perspective aligned with social justice education, which is to “provide all students with the skills, attitudes, and knowledge needed to function within their community cultures, within the mainstream culture, and within and across other ethnic cultures” (Banks, 2008). Multicultural education (MCE) theorists posit antiracist, critical, and social justice goals (Darling-Hammond, 2002; Nieto, 1999) promoting good civic values that attempt to “reduce the pain and discrimination that members of some ethnic and racial groups experience because of their unique racial, physical, and cultural characteristics” (Neito, 1999, p. 3). Multicultural education has a five-pronged approach (Banks, 2008): a) content integration, which involves integrating content as it is developed in diverse cultures and methods; b) knowledge construction process, which has to do with students’ engagement in constructing meaning; c) prejudice reduction, which helps students understand and value other cultures as well as their own; d) equity pedagogy, that is student-centered, helping develop student content knowledge and social responsiveness; and e) empowering school culture and social structure, that supports student self-empowerment and community values. These five aspects of multicultural education are geared toward inclusion of knowledge and perspectives of marginalized cultural groups.
Specific to mathematics education, a large body of work grew out of the theories of *Multicultural Mathematics* (Nelson, Joseph, & Williams, 1993) and *Ethnomathematics* (D’Ambrosio, 2001). Proponents of these theories express concern that mathematics as it was and still is taught in schools today is devoid of culture and the real world experiences of students. In a seminal study of young Brazilian street vendors, it was found that although the children could easily perform calculations as they negotiated the price of wares, they were unable to translate their skill to their school work (Nunes, Carraher, & Schliemann, 1994). The key impetus for these two theories emerging out of *multicultural education* is the disconnect students of mathematics felt between their school and lived experiences. One of the early advocates of *ethnomathematics*, D’Ambrosio (2001) suggested that teachers can help students realize their full mathematical potential by understanding how mathematics was culturally developed and used in different parts of the world. Such an approach acknowledges the historical development of the discipline and allows students to further construct their own personal understanding of it. Similarly, *multicultural mathematics* and the work of Nelson, Joseph, and Williams (1993) emphasizes drawing in mathematics concepts from around the world into the curriculum. Multicultural mathematics (and in fact, multicultural education) questions the superior/positivistic positioning of Western knowledge. Theorists in the field distinguish between what they envision as multicultural mathematics and the ‘multiculturalism’ of education in the name of multicultural education (Nelson et al., 1993). Multiculturalism usually results in incorporating some artifacts from other parts of the world or celebrating events particular to other cultures and ends up being a colorful and entertaining addition
to the school. On the other hand, multiculturalism is an authentic effort to recognize contributions of multiple cultures and societies to the field of mathematics (Nelson et al., 1993).

**Culturally relevant pedagogy**

At the individual level, social justice pedagogy seeks balance between cognitive and emotional components of the learning process (Adams, 2007), giving equal attention to student affect and academic excellence. Current mathematics education scholarship on culturally relevant teaching draws from Gloria Ladson-Billings’ CULTURALLY RELEVANT PEDAGOGY (Ladson-Billings, 1995). Putting together the concepts of ‘cultural congruency’, ‘cultural responsiveness’ and ‘culturally compatible pedagogy’, Ladson-Billings defines CULTURALLY RELEVANT PEDAGOGY as being “specifically committed to collective, not merely individual, empowerment” (p.160). Culturally relevant pedagogy places high expectations on all students, and helps them achieve academic excellence, cultural competence and critical consciousness (Ladson-Billings, 1995) as does social justice education (Cochran-Smith, 2004).

Two other perspectives from literature make similar points that are useful to this discussion. One of them is CULTURALLY RELEVANT CARING (Parsons, 2005), and the other is CULTURALLY RESPONSIVE TEACHING (Gay, 2000). Parson’s work as a White teacher making the effort to bridge her perceived distance from her Black students, led her to think about what it means to move from merely caring to culturally relevant caring. Parsons (2005) draws attention to the statistic that 84% of teachers in the US are White, and are often unaware of their status of whiteness and white privilege.
Caring for one’s students is often a primary reason cited by teachers to enter and stay in a profession in spite of the disadvantages of poor salaries and lack of administrative support (Parsons, 2005). For many teachers, satisfaction comes from seeing the ‘light’ of understanding in their eyes (Nieto, 1999). Parsons (2005) posited that CULTURALLY RELEVANT CARING has three basic components: a) “engrossment” (p.26), which is giving one’s full attention to and acting in the best interest of the cared-for; b) “receptivity” (p. 26), which is non-judgmental acceptance of the cared-for; and c) “vision” (p. 27) of the best possible outcomes for the recipient of care. The goal of culturally relevant caring is social change, with teachers facilitating reflection, critical thinking, and collaborative problem solving explicitly around social awareness and change (Parsons, 2005).

CULTURALLY RELEVANT CARING is caring for the individual student and also about the sociocultural factors that the student brings; understanding the student’s individual needs, hopes and dreams, along with the larger contextual issues of the student’s life that impact those needs, hopes and dreams. This would require moving beyond acceptance of the learner as an individual to respecting everything he or she represents; moving beyond what one perceives as the best interest of the student to being willing to allow the individual to seek his/her own best interest and being willing to stand by that individual (Parsons, 2005). Culturally responsive teaching has a multicultural curriculum component as well, and uses the cultural orientations and background experiences of the students to facilitate teaching (Gay, 2002).
Challenges in teaching for equity and social justice

Mathematics teacher educators and teachers working for equity and social justice face the challenge of incorporating principles of equity in their work. Brewley-Kennedy (2005), investigating a methods course for pre-service elementary teachers, documented personal struggles that a teacher educator encounters when setting agendas for equity, and to what extent the teacher educator is able to address equity issues explicitly and implicitly. Brewley-Kennedy (2005) identified the main challenges of the teacher educator as the need to maintain a “safe place” (p.21) in class, one’s own sense of preparedness to discuss equity issues, student resistance to equity conversation, and one’s own comfort in discussing certain topics. Another key factor the instructor is challenged with in a multi-race classroom is what the literature identifies as “Silence in Whiteness” (p.24), a seeking of safeness in silence among White teachers. de Freitas (2008) also reported from her own action research project on pre-service mathematics teacher resistance to social justice issues. de Freitas (2008) suggested that self-study narratives (of identity) could be used to develop critical awareness among pre-service teachers. While there are suggestions of how awareness of equity and social justice issues can be integrated into teacher education programs, one can never be certain as to how pre-service teachers’ exposure to them translates into their classroom practice.

Teaching mathematics for equity and social justice is not a simple and straightforward task; there are many challenges. Even those teachers who reflect a commitment to equity seem to be challenged in their work for equity in practice. Reed & Oppong (2005) conducted a study on teachers who seemed to be committed to equity, to
examine how they actually attend to equity in their classrooms. Two high school mathematics teachers teaching in diverse classrooms were purposefully selected to participate in the study because in their interviews they were able to articulate their beliefs about and commitment to equity. The study focused on the participants’ attention to equity in their classrooms as a result of their commitment. In practice, though, the teachers exhibited that they still had trouble holding high expectations for all students, as they spoke of Black students and careers in sports. Without offering any generalization, the study offers examples of how knowing what equity should be does not necessarily result in equity in practice (Reed & Oppong, 2005).

A present day challenge many teachers, however experienced, face has to do with policies that hinder work for equity. One example is the accountability criteria that are imposed on teachers through policies like the NCLB (2002) (Sleeter, 2008). Sleeter (2008) conducted a study exploring the extent to which two experienced classroom teachers were able to implement democratic practice in their classrooms and found that the teacher who had experience with democratic teaching felt thwarted by the pressure of accountability. With the pressure of accountability, teachers tend to focus more on making the goal of their teaching student achievement rather than understanding, which hinders teaching for equity as skill and drill becomes the norm rather than teaching for understanding (Sleeter, 2008).

For the purpose of the study, I focus on teacher perspectives about mathematics content and pedagogy. Teachers bring into their practice their own understanding of what mathematics is and how it was and is still being developed. Teachers are challenged by
the perspectives they bring into their practice in translating their social justice
perspectives (Erchick, Dornoo, Joseph, & Brosnan, 2010). In a study of teachers’ review
of student work samples, Erchick et al. (2010) found that teachers’ perspectives on
mathematics content and pedagogy influenced their implementation of equity pedagogy.
For instance, teachers with a procedural view of mathematics content showed less
evidence of equity in their responses than those with an integrated procedural-conceptual
view. With regard to pedagogy, those with a teacher-directed perspective showed less
evidence of equity in their responses than those with a learner-responsive perspective
(Erchick et al., 2010).

Teacher perspectives about the field of mathematics

An understanding of how the field of mathematics itself perpetuates biases is
essential for teachers as they begin their work for social justice. Mathematics, as it has
been taught over the years is viewed as a value-free discipline, consisting of absolute
truths, logical reasoning and rigor (Buerk, 1985). Both in its content and the way it is
presented is largely a Eurocentric view, having nothing to do with the culture or
experiences of students outside the classroom (D’Ambrosio, 2001; Joseph, 1993). On the
other hand, the objective of Indian and Chinese mathematics had been is to provide
evidence and validate their results using any method, including visual representations,
instead of only using a string of self-evident axioms (Nelson et al., 1993). Another
example of a Eurocentric view is seen in formal proofs. Validating formal deductive
proofs and dismissing other kinds like geometric proofs, offered in Indian and Chinese
texts, rejects notable work in these cultures. Burton (1998) criticizes what she terms the
colonization of mathematics, leaving students in Africa, Asia and Latin America unaware of the contribution of their histories to the development of mathematics. Nelson et al. (1993) posits that such marginalization not only denies the recognition of the heritage of minority students, it affects the attitudes of the majority about cultural dependency, and denies the field of a richer mathematical knowledge.

To some extent, the mathematics education community is moving away from the view that mathematics is fixed and beginning to think of mathematical knowledge as flexible, changing and developing. The community acknowledges that it is critical to help students see that there is no fixed way of finding solutions, that there could be multiple or no solutions, and there are multiple ways of representing a solution. Students need to be allowed to question, argue, make conjectures and justify their thinking in order to build mathematical knowledge and understanding. This understanding of a ‘fluid and flexible’ mathematics is often difficult to accept for many teachers.

**Teacher perspectives about mathematics content**

Teachers bring into their practice their perspectives about mathematics content. Many believe that mathematics is mostly about computational skills when mathematics is indeed much richer; and learning and teaching mathematics content with understanding is more complex than teaching and learning the skill of mathematical manipulations (Hiebert et al., 1997).

Mathematics, with its structure and well-defined content (as it is taught in schools today) lends itself to the discussion on two kinds of learning: conceptual and procedural. In Hiebert & Lefevre's (1986) view, the most widely understood distinction between
conceptual and procedural knowledge was that between skill and understanding. They posit that in the past, mathematics educators have argued their preference of one over the other using descriptors of distinction such as meaningful versus mechanical used by Thorndike in 1922, or schematic versus teleological by Gagne in 1977. Hiebert & Lefevre's (1986) define conceptual knowledge as a “connected web of knowledge, a network in which the linking relationships are as prominent as the discrete pieces of information” (p. 3-4). In other words, conceptual knowledge cannot exist as isolated pieces of information. Procedural knowledge, according to them, consists of two parts – one composed of the formal language, or symbol representation system, and the other of algorithms and rules. This is what makes procedural knowledge to be sequential step-by-step prescriptions to complete a task. Baroody, Feil, & Johnson (2007) clarify that Hiebert & Lefevre's (1986) do not limit procedural knowledge to knowledge without relations but that procedures are often embedded in other procedures. Star (2005) argues that both types of knowledge can have either a superficial or a deep quality and that knowledge type and quality should be treated as independent dimensions. Mathematics education researchers, according to Baroody et al., (2007), view procedural to conceptual as a continuum from sparsely to richly connected knowledge. They often contrast unconnected, disembodied, meaningless, context-bound, mechanical procedures (or ‘weak schemes’) and well-connected, contextualized, integrated, meaningful, general, or strategic procedural knowledge (or ‘strong schemes’). Researchers do agree, though, that flexibility and adaptability are critical components of mathematical proficiency (Baroody et al., 2007).
Skemp’s (1976) work with different types of understanding demonstrates to teachers how students understand concepts are in two distinct ways. The first way is *instrumental* understanding, which is procedural understanding and knowing how to apply formulas. There is very little thought process and many more memorizing steps given by the teacher. Under instrumental understanding students do not understand why, they only understand how to get the correct answer. The second type of understanding is *relational* understanding which falls into the category of constructivist teaching, where students understand how to apply a method but also why to apply the method and why the method works. Students can apply and adapt concepts to fit different ideas by transferring relatable knowledge. Skemp (1976) stresses that teachers should attempt to help students make their understanding more relational and less instrumental.

Star (2005) also defines procedural and conceptual knowledge as being orthogonal, and in which deep, flexible procedural knowledge can be achieved with or without conceptual knowledge. He awards great importance to ‘flexibility’ in determining the depth of procedural and conceptual knowledge. A student with only superficial knowledge, for example, would use well-practiced standard techniques, which may lead to less efficient or erroneous solutions. Such a student may also not have the flexibility of thinking to be able to apply their techniques to solve unfamiliar problems. Hence, flexible knowledge to “navigate through the procedural domain, using techniques other than ones that are over-practiced, to produce solutions that best match problem conditions or solving goals” Star (2005, p. 409) would be considered to be both procedural and deep.
Baroody et al. (2007) taking off from Star’s model refine the understanding of integration of conceptual knowledge and procedural knowledge. In their view, depth of understanding entails both the degree to which procedural and conceptual knowledge are interconnected and the extent to which the knowledge is otherwise complete, well structured, abstract and accurate. Their model gives the mutually dependent relationship between procedural and conceptual knowledge. As one moves progressively towards greater integration of the two, knowledge also becomes an increasingly well-structured, abstract and accurate web.

Integration of conceptual and procedural instruction is expected to enhance mathematics learning. Baroody et al. (2007) suggest that one way to do this is to ensure that children are exposed to the big ideas in mathematics so that they can look beyond the surface features of procedures and concepts to gain a deeper understanding of conceptual and procedural knowledge. Baroody et al. (2007) distinguish their conceptualization with degrees of depth/superficiality, connectedness, and mutual dependence/independence and note: “depth of understanding entails both the degree to which procedural and conceptual knowledge are interconnected and the extent to which that knowledge is otherwise complete, well structured, abstract, and accurate” (p. 123). Erchick et al. (2011) documented teacher change along the range of conceptualizations, from procedural to integrated procedural/conceptual and found that teachers may not be consistent in one position, but may be in between or shifting towards one or the other perspective. They also found that a teacher having a strictly procedural perspective on mathematics limits
students’ opportunities for learning with understanding provided by the integrated procedural-conceptual perspective.

**Teacher perspectives about mathematics pedagogy**

Teachers enter their practice with a range of perspectives on how mathematics should be taught. On one end of the continuum is a teacher-directed pedagogy, while on the other end is a learner-responsive pedagogy (Erchick et al., 2011). For any learning activity to be a fruitful exercise, it must go beyond feeding the students with knowledge to helping students make connections with that knowledge. Ball (2000) reinforces the idea that being sensitive to how a child might consider mathematical concepts and being able to use it is critical to be able to manage situations that arise in the classroom. Hence, there needs to be a purposeful moving away from what one might call a “teacher-directed” pedagogy to one that is “learner-responsive” (Erchick et al., 2011, p. 113). In a teacher-directed pedagogy, the teacher directs students on what to do, and on what and how to learn. The teacher plays the dominant role; and students respond to the teacher by following instructions. This is what Paulo Friere (1973) refers to as the “banking” model – with teachers depositing knowledge while students are mere recipients. In the “banking” concept of education, knowledge is a gift to be bestowed by those who have it on those who don’t, and in his view, mirrors attitudes and practices of an oppressive society. A liberating learner-responsive pedagogy does away with this dichotomy of educator and educated, giving an opportunity for both teachers and students to be part of knowledge creation.
The initial step in moving from teacher-centeredness to learner-responsiveness is student-centeredness, in which student tasks and learning form the objective of lesson planning. In student centered pedagogy the teacher’s pedagogical decisions are based on student understanding but are not necessarily flexible to address student needs based on collaboration with the learner. Learner responsive pedagogy, on the other hand, also includes a shift in responsibilities and roles in the learning process. This shift includes students doing the mathematical thinking and taking charge of their learning, as opposed to the teacher having greater authority and telling them how to think. There is an intentional move on the part of the teacher to make instructional decisions explicitly based on what is known about the learner and implementing a pedagogy that supports students’ cognitive needs (Erchick et al., 2010). Learner-responsive pedagogy calls for the need for ‘authentic’ or ‘performance’ assessment which enables teachers and students value high-quality work (Kornhaber, 2004), and giving constant feedback on performance in order to make further pedagogical decisions. This makes learner-responsive pedagogy flexible and adaptive to the students (Ball, 2000).

**Revisiting the research questions**

Reviewing literature on contexts that engage marginalized students in mathematics, Gutiérrez (2002) calls for a clearer research agenda around issues of equity, and a need for coordinated effort to help marginalized students to master dominant math, develop a critical perspective, and develop a positive relationship with the subject. Gutiérrez (2002) identified three main obstacles for addressing equity: first, the belief that math achievement is related to ability at birth; second, a “deficit” model that suggests
that the deficit is within students, families and communities; and third, research in which many issues get clumped together.

Even though teaching for equity is prevalent in discussions among educators, and a growing concern for teachers, it is not yet a major focus in mathematics research communities. Ladson-Billings (1995) suggests that researchers must continue work in finding out about the practice of successful teachers for students poorly served by our schools. Martin (2009) also reflects on this as he suggests we need to look more closely at the anticipated outcomes for success of marginalized students in relation to the constraints and opportunities in the larger social context. Research must include the voices of parents and communities in non-exploitative ways. And for practitioners, the place to find out about classroom practice is in the lived experiences of teachers. Ladson-Billings encourages teachers to study their own perspectives and practices. Her work challenges us to consider what ‘good teaching’ is and to look for it in unlikely places, and challenge those who say it cannot be made available to all children (Ladson-Billings, 1995).

Work for social justice in mathematics education does not have the attention it deserves in the present day; evident from the lack of attention it gets in different forums and conferences. Multiple agencies need to come together for schools to become places of equitable teaching practices and settings for individual and social transformation (Darling-Hammond, 2002). The research community has a crucial role to play by exploring how teaching for social justice could impact practice. While some researchers suggest research to critically examine the current structure and practice of school
mathematics by posing profound questions like ‘What is Mathematics?’ (Lim, 2008; Leedy et al., 2003), others suggest teacher dispositions are key to influencing practice (Erchick & Tyson, 2011). More research is needed to help unpack what teaching mathematics for social justice means for teacher education, teacher practice and student learning.

The need of the hour is classroom-based research on teachers’ pedagogy for students from diverse social and cultural backgrounds. Good and effective teaching practices need to be studied as case analyses, leading to vivid descriptive information that would inform practice. Research needs to find out more about core characteristics of these practices that lead all students to participate and achieve in mathematics, be critical of knowledge and society, and begin to erase inequities globally (Esmonde, 2009; Gutiérrez, 2002). Some researchers suggest studies in mathematics education should integrate research from other fields like cognitive psychology and social science to inform efforts to empower students of mathematics (Lubienski, 2002).

The objective of this study is reiterated as that of investigating an experienced teacher’s practice in her mathematics classroom of diverse students from low SES and recent immigrant populations. Teacher perspectives of the field of mathematics, its content and pedagogy, but also her perspectives of teaching mathematics for social justice that contribute to student self-empowerment are studied. In particular, the study will provide rich descriptions of what the teacher accomplishes in using instruction to help students’ self-empowerment and improvement in mathematics understanding. The study seeks to specifically address the following questions –
a. What instructional decisions does the teacher make that contribute to equitable teaching practices for students from low SES and ELL populations?

b. How does the teacher's disposition towards mathematics content and pedagogy influence her instructional and pedagogical choices for student self-empowerment in mathematics?

c. What goals are central to the teacher's pedagogy for equity and social justice?
Chapter 3. Methodology

The objective of my case study was to provide a vignette of what equitable teaching of mathematics looks like in the classroom and my investigation will focus on features that are particular to social justice pedagogy. I investigated teacher perspectives about the field of mathematics, its content and pedagogy and how those perspectives influence instructional decisions. I identified key features of Ms. Lara’s pedagogy that have implications for social justice, and suggest that her pedagogy influences students’ lives beyond learning of mathematical content and helps build student identities, especially those from marginalized and low SES families. In doing so, I also investigate what Ms. Lara believes she can and cannot accomplish, and the challenges she encounters in using instruction to help students’ self-empowerment as learners of mathematics and as social individuals. My study seeks to specifically address the following questions –

a. *What instructional decisions does the teacher make that contribute to equitable teaching practices for students from low SES and ELL populations?*

b. *How does the teacher's disposition towards mathematics content and pedagogy influence her instructional and pedagogical choices for student self-empowerment in mathematics?*

c. *What goals are central to the teacher's pedagogy for equity and social justice?*
The goal of this chapter is to describe the components of the methodology for this investigation. It begins with an explanation of the methodological principles I considered while preparing the study. These include a guiding methodological model (CCI Triangular framework) based on theoretical perspectives, the paradigm of research, researcher roles, and issues of credibility. Following this I provide a comprehensive description of the methodological practices I used for my investigation. A summary of the methodology for my study will conclude the chapter.

**Methodological principles**

This section begins with a description of my guiding principles for the methodology, the “CCI Triangular Framework”, based on the theoretical perspectives detailed in the previous chapter. After this, specific considerations that determined my methods will be described. These include the paradigm of research chosen, the researcher roles, and issues of credibility.
The "CCI Triangular Framework" (Figure 2) for the methodology of my study outlines three primary characteristics – *clarity (स्पष्टता)*, *compassion (करुणा)*, and
integrity (अखंडता). The meanings of the terms in Hindi (Devanagari script) helped me in providing those aspects that the English words do not necessarily imply. I will proceed to explain them in the following paragraphs.

The word “स्पष्टता” is a combination of having a clear vision and of cleanliness (free of blemish). Hence, when I establish the clarity of the study, I not only emphasize clarity in understanding the context and practice of the “case” using qualitative methods, but also reflect on my own position and biases as a researcher and teacher, having been an integral part in the study. The cleanliness is in refreshing and renewing my own understanding of what it means to teach mathematics equitably and reflect on my role as teacher-researcher-educator. The need for “स्पष्टता or Clarity” urged me, therefore, to seek a clear understanding of the teacher’s work from her perspective and also be more reflexive. I describe two methodologies that are pertinent to this objective: a) interpretive ethnography, and b) case study methodology.

The second concept integral to my study is “करुणा, or Compassion”. The word in Hindi is especially active, containing in it a purposeful drive toward action. Hence, करुणा is not a passive emotion that signifies having pity or feeling sorry for someone, but rather an active sentiment that urges one to social action. Furthermore, करुणा is two-sided. It benefits the giver as much as it does the receiver. My research necessitated action through a humanistic approach. The classroom support provided to the participant Ms. Lara provided me, the researcher, access and helped build relationships that are critical to
my work. While this is true, the study also informs the larger community of researchers, teacher educators, and practitioners in trying to understand a teacher’s pedagogy for social justice. Ms. Lara and her classroom as the site for my study provided the field with an “information-rich” (Patton, 2002, p. 169) case, which I will describe later on in the chapter.

The third characteristic of my study is “अखंडता, or Integrity”, which means solidarity and strength as much as honesty and truth. In providing rich descriptions of the teacher’s intentions, perspectives, and pedagogy I privilege participant voice. My descriptions will also contain sections where my voice is also heard and the challenges and struggles of both the participant and researcher are reflected in the telling of the story. In describing the data sources, the process of data collection, and analytical procedures, I do so with अखंडता, truthful and accountable to participant, students, and myself. अखंडता also provides me the necessity for considerations of reliability and validity relevant to my study.

**Qualitative paradigm**

The need for “स्पष्टता or Clarity” prompted me to pursue a clear understanding of the teacher’s work from her perspective and also reflect on my role as a teacher-researcher-educator. Hence, the nature of the study and research questions guided using a qualitative research paradigm. Qualitative researchers contended that their work with its subjectivity and interpretive approach provides a fuller understanding of human life and potential to “transform the world” (Denzin & Lincoln, 2005, p.3). Some qualitative
researchers contend that quantitative work, on the other hand, “reproduce(s) only a
certain kind of science, a science that silences too many voices” (Denzin & Lincoln,
2005, p.12). Qualitative investigators highly value detailed descriptions of interviews and
observations since they help them to “get closer to the actor’s perspective” (Denzin &
Lincoln, 2005, p.12). The particular qualitative methodology I chose is the case study
method, which I will proceed to justify.

**Case Study Method**

I argue that the case study method is an appropriate and necessary method for my
investigation. A case study essentially “tries to illuminate a decision or set of decisions:
why they were taken, how they were implemented, and with what result.” (Schramm in
1971 as reported by Yin, 2003, p. 12). They are useful to understand individuals and
groups, as well as social phenomena. The distinguishing factor of case studies in
investigation is that they allow one “to retain the holistic and meaningful characteristics
of real-life events – such as individual life cycles, organizational and managerial
processes” (Yin, 2003, p. 2).

Case studies were not always regarded as rigorous or reliable research, often
criticized as being imprecise and lacking objectivity. Some researchers still believe that
case studies should be used only in the initial exploratory phase of research, and should
be followed up by other, more “analytical” methods. On the other hand, there are classic
cases like Erlwanger's (1973) study of Benny that have influenced educational thought.
Benny’s case challenged and changed how mathematics educators since think about
assessment of student thinking. Case studies, thus could provide a clearer, more in-depth
picture of the phenomenon under study. They are of three types, according to Yin (2003): explanatory, exploratory, and descriptive. Explanatory studies look for reasons why some phenomenon occurred and how. Most often, such studies look at a particular situation or instance. Exploratory studies are an effort to develop more knowledge about a particular phenomenon. Such explorations are usually used to improve the focus of larger studies. The third type, Descriptive studies are used to describe a particular setting or phenomenon. Descriptive studies do not usually generalize since they are particular to the setting; it is left to the reader to infer generalizability (Yin, 2003).

Gall, Gall, & Borg (2003) agree with Yin (2003) that a case study is an in-depth analysis used to examine a natural phenomenon emphasizing its real-life context. A case study is used to cover contextual conditions, believing that they are relevant to the phenomenon under study. In the case of my study, contextual elements are not only relevant, but also necessary in order to make the case study a distinctive one. Ms. Lara’s classroom consists of students from low SES and immigrant families, providing the context to investigate the teacher’s journey in teaching for social justice.

The choice of using case study as the method of my investigation is a strategic one. A case study primarily poses ‘how’ and ‘why’ questions about contemporary events over which the researcher could directly observe and further investigate through interviews (Yin, 2003). This is what my case study does. I investigate Ms. Lara’s practice with ‘how’ and ‘why’ questions asked during my interviews with her. My “case”, Ms. Lara, was also a deliberate choice for an “information-rich” case (Patton, 1990, p. 169) in order to investigate my research questions. It is one that has allowed me access to
multiple sources of data, enabling “triangulation”: “a careful reviewing of data collected through different methods in order to achieve a more accurate and valid estimate of qualitative results” (Oliver-Hoyo & Allen, 2006, p. 42).

Ms. Lara’s case is one that provides a potential exemplar of an excellent teacher of mathematics for equity and social justice. As a consequence, I apply theoretical propositions to the process of collection and framework for analysis (Yin, 2003). I describe strategies the teacher uses and may be applicable for classrooms that are multi-racial, and multi-lingual, where the students are from poverty and/or recently immigrant populations. As in case study research, my study seeks to accomplish multiple goals: a) explore the situation from the point of view of the teacher, wherein the intervention does not have a single set of outcomes; b) describe the intervention in the mathematics classroom of one teacher and the real-life context in which it happened; c) explain the presumed causal links in real-life interventions that are too complex for other research strategies like surveys or questionnaires and quantitative methods.

**Interpretive Ethnography**

“Ethnography is that form of inquiry and writing that produces descriptions and accounts about the ways of life of the writer and those written about” (Denzin, 1996, p. xi). As an ethnographer my attempt was be to record and describe those events that happen in Ms. Lara’s classroom that not only influence her conception of her role as a teacher but also her understanding of her impact on her students’ lives. I, as researcher, am also involved in what happens in the classroom as I support the mathematics teaching and hence, inevitably, the narrative was also a reflection of my own journey. A detailed
explanation of the support provided in the classroom was provided in the next section. In particular, I pay attention to critical aspects that Denzin (1996) suggests as practices for interpretive ethnography: connecting ethnography to theory, embedding ethnography in culture, reflecting the voice of my participant, and being reflexive. I proceed to elaborate these aspects of my work.

Firstly, an interpretive ethnographer connects ethnography to theory. According to Denzin (1996), interpretive ethnography in particular is a form of writing that not only provides a view of culture and society, but also attempts to theorize about the social aspect of society. In other words, an interpretive ethnographer not only records observations about culture and society, but also makes connection to theory. An ethnographer also attempts to do the reverse, which is to understand culture and society through a theoretical lens. My study is just such an attempt. By providing vivid descriptions of the phenomenon of change in perspectives of Ms. Lara, I hope to learn more about how learning to teach mathematics for social justice in a particular context and classroom, but I will also attempt to theorize about teacher education for immigrant, low SES populations in general. It is a tall endeavor, but I hope to make that attempt nevertheless, since I believe that the connection between theory and practice needs to be explicitly made if research is to be accessible to teachers in classrooms. My endeavor in this study will particularly focus on making “teaching mathematics for social justice”, a concept often criticized for its ambiguity (Cochran-Smith, Barnatt, Lahann, Shakman, & Terrell, 2009).
A second observation that Denzin (1996), makes about ethnography is that it is deeply embedded in culture. He also claims that today’s diaspora in the world has created a new ‘world culture’ that has also affected how ethnographers do their work. Today we see a new ‘world culture’ caused by movement of peoples across continents, and technology that is ‘shrinking’ the world. Everyone, according to Denzin (1996), is a tourist, a refugee, and an immigrant of some sort, moving from one part of the world to another and adding to this movement is also the easy flow of information through media and technology that creates a new culture that is fluid and changing constantly. Hence, it is necessary for ethnographers to think beyond the ‘local’ context and think more globally as their writing represents this multi-national culture. My study is set in a school where the immigrant population is quite large. The students in Ms. Lara’s class are a mixed group with students who are ‘locals’ as well as Latina/o students and immigrants from East African countries, adding to the diversity in the classroom. In addition, I am Indian and the teacher is Caucasian. It is therefore, only natural that a new culture will be created in the classroom and my study will inevitably reflect that.

Thirdly, an ethnographer does not “own the field notes [she] make[s]…. [They] do not have undisputed warrant to study anyone or anything.” (pg. xiii). The ‘voice’ of the subject needs to be heard, and that is what I hope to accomplish in my study. The interpretation will, at every stage be authenticated with member-checks to ensure that the narrative reflects the voice of the participant in the study. Denzin (1996) posits that the ethnographer cannot presume to present an objective image without being held accountable to the one about whom one is reporting. The record will focus on giving
‘voice’ to the subject of observation, rather than the observer. The object/s of an
ethnographer’s study, in this case the teacher Ms. Lara, have their own views of how they
would like to be represented. My intention through this study is to ensure that Ms. Lara’s
voice comes through in the writing as much as possible.

The fourth and most critical aspect of an ethnographer’s work is self-reflexivity.
The writer is very much a part of the writing. I have chosen to position my study in the
context of an immigrant population precisely because I see a connection through my own
migration experience. Through self-reflexivity, I hope that the accounts will not be only
mine, purely subjective, and will not privilege any particular interpretation. With
reflexivity, comes the need to be honest, committed, and ethical. Ethical considerations in
research are critical as the context of my research is among an under-represented
community, that is, those who are immigrants and of low SES. More about ethical
considerations is given in the theoretical framework for the study in the previous chapter.

To summarize, interpretive ethnography and case study methodology are
compatible and appropriate for this research study. The objective of this investigation
was to provide a comprehensive understanding of the ‘case’ of an experienced teacher’s
pedagogy for equity and social justice. In so doing, rich ethnographic descriptions
embedded in the culture of the classroom, school, and community will be taken into
account. In following the teacher’s work, consideration to circumstances of the school
and challenges of the environment are inevitable, which are possible using ethnographic
accounts. Moreover, the case study is an inquiry from the teacher’s perspective, and an
ethnographer’s work foregrounding the participant’s voice is relevant. During the entire
course of the classroom support and data collection, I continued to be reflective, as the work of an interpretive ethnographer requires.

I will now proceed to explain the roles I played as teacher-observer and participant-observer in my study and their implications for the study.

**Researcher roles**

Glesne (2011) proposes that a researcher assumes multiple roles as the research study progresses. In her fieldwork, the researcher gets involved as reformer, advocate, and friend. Qualitative researchers need to be conscious of these roles, and especially reflective regarding one’s roles. In my study, I particularly reflected on my roles as an insider, sharing something in common with the participant and students, and as an outsider, not having a shared commonality. In the context of my study, I was both an insider and an outsider in different ways. I shared some experiences and perspectives with Ms. Lara – she was a woman from the middle class, and a mother. She cared deeply for issues that I cared about, especially her concern for children from low SES populations, and like me, she wanted to do everything in her power to make a difference in the lives of her students. At the same time, I was different from her culturally. Being an international student from India, I sometimes saw myself as an outsider. My identity as a non-white foreigner sometimes made me think that I did not know everything I needed to know about the American culture in order to conduct research. I therefore needed to pay greater attention to the ethics of these roles. I had to reflect on whether I saw in Ms. Lara all that I already expected and hoped to see?
I was an outsider in Ms. Lara’s class, even though she opened herself up to me. I was invited into her class, and that provided access to me, but she might have considered my presence in her classroom all through the two years invasive. I was video-recording classroom sessions without any prior information to her. I was observing her teaching and her interactions with her students all through the two academic years. She opened up her classroom for my research with no questions asked. In this situation, if I had observed something in Ms. Lara’s pedagogy that was inappropriate, I was keenly aware about the ethics that might have been involved in making the decision about making that information public. I recognized shortcomings only in the environment, as circumstances that might have hindered Ms. Lara’s equity pedagogy and not in Ms. Lara herself.

For the duration of the first phase of this study, while I provided support in the mathematics classroom, I assumed the role of teacher-observer. I taught the students while the teacher, Ms. Lara observed. I also made observations and took field notes, as a natural process of recording information to assist in teacher support. During the second phase of the study while I provided minimal support to plan and provide feedback to the teacher, I assumed the role of teacher-researcher. I participated in co-teaching during some group-work activities while recording observations for the research study.

**Teacher-Observer**

During the first phase of the study, the academic year 2011-12, I visited Ms. Lara’s classroom once a week, playing the role of teacher, along with two other teacher educators. We planned and taught the ELL (English Language Learners) students mathematics using the CGI (Cognitively Guided Instruction) model of instruction.
During this time, the teacher, Ms. Lara, was the observer. During this phase, I, as educator, not only taught the students, but also noted observations in order to better support Ms. Lara’s work. In addition, I interacted with her on a regular basis. These interactions comprised of discussions about instructional strategies and student learning, and also provided an opportunity for me to get to know Ms. Lara. These collaborations and exchanges helped me in building relationships with her as well as with the students, and in understanding the environment of the school.

**Participant-Observer**

During the academic year 2012-13, I became more of a participant-observer. Ms. Lara taught the class while I observed, made field notes, and video-recorded some of the sessions. I also had pre and post conferences with the teacher to enable continued support of her work and mathematics instruction. Glesne (2011) establishes that through participant observation one becomes immersed in the research and seeks to answer the research questions. As a participant observer, I was part of the classroom, interacting with and helping students by posing questions. One of the issues that I, as a participant-observer needed to address was the extent of my participation in the intervention. Glesne (2011) offers a solution by advising researchers to “(p)articipate, but in a way that does not get you inextricably incorporated in a setting’s ongoing affairs unless you are choosing to don more action- or participant oriented research” (p. 72). Hence, my role as a researcher in this second phase of the study was primarily that of observer. I observed the classroom instruction, but as I did so, I also used my observation to conference with the teacher as she prepared for future instruction. During the instructional time, however,
I was involved only peripherally, supporting the teacher only when required. This happened during small group work, for example, or if there was a mathematical clarification or question that needed to be raised to further students’ understanding of mathematics.

I would like to point out that my relationship with the students made me think of my outsider role as having some advantages. Students who were ELLs were mostly from Eastern Africa and Mexico, and they seemed to be drawn towards me. They asked me how I had come to be in the United States and what I was studying. One of the students asked if he could also go to university like I did. I wondered if I gave them confidence that they too, being immigrants coming from a different culture and language, could learn and go to college. The students spoke freely in my presence, and through my interactions with them, I knew that they were happy being in Ms. Lara’s classroom. Students discussed their lives outside the classroom, and about their families and friends. I understood that the rapport I had with the children had to do with my being a woman of color. As far as I could tell, in the school there were no teachers who were of color.

Through both phases of the study, my intention as researcher was to be intentionally reflexive about my role in the classroom. As I provide descriptions of the classroom, I do so as far as possible, as an observer, privileging the participant, Ms. Lara’s voice and practice.
Issues of credibility

Key features of the research design that establish the study’s credibility are its prolonged engagement, triangulation, referential adequacy, and transferability. I proceed to elaborate upon each of these characteristics further.

Prolonged engagement

Key issues were considered pertaining to credibility issues in establishing the trustworthiness of the study. Lincoln & Guba (1985) propose that the activities should have prolonged engagement of at least a year, and that observation is persistent to ensure that there is not just a ‘snap shot’. In this case study, classroom support began in November 2011 and continued till the end of the academic year. The support continued as the study progressed and data was collected over the next academic year, 2012-13. I spent time in Ms. Lara’s class over the entire period almost every week of class. During the time in the classroom, I made extensive and in-depth field notes about the activities in the classroom. In addition, I spent time with the participant outside the classroom to conduct the interviews. This enabled comprehensive conversations about Ms. Lara’s work and the challenges she faced. Prolonged engagement and persistent observation were thus established.

Triangulation

An important criterion to establish validity is triangulation, “a careful reviewing of data collected through different methods in order to achieve a more accurate and valid estimate of qualitative results” (Oliver-Hoyo & Allen, 2006, p. 42). Lincoln & Guba (1985) recommend the use of multiple sources like documents, interviews, and video-
recordings. Also multiple individuals and/or groups should be involved in collecting the data. In my study, data was collected through classroom observations by way of my (the researcher’s) field notes, video-recordings of classroom instruction, student work, audio recordings of interviews with the participant, and participant reflective notes. I also recorded students’ explanations of their mathematical activities. Since the intervention during the first year involved other teacher educators, their inputs were gathered through informal conversations. During the analysis process, preliminary findings were shared with them as a means to confirm and validate the results. Preliminary findings were also shared with the participant herself as a means to do member-checks.

**Referential adequacy**

*Referential adequacy* is established by keeping a well-developed data corpus with detailed descriptions. A chain of evidence through various data sources was maintained. Three peers who are fellow researchers reviewed my coding and gave me feedback. My fellow-researchers were requested to review coding and drafts of the analysis as the study progressed. The coding was considered valid only if there was at least 80% agreement between coders. In case of disagreement, I discussed issues and re-coded segments together in order to reach a consensus. During the process of writing up the research, findings were shared with the participant in order to conduct *member checks* to further validate what was said or happened in the classroom or the interviews. Findings from the data were also shared with fellow researchers and their feedback sought in order to minimize researcher bias. Among the fellow researchers was one who had also worked in
the teacher’s classroom and observed her pedagogy, and this helped to validate the research findings.

*Transferability*

The study’s *transferability* is an important aspect for the field of mathematics education. Rich descriptions of the classroom context and teaching sessions are provided so that teachers in other similar settings might find the concepts applicable. My study investigated the work of a white middle-class female teacher in her classroom of racially, linguistically, and socioeconomically diverse students. On the other hand, the research admittedly is not ‘generalizable’ as conditions need not be the same across various populations. The study makes accessible those concepts and considerations in teaching mathematics for equity that have implications for social justice, especially in contexts that consist of multicultural, multilingual, and low socioeconomic immigrant populations. The purpose of my study was to provide a vignette that teachers might use to access concepts of equitable mathematics teaching and consider issues of social justice in mathematics classrooms. This purpose while being broad, allows different aspects of the study to be applicable to different contexts.

**Research Context: Liberty Elementary School**

A fifth grade mathematics class at Liberty Elementary School (names of school, participant, and students are pseudonyms) is the context for my study. In describing my research context, I return to the “CCI Triangular Framework” (Figure 2.) for my study, and consider the second attribute of research informed by equity and social justice, “करुणा, or Compassion”. Through this attribute, a humanistic approach comes into focus.
The term is a call to action derived from understanding and empathy. It also contains within it the element of reciprocity. Ms. Lara reached out for help. When she was faced with a situation in which more than half her students were ELLs (English Language Learners), she reached out to the team of teacher educators at a large mid-western university for help. On Ms. Lara’s part, her करुणा drove her to action as a result of her desire to help her students. Her request set things in motion for the team to provide the classroom support Ms. Lara needed. This then provided access and helped me, the researcher, to build relationships that were critical to the study. While the support proved to be beneficial to the students in their mathematics learning and the teacher in her teaching, it was also beneficial to me, the researcher. Working with Ms. Lara and her students helped me to grow as a teacher and researcher and understand the context of students in poverty and from recent immigrant families within the United States. The experience of spending time in the classroom with the teacher and the students was also a source of great joy to me. Interacting with the students and learning from them re-opened me to children’s sense of creativity and hope. It helped me learn about the teacher’s pedagogy for equity and social justice, and provided a vignette and an “information-rich” (Patton, 2002, p. 169) case for researchers, teacher educators, and practitioners.

The context for the study is a fifth-grade classroom in a low performing urban elementary school. Student demographics are provided in Table 1 below.
<table>
<thead>
<tr>
<th>Category</th>
<th>Black</th>
<th>Hispanic</th>
<th>Multi-racial</th>
<th>White</th>
<th>Free/reduced lunch</th>
<th>Limited English proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of students</td>
<td>49.2%</td>
<td>7.1%</td>
<td>5.1%</td>
<td>35.5%</td>
<td>89.9%</td>
<td>20.5%</td>
</tr>
<tr>
<td>in Liberty Elementary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Student demographics of Liberty Elementary in the year 2010-11

Liberty Elementary was placed on ‘academic watch’. This meant that because of inadequate academic performance of the students in standardized tests, the school was under observation, and required to show progress over the academic year. If a school consistently fails to meet the standards for adequate yearly progress for three years, the school is then ‘reconstituted’. This meant that the local school superintendent evacuates a low-performing school’s entire staff, including administrators and all teachers and brings in an entirely new set of staff. The idea behind reconstitution is that by bringing in fresh staff committed to change, will cause the academic achievement of the students to improve. Liberty Elementary had been reconstituted three times, and Ms. Lara was one of the new teachers after the third reconstitution.

At the beginning of the academic year 2011, the teacher, Ms. Lara approached a teacher educator from the local university asking for help in teaching mathematics to her 5th grade students who had never had mathematics instruction in their previous years of schooling. She had eight ELL students who were struggling in mathematics; some of them were unable to keep track of numbers beyond 30. As part of the non-research
intervention, the team of teacher educators, one faculty member and two doctoral students, from the local university started supporting the teacher by spending one hour twice a week in the classroom with students. The team used the Cognitively Guided Instruction (CGI) model for the intervention. CGI is based on the premise that students bring into the classroom “informal or intuitive” knowledge of mathematics even before receiving any kind of formal instruction (Carpenter, Fennema, & Franke, 1994). This knowledge serves as a platform for teachers to plan instruction and construct curriculum at the elementary level. This provided the necessary access to me for the study.

The support in the classroom comprised of the teacher educator teaching the ELL students while Ms. Lara observed and took notes. This continued for the first six months of the intervention. After the first six months, the teacher educator and Ms. Lara co-taught some of the classes. During this time, they planned the sessions together and after the class had a post-conference to discuss how the session went and plan for the forthcoming sessions. At the end of every session, student work samples were collected to learn about student thinking and use them to plan further instruction. The teacher, Ms. Lara having observed these sessions through the year, continued to use some aspects of the CGI model in her own instruction over the following academic year. As part of the instructional support, and to understand the teacher’s needs, I conducted interviews with Ms. Lara periodically, and provided feedback. As part of the research study, I asked Ms. Lara to reflect on her role as she supported her students’ self-empowerment through mathematics instruction. The teacher particularly reflected on pedagogical aspects that have relevance for students of marginalized and low SES groups.
**Research Participant: Ms. Lara**

Ms. Lara (pseudonym) is a white, middle-class female teacher in a fifth-grade classroom in a low performing elementary school, Liberty Elementary, in a large urban school district. She has a certification in special education and is certified in elementary education. Ms. Lara worked with students with special needs before coming to teach at a ‘regular’ school in this poor urban district. Ms. Lara’s training includes teaching students with learning disabilities besides her regular teaching licensure. She has completed part of a doctoral program in Educational Philosophy. She has over thirty years of teaching experience, although she has been working in Liberty Elementary only since the beginning of the academic year of the intervention. She came to this school on a request from her previous Principal, who was looking for committed individuals who would help her take over and improve the school, which at the time was placed on an ‘academic emergency’ (i.e. the school did not show adequate yearly progress (AYP) under predetermined criteria for four consecutive years). When Ms. Lara agreed to work in the school, she anticipated a classroom of low SES students (based on her knowledge of the school district) and poor academic performance. What she did not expect was the large population of ELL students. Besides this, she was also asked to teach mathematics. In all her years of experience, Ms. Lara had never taught fifth grade mathematics. Faced with the situation of having to teach fifth grade mathematics for the first time, and doing so with the challenges of having to teach a diverse group of students, Ms. Lara requested help from the local university.
Ms. Lara is a soft-spoken white woman with a gentle voice. If one listens to her on an audio recording, one would think of her as being much younger than she is. She has a way of making everyone feel comfortable in her presence. She is a good listener and shows genuine concern for people around her. I can think of many times I saw evidence of her concern for others. Let me provide one example. I traveled by bus to get to the school. Ms. Lara would become concerned when it was raining or snowing, and ask if I needed a ride, and if I had adequate warm clothes. In the midst of the myriad tasks she had, she would still stop to inquire about my life, my family, and my concerns. She encouraged me with her words and I found in Ms. Lara, a caring and good friend.

Ms. Lara’s special education and Montessori training informed her pedagogy. It was interesting to me to see how she integrated perspectives from both traditions. It was also interesting which aspects she assimilated in her own practice. From the special education field, she incorporated the ideas for individualized instruction and acceptance and respecting of diversity. She claimed:

“Most of my background’s in special ed and you never have a homogenous group, or we never did. I mean you had just this huge range of not only capabilities, but parents from—in one class, you could have a family that was really dysfunctional to almost society families. It's just like this acceptance of whoever you’re with, you just respect where they are. I mean, to me, last year with my little group was just the icing on the cake for that. I think that was the first
time I really realized that looking at them from their point of view how important it was, how important. [I: Apr 6th, Place value].

Even though her special education training came from course work that was mainly behaviorist, Ms. Lara’s pedagogy was basically constructivist. She viewed her role in the classroom as primarily that of a facilitator for students to learn and construct knowledge through interaction with one another and with the materials. She emphasized that students be given the opportunity to make decisions and choose not only how they learned but also what they learned. She used students’ questions and translated them into lessons that helped them learn concepts in mathematics. Naturally, such lessons also integrated not only a range of concepts in mathematics, but also a range of content areas.

From her Montessori background, Ms. Lara incorporated ideas for assessment and paying attention to students’ learning. She told me that the phrase “follow the child”, taken from that tradition became her theme in practice. She constantly paid attention to how the students were learning, and based her decisions on her observations. She understood how her students learned differently, and chose to offer experiences that helped them to engage and learn in their own way and at their own pace. Her assessments were not based on paper-pencil tests, but rather on informal conversations and questions she asked as they did their work. In explaining her process of planning her lessons she referred to her Montessori experience:

“Well, it’s kinda fun because there’s a pattern. If they catch onto a pattern,…then they can go on one
farther……the math materials in Montessori, are—follow patterns and the kids can see what’s gonna come next….It just unfolds. I think, and I really do think a lot of that is Montessori again because one thing always—there’s a sequential pattern to what you—taking something and then taking it a little bit farther and a little bit farther and a little bit farther. It’s like building it on a foundation, and I have such respect for those materials and that philosophy.” [I: Apr 6th, Place value].

I chose Ms. Lara as the “case” for my investigation for several reasons. I argue that Ms. Lara, her classroom, and the school provided a singularly important context for mathematics education. It is representative of situations all across the country: more multiracial student populations are being taught by mostly white teachers, there are an increasing number of immigrant families, and poverty continues to prevail in urban schools. Many such schools are low performing, and teachers are challenged by circumstances and policies like standardized testing, which are beyond their control. The deliberate choice of a single case is not unlike Elbaz's (1983) seminal case study on teacher practical knowledge. Elbaz (1983) established that the choice was deliberate because there was a need for a “vivid and complete description” (p.23) of one case to gain an understanding of the teacher’s knowledge “from her own view” (p.24). The choice of the teacher also was deliberate: the teacher was “committed to her work, able to articulate her point of view and interested in doing so” (p.24). Similarly, the case of Ms.
Lara provides an “information-rich” (Patton, 1990, p. 169) case, one that is a vignette of equitable mathematics teaching in an ethnically diverse school.

Ms. Lara herself is a purposeful selection for my study for the following specific reasons:

1. Ms. Lara asked for help. When she was placed in an elementary school in which most of the students were ELLs who had little or no mathematics instruction in the previous four years of schooling, she approached the University mathematics teacher educators for help. Besides providing the needed access, it gave me, as the researcher to build a relationship with her, my participant. Her asking for help showed that Ms. Lara was open to learning, even though she was an experienced teacher, by her own admission:

   I am such the student when I'm in school or not, that when I can stop and see what other people are seeing, it makes it that much easier what the kids need or what I need to change, what I need to do….. Teachers don't get to observe very much. So when somebody else comes in and I can watch little bit, it's a huge difference. [Initial Interview: March 15th, 2012]

2. Ms. Lara chose to be in the particular school, knowing there was high poverty and immigrant population in the area. Her decisions were based on the concern she had for students with special needs, low socioeconomic, and immigrant populations. She
derived satisfaction from her work with high needs populations. She shared her experiences with me and emphasized the appeal that working in high-needs schools had for her: “when they finally get something, it is such a satisfaction for them and for me, and it just pays off, you know, it's a huge payoff” [Initial Interview: March 15th, 2012].

She intentionally moved to a poor-performing district when asked by the Principal she had previously worked with. She believed she could make a difference and it was her way of ‘giving back’, having “gotten as much from the kids as I give to them.. And I see it as an opportunity to give something back.” Her students inspired her. She was determined to help them overcome the difficulties they have in their lives and see them succeed:

They have so many things in their lives that are stumbling blocks and that are keeping them from learning and it's such a challenge, and it's such a push of mine to get through to them and then to figure out what is the problem, what is it that's stopping you. And it makes it more of a challenge, to be able to get through to the children who have so many things against them sometimes. [Initial Interview: March 15th, 2012]

3. Ms. Lara has completed some of her doctoral work in Educational Philosophy and therefore familiar with literature on education, and related theoretical underpinnings. Her knowledge and perspectives, therefore, would presumably add insight to the study.
4. Ms. Lara has over thirty years of experience. Lara is therefore experienced and knowledgeable about the education system in the United States. She has also overcome the usual challenges that a novice teacher might experience, like self-preservation, mathematical content or classroom management issues (Wood, Jilk, & Paine, 2012).

5. Ms. Lara cares for her students. From my initial observations, I found that her pedagogy aligns with Ladson-Billings' (1995) concept of CULTURALLY RELEVANT PEDAGOGY. Ms. Lara is both caring and purposeful in the way she communicates and works with her students. The students know and understand her verbal and non-verbal communication. These aspects of her work are relevant in addressing my research questions.

6. During the teacher educators’ work in her classroom, I observed that Ms. Lara took notes as she observed teaching, and shared her observations me. She was reflective and reflexive in her observations, was keen to learn and share what she was learning. She expressed herself well, going into great detail about her thoughts. This is critical because the study aimed to capture the experience of the teacher in as much detail as possible. Below is an excerpt from an interview with Ms. Lara as an example of her reflectivity:

   Everything I've ever learned, I have and I can just use it.
   What's fascinating to me is that so many times in education, they talk about things being re-invented, over and over and over again, and you know, we'll get this program and we'll use it for a while. When you stay in the school system long enough, you see things start to repeat themselves, but I feel
like everything I've ever experienced, I've ever had, I have
the opportunity to use that and it doesn't get old. [Initial
Interview: March 15th, 2012]

Data sources

I collected multiple sources of data in the form of initial interviews, classroom
observation data and follow-up interviews for the purpose of triangulation. I conducted
initial interviews in order to ascertain the teacher’s background and perspectives on
mathematics, teaching, and learning. Video recordings of five teaching sessions covered
three content areas of fifth grade mathematics - numbers and operations in base ten,
numbers and operations – fractions, and measurement and data. Each teaching session
was followed by a follow-up interview that lasted approximately 45 minutes. I conducted
five such interviews and audio recorded and transcribed them. Student work samples
from every observed teaching session were collected as data to understand student work
in mathematics as well as to be used as artifacts in the follow-up object interviews with
the teacher. Further, my extensive field notes recorded over the entire period of the
intervention and study, and the teacher’s reflective notes also provided data for the study.
The following table (Table 2.) is a summary of the data sources, and the timeline for data
collection.
<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Number of units of data</th>
<th>Months when data was collected</th>
<th>Hours/minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video recordings of teaching sessions</td>
<td>5 sessions of length between 45 and 75 minutes each</td>
<td>October 2012 through February 2013</td>
<td>255 minutes of video recordings</td>
</tr>
<tr>
<td>Audio recordings of interviews with participant</td>
<td>Three initial interviews, five follow-up interviews of length approx. 45 mins. each, and one final interview</td>
<td>September 2012 through May 2013</td>
<td>370 minutes of audio recordings transcribed</td>
</tr>
<tr>
<td>Student work samples</td>
<td>Samples from 16 teaching sessions from 4-6 students</td>
<td>September 2012 to February 2013</td>
<td>About 100 student work samples.</td>
</tr>
<tr>
<td>Researcher field notes</td>
<td>16 class sessions</td>
<td>September 2012 to February 2013</td>
<td>Notes from 16 class sessions</td>
</tr>
<tr>
<td>Participant reflective notes</td>
<td>As shared with researcher</td>
<td>September 2012 to February 2013</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Summary of data sources and collection

Data collection procedures

Returning to the “CCI Triangular Framework” (Figure 2.) for my study, I consider the third characteristic, “अखंडता, or Integrity”, which means solidarity and strength
intertwined with honesty and truthfulness. I proceed to describe the data collection and procedures grounded in accountability to participant, students, and myself.

After Ms. Lara was selected and consented as participant for my study, I conducted an initial interview to ascertain details about her background training and experience, as well as her perspectives on teaching and learning. After one year of classroom support provided by me and two other teacher educators, I conducted an initial interview during the summer. I conducted two more interviews at the beginning of the following academic year. Classroom support and observations began when the session for the new academic year 2012-13 began. I was present in the classroom once a week to observe and when necessary, to support teaching in mathematics. Data collected through video recordings of the teaching sessions was done so with minimal intrusion. I used a flip camera of size approximately 6 inches by 3 inches placed at the back of the classroom where I sat and made field notes. The placement of the camera did not interfere with the teacher’s instruction or interaction in the classroom. Students at first showed some curiosity about the camera but after a couple of days, my presence with my camera and computer became a familiar sight and did not disrupt their regular work. After every teaching session, I collected samples of student work. In order to capture interesting moments, I took pictures of student work (especially of work using objects and manipulatives not recorded on paper), and recorded student conversations. If students came up with strategies they were asked to explain those strategies and their explanations recorded. Student work samples and explanations provided me with information that I
used in follow-up interviews to assist Ms. Lara to recall and reflect on what happened in her class.

**Data collection: Initial in-depth interviews**

I conducted three initial in-depth interviews. The first interview was conducted in the summer of the first year, 2011-12, after a year of classroom support. In order to begin investigation to the teacher’s perspectives and practices, it was important to ascertain some background information about the teacher. The interview protocol that I used was largely open-ended, with the intention of gathering information about the teacher’s educational and professional experiences, her beliefs about teaching, what led her to take up the job to teach in a high-needs school, what she saw as her role in her students’ lives, and what her experiences were during the past year when she was being supported by the research team. During the next interview, I asked Ms. Lara to relate her experience over the year of classroom support and reflect on her students’ mathematics growth. Student work samples that were collected over the year to help plan instruction were used in the interview for Ms. Lara to reflect on students’ mathematical work. She also shared with me her reflective notes as she observed the teacher educators working with the students. I conducted a third interview at the beginning of the second year of classroom support. This interview was also open-ended, with the goal of determining what the teacher’s goals and challenges were at the beginning of the new academic year, and what lessons from the previous year she drew from into her future work. All three interviews were audiotaped and transcribed. Findings from these interviews helped me to record Ms.
Lara’s perspectives and beliefs about her work. The interviews also gave me insight into her perception of her role in her students’ self-empowerment.

**Data collection: Classroom observations**

The objective of my study was to provide rich descriptions of the teacher’s practice of teaching mathematics equitably. Hence, my observations through video recordings, student work samples in the form of written work and photographs, and field notes provided critical information. My ‘prolonged engagement’ (Lundy, 2008) with Ms. Lara, “spending extended time with respondents in their native culture and everyday world in order to gain a better understanding of behavior, values, and social relationships in a social context” made the study possible. Building relationships with the teacher and students in the context of their classroom and school enabled a deeper understanding of her work. As specified earlier, I was present once a week, almost every week in Ms. Lara’s classroom, during her mathematics classes. I selected five class sessions covering three content areas of fifth grade mathematics - numbers and operations in base ten, numbers and operations – fractions, and measurement and data. The video recording was done using a Flip UltraHD video camera placed at the back of the class on a tabletop. The camera had a small stand to which it can be fixed; the camera with the stand was no taller than 8 inches. Although at first the students were curious about the gadget, they soon got used to seeing it there, and continued with their daily work without any disruption. The videos thus captured the teacher’s conversations and interactions with the students in the natural setting of regular mathematics lessons. Besides teacher-student interactions, the arrangement of the physical space in the classroom was also captured in the recordings.
How the classroom was arranged to accommodate group work at certain times and individual work at others was an interesting observation that helped me understand the activities and pedagogical decisions of the teacher.

My field notes consisted of descriptions of significant interactions in the classroom. Some of them were regarding mathematical tasks and others were conversations that formed a part of the discourse in the class. The nature of the interaction of the teacher helped in the analysis of her pedagogical and instructional choices. The environment of the classroom as a learning community, and classroom management strategies of the teacher were noted. Besides this, the observations included my interactions with the students and with Ms. Lara.

**Data collection: Follow-up interviews**

After each video-recorded session, I reviewed the video, made notes and prepared protocols for follow-up interviews. These semi-structured follow-up interviews were used to inquire into the teacher’s goals and intentions behind her instructional decisions. The duration of the interview was interspersed with viewing sections of the video and responding to questions like “why did you choose to respond to this student in this manner?” or “why did you allow the students to decide?” or “what prompted you to ask that question?”. In some cases, student mathematical understanding was discussed using artifacts (student work samples or photographs) from the classroom. All interviews were audio recorded and transcribed. The objective of these interviews was primarily to learn about the teacher’s perspectives and reasons for making certain pedagogical and instructional decisions.
A portion of a typical follow-up interview protocol is provided in the Table. 3 below as an example:

<table>
<thead>
<tr>
<th>Time stamp of episode</th>
<th>Brief description of episode</th>
<th>Interview question</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:02:28 – 0:03:09</td>
<td>Teacher connected the concept of square arrays to square numbers and geometrical representation</td>
<td>I saw how you helped the student make the connection between arrays, power of two, and a square. Why did you do that?</td>
</tr>
<tr>
<td>0:05:22 – 0:06:07; 0:06:50 – 0:07:10</td>
<td>Linda is distracted, teacher asks her to focus.</td>
<td>Linda suggested ‘division’ and you stopped others from speaking and asked Linda to explain her idea clearly. Why do you think that was necessary?</td>
</tr>
<tr>
<td>0:10:20 – 0:13:15</td>
<td>Students make the key to the pictograph.</td>
<td>One student suggested half heart equals 1 when you said that 1 heart equals 2. What does that tell you about his mathematical understanding?</td>
</tr>
<tr>
<td>0:16:00 – 0:16:55</td>
<td>Teacher has serious talk with Linda</td>
<td>You were firm with Linda. What were you hoping to achieve?</td>
</tr>
<tr>
<td>0:22:10 – 0:25:50</td>
<td>Teacher notes all the suggestions and starts reviewing them</td>
<td>The children made all the suggestions. Did you plan it like this? What was your lesson plan? Did it go according to your plan?</td>
</tr>
<tr>
<td>0:28:03 – 0:32:55</td>
<td>Students draw bar graph</td>
<td>You asked many questions. How do you decide what questions to ask?</td>
</tr>
</tbody>
</table>

Table 3. Sample follow-up interview protocol
Over the first few sessions, it became evident that patterns emerged in the teacher’s pedagogy. For example, the teacher provided opportunities for students’ decision-making, and in so doing, shared authority with them. This phenomenon recurred in all the sessions and in the follow-up interviews, the researcher was able to pointedly ask Ms. Lara about this particular strategy and learn why it was important to her.

**Data collection: Final Interview**

At the end of the study, I conducted a final interview with Ms. Lara. The primary purpose of the final interview was to help both of us to reflect on our experiences over the two years of classroom support. A second purpose of the interview as to learn from the teacher what she believes should be a result of the study in terms of teacher practice and teacher education. The interview was conducted after much of the analysis was completed. Therefore, it provided an opportunity for me to do a member-check to clarify my observations of Ms. Lara’s pedagogy, and for her to validate my key findings. The interview also provided a platform for her to add to the findings based on her own perception of her work and growth. Overall, the final interview provided an overview of the nature of the teacher’s work and provided directions for teacher education and professional development.

**Data collection: Time line**

Although the data collection was spread over one academic year, it is important to note that my study covers the period of two academic years. Classroom support began a year prior to the data collection. The first year was critical for the study as it was necessary to allow relationships to develop in the context of Ms. Lara’s classroom.
During the first year I was part of the team of teacher educators, and visited Ms. Lara’s classroom once every week. I worked with the ELL students in the class, teaching mathematics, and interacting with Ms. Lara and other teachers and administrators in the building. It was also a time when I informally observed Ms. Lara as she interacted with her students. I saw aspects of her pedagogy that exemplified culturally relevant and caring pedagogy (Ladson-Billings, 1995a; Parsons, 2005), and recognized that Ms. Lara was a case that could provide teachers, teacher educators, and researchers valuable information about mathematics teaching for equity and social justice. The time line reflected in Table 4 spans over the second academic year only, and includes the data collection and analysis process, which were integrated during the course of the year.
Table 4. Summary of data collection and analysis

Data Analysis

The qualitative design of my study involved analyzing the initial interviews, video recordings of lessons, audio recordings of follow-up interviews, and triangulating information with my field notes, reflective notes of the teacher, and final interview. The data was transcribed and analyzed with the help of the software “Transana”. Field notes and transcriptions of video-recordings and interviews were analyzed using the procedures...
described below. This first round of coding was used for the initial interviews based on grounded theory (Charmaz, 2000), which identified broad themes. For example, teacher’s background, her understanding of mathematics, experiences with teaching, instructional decisions, beliefs about her students, concerns, and reasons for her choices are some of the themes used for the first round of coding. In the analysis of the video recording, the first step comprised viewing the videos and time-stamping sections to mark off segments of the lesson. Each thematic segment contained an interaction or a portion of instruction that could be considered a ‘unit’ for the purpose of coding. Time-stamping the video served a second purpose; it helped one to return to that section of the video at the time of the follow-up interview. Once the segments were separated through time-stamping, they were coded using the “Using mathematics to teach for equity and social justice codebook” (Refer Appendix A for elaborate codebook, Table 5 for abbreviated codebook) which will be described in subsequent paragraphs. Transcriptions of interviews were also similarly coded.

Classroom videos were coded against the “Using mathematics to teach for equity and social justice codebook” (Appendix A). Sections of the videos were identified and interview protocols prepared for follow-up interviews with the teacher. Student work samples also were identified as artifacts that could provide information for teacher reflection during the interviews. These interviews were audio recorded and transcribed. One final follow-up interview was conducted at the end of the study.

All names of students used in reporting the data are pseudonyms. Identifiers for the data used in the rest of this document follow the format:
Data analysis: The codebook

The “Use of mathematics to teach for equity and social justice codebook” (Refer Appendix A for elaborate codebook, Table 5 for abbreviated codebook) is a codebook grounded in literature generated from the work of various researchers (eg. Boaler, 2002; Delpit, 1993; Erchick, 2002; Ladson-Billings, 1995b). It consists of features covering a range of equitable instructional practices in teaching mathematics for equity and social justice. The codes are grouped into four main categories: content objectives (teacher’s attention to mathematics), pedagogical orientation (purposeful support of students as learners), contextual relevance (awareness of instructional context), and social justice objectives (intentionality for student self-empowerment).
<table>
<thead>
<tr>
<th>Code</th>
<th>Concept</th>
<th>Research support</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETL</td>
<td>Explicit Talk about the meaning and use of mathematical Language</td>
<td>Ladson-Billings (1995); Delpit (1993)</td>
</tr>
<tr>
<td>ETR</td>
<td>Explicit Talk about ways of Reasoning</td>
<td>Ladson-Billings (1995); Delpit (1993)</td>
</tr>
<tr>
<td>EST</td>
<td>Explicit Student Tasks and work</td>
<td>Ladson-Billings (1995); Delpit (1993)</td>
</tr>
<tr>
<td>IT</td>
<td>Quality Instructional Time spent on mathematics</td>
<td>Ladson-Billings (1995)</td>
</tr>
<tr>
<td>EDC</td>
<td>Encouragement of a Diverse array of mathematical Competencies</td>
<td>Boaler (2004); Cohen &amp; Lotan (1997, 1999); Ladson-Billings (1995);</td>
</tr>
<tr>
<td>AU</td>
<td>Autonomous student work opportunities</td>
<td>Boaler &amp; Staples (2008)</td>
</tr>
<tr>
<td>RWP</td>
<td>Real-World Problems or examples</td>
<td>Burton (1998); Carraher et al. (1994); Gutstein (2006)</td>
</tr>
<tr>
<td>ESE</td>
<td>Emphasis of Student Effort and message that effort will eventually pay off</td>
<td>Ladson-Billings (1995)</td>
</tr>
<tr>
<td>EE</td>
<td>Expressed Expectation that everyone can do the work</td>
<td>Ladson-Billings (1995)</td>
</tr>
<tr>
<td>OCK</td>
<td>Opportunity for Co-construction of Knowledge</td>
<td>Cochran-Smith (2004); Esmonde (2009)</td>
</tr>
<tr>
<td>SVA</td>
<td>Fore-grounding Student Voice and Agency</td>
<td>Freire (1973); Leedy, LaLonde, &amp; Runk (2003)</td>
</tr>
<tr>
<td>EMR</td>
<td>Explicit attention to Mutual Respect</td>
<td>Cochran-Smith (2004); Bartolome (1994);</td>
</tr>
</tbody>
</table>

Table 5. Using mathematics to teach for equity and social justice codebook (abbreviated)
The earliest form of the codebook was developed by researchers to identify equitable teaching practices in video recordings of lessons through “mathematical quality and equity (MQE) video codes” (Goffney, 2010). The codebook has since been used to analyze data in the form of written responses of teachers in a study conducted by Erchick et al. (2010). In the study there were twenty codes, each having E for example, and N for non-example attached to it. After feedback received from other researchers, the codes were categorized into the first three headings: content objectives (teacher’s attention to mathematics), pedagogical orientation (purposeful support of students as learners), and contextual relevance (awareness of instructional context). After this alteration was made, and the codebook was then used in another study Joseph & Erchick (2012), in which video recordings of three teachers’ practice was observed and coded. Drawing from findings from that study, a fourth theme that seemed to be absent from the original codebook was added. This fourth category contains four features of a teacher’s work that emerged as having implications for a social justice pedagogy. The complete codebook used in this study is a result of these two stages of development (Figure 3).
Figure 3. Development of "Using mathematics to teach for equity and social justice" codebook

The thirteen codes (Erchick et al., 2011, 2010; Goffney, 2010), under their four main categories are explained in greater detail in Appendix A.

**Data analysis: Initial interviews**

The audio recordings of the initial interviews were transcribed using the software “Transana”. The interviews were then analyzed using the procedures described below. This first round of coding was used for the initial interviews based on grounded theory (Charmaz, 2000), by which broad themes were identified. For example, teacher’s background, her understanding of mathematics, experiences with teaching, instructional decisions, beliefs about her students, concerns, and reasons for her choices are some of the themes used for the first round of coding. This grounded theory method also provided for emerging themes. A second round of coding was done using the “Using mathematics to teach for social justice codebook” (Table 5). Some examples of the coding scheme are provided below.
Example 1:

Ms. Lara: I see them being able to take a greater number and add on, or, or as they are thinking I can see them drawing the pictures that are more appropriate, you know, to solve their problems. But that would only be preserved in a portfolio of some kind. I'm guessing that there's a huge gap between testing and people with a different language, you know, and being tested in a language that's not native to them.

[Initial interview: March 15th, 2012]

Coded: ETL, EDC, EMR

Example 2:

Ms. Lara: I want everybody to ante up and do the best they can. It’s like a truth culture. I want them to get the best of me and I want to get the best of them. And I can’t do it when they’re only half here. If I don’t have their attention I can’t do anything. It’s an honesty…what do they call it? It’s like when you’re present. Like being present somehow.

[Initial interview: Oct 10th, 2012]

Coded: OCK, EE, EMR
Data analysis: Classroom observations

In the analysis of the video recordings of lessons, the first step comprised viewing the videos and time-stamping sections to mark off segments of the lesson. Each thematic segment contained an interaction or a portion of instruction that could be considered a ‘unit’ for the purpose of coding. Time-stamping the video served a second purpose; it also helped the researcher to return to that section of the video at the time of the follow-up interview. Once the segments were separated by time stamping, they were coded using the “Using mathematics to teach for social justice codebook” (Table 5). Some examples of the coding scheme are provided below.

Example
Amanda stepped up to the board and wrote $8/10 = .8$ and then said, “It also equals 8%.”
Ms. Lara: Ok. Are you sure? You want to write that down?
Amanda writes $8/10 = 8\% = .8$.
Ms. Lara: What do you think guys? What does percent mean again?
Amanda: Out of a hundred. Oh!
Ms. Lara: So 8% is $8/100$ (writes). So what do you need to change to match all three.
Amanda changes $8/10$ to $8/100$.
Ms. Lara: Closer, but not there yet. So what does it say now?
Amanda: 8 out of a hundred is 8 percent.

Ms. Lara: And then what?

Amanda changes .8 to .08 and says 8 hundredths.

[V: Nov 20th, Fractions]

Coded: ETR, ETL, EE, ESE, OCK, SVA

**Data analysis: Follow-up interviews**

After each video-recorded session, the researcher reviewed the video, coded the video, and prepared protocols for follow-up interviews with the teacher (Table 3 is an example). The protocols were based on the results from applying the codebook (Table 5), as a means to find teacher intentions and goals in the instructional strategy observed during the lesson. Examples of the coding of follow-up interviews are given below.

Example 1:

Ms. Lara: it empowers the kids to have some decision in their day-to-day life, you know…. I was trying not to make it 'do what you want'. I was trying to make it you know 'think about it and it's yours, it's not mine, it's yours.'

[I: Nov 25th, Measurement & Data] Coded: SVA, ECT

Example 2:

Ms. Lara: I wanna make sure that they give it at least three different definitions… I can explain something given a term they already know, then you get all these connections
that start to happen……. I might not understand something, and someone might say it differently, and suddenly, I get it! Students also have different ways they’ll get it. So I make sure they see things in many different ways. [I: Nov 25th, Measurement & Data] Coded: ETL, EDC, ETMP

**Data analysis: Final interview**

The final interview was conducted after the analysis was completed. It provided an opportunity for me to ask any questions about missing pieces of information. It also helped me to find out Ms. Lara’s perspectives for the relevance of her work to teacher education and professional development. I also made use of the opportunity to share with her key findings from my study to help validate them, as a means of ‘member-check’. I asked Ms. Lara about her next steps. Again, themes were identified and these informed the concluding chapter of my study.

**Integrated Coding scheme**

Videos of lessons were coded using the ‘Using mathematics to teach for equity and social justice’ codebook (Table 5). Transcribed texts from follow-up interviews were similarly coded. In order for the reader to have an understanding of the coding scheme, some examples of Ms. Lara’s statements during one of her lessons [Video] and in the follow-up interview [Interview] are provided.
Example 1:

[Video] Ms. Lara: I am giving it to you. It’s not my decision. It’s yours.

[V: Oct 25th, Measurement & Data]

[Interview] Ms. Lara: it empowers the kids to have some decision in their day-to-day life, you know…. I was trying not to make it 'do what you want'. I was trying to make it you know 'think about it and it's yours, it's not mine, it's yours.'

[I: Nov 25th, Measurement & Data]

Coded SVA, ECT

These statements from the video and interview were coded SVA (Student Voice and Agency) and ECT (Explicit attention to critical thinking) because through her statement of giving students the choice, Ms. Lara was providing them an opportunity to critically think about their choices and how their choice might impact how they chose to use instructional time. Ms. Lara’s students had ‘voice’ in her classroom; their needs and concerns were privileged in the instructional decisions that were made.

Example 2:

[Video] Ms. Lara: Someone at your own table might have an answer. [V: Oct 25th, Measurement & Data]

[Interview] Ms. Lara: I think it was important for them to work as a group on this, you know. And to realize that
somebody else knew something that they wanted to know.

I mean they didn't have to ask me. [I: Nov 25th,

Measurement & Data]

Coded OCK, SVA, EMR

The codes for the above statement were OCK (Opportunity to co-construct knowledge), SVA (Student Voice and Agency), and EMR (Explicit attention to mutual respect). Ms. Lara intentionally directed a student’s question back to the group, demonstrating that she wanted them to have agency and voice. She was seen to withdraw from her leadership position in her classroom. She intended for her students to work together to help each other construct knowledge, and respect each other’s mathematical understanding by listening to one another.

**Summary of methodology**

In summary, the methodology for my study was structured based on three key elements of “CCI Triangular Framework” (Figure 2): Clarity (स्पष्टता), Compassion (करुणा), and Integrity (अखंडता). Clarity (स्पष्टता) of the study was established in a clear understanding of the work of the teacher using qualitative methods and rich descriptions. My role as teacher-researcher-educator during the period of the study was clarified. The case study methodology was used in order to learn as much as possible about the teacher’s practice and perspectives. I drew on interpretive ethnography methods to make Ms. Lara’s case a vignette embedded in the culture of her classroom, school, and community. Qualitative methods provided rich descriptions, and foreground participant
voice. Compassion (करुणा) guided the humanistic element in the context and environment for the study. Relationships were built and maintained over prolonged engagement. The study was mutually beneficial, as Ms. Lara’s classroom had support and the researcher and research community learn more about an exemplary teacher’s work for equity and social justice. Such vignettes are few, and may be immensely valuable to teacher educators and researchers in their endeavor for equity in mathematics education. The concept of Integrity (अखंडता) was useful to establish data collection and analysis procedures that establish the study’s credibility. The researcher’s multiple roles as a researcher-teacher and participant-observer during the two stages of the study enabled the data collection and analysis processes to proceed with as little interference as possible. Issues of reliability and validity of the study were established as described in the chapter, through prolonged engagement, triangulation, referential adequacy, and transferability.
Chapter 4. Results

The purpose of my study was twofold: (1) identify and investigate a teacher’s perspectives and practices relevant to her pedagogy for equitable teaching of mathematics and (2) explore implications for social justice of those perspectives and practices. My investigation focused around the teacher’s interaction with the students, activities through which concepts were taught and presented, and types of tasks that students were engaged in during their mathematical explorations. The following research questions guided my study:

a. What instructional decisions does the teacher make that contribute to equitable teaching practices for students from low SES and ELL populations?

b. How does the teacher's disposition towards mathematics content and pedagogy influence her instructional and pedagogical choices for student self-empowerment in mathematics?

c. What goals are central to the teacher's pedagogy for equity and social justice?

I conducted initial interviews with the teacher Ms. Lara, to elicit background information, her perspectives on teaching and learning, and to extrapolate on her experience over the first year of classroom support. Following this, I video-recorded five mathematics lessons over a period of five months. I conducted follow-up interviews after each lesson to investigate Ms. Lara’s decision-making and pedagogy and I conducted a
final interview after completing a considerable amount of data analysis in order to clarify unresolved responses. I collected student work samples and researcher and teacher field notes to triangulate the data analysis.

The chapter includes:

- a summary of the five lesson episodes
- data analysis design for the study
- a description of how the interview protocols were conceptualized
- investigation into the lessons and interviews through the ‘Using mathematics to teach for equity and social justice’ codebook (Appendix A.)
- report of findings from total counts of codes
- summary of lessons
- models of the five teaching sessions that outline goals achieved under the four categories of the codebook – mathematics content, pedagogical orientation, contextual relevance, and social justice objectives
- Goals and intentions of the teacher’s perspectives and practice from the analysis and information from initial interviews
- Attributes of the teacher’s practice and perspectives to answer the research questions and give a broader understanding of equitable mathematics teaching including implications for social justice
- key aspects of the teacher’s work that may have impeded her pedagogy for equity and social justice.
### Summary of lessons

Table 6. Summary of lessons

<table>
<thead>
<tr>
<th>Unit as per Common Core Standards for Mathematics (Lesson name)</th>
<th>Topics</th>
<th>Activity/Task</th>
<th>Methodology</th>
<th>Mathematical Goals</th>
<th>Additional unplanned-for mathematical explorations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement and Data (Measurement &amp; Data)</td>
<td>Measuring and recording the following in CGI and customary units: Weight, Circumference, Radius, Diameter, Capacity Data recording and analysis: Representation, Mean, Median, Mode</td>
<td>Each group was given a pumpkin. As a group they record all measurements, and count seeds using efficient strategies. As a whole class the data is consolidated and measures of central tendency calculated.</td>
<td>Group work Students work in groups to find all measurements, record and convert to required units, count seeds and analyze data collected</td>
<td>Students review using measuring instruments, units of measurement, data collection, measures of central tendency</td>
<td>1. Difference between volume and capacity 2. Relationship between weight and number of seeds</td>
</tr>
<tr>
<td>Numbers and operations – place value (Place value)</td>
<td>Place value of digits in decimal numbers</td>
<td>Students look at numbers write on the board to determine place value of each digit. Teacher and students challenge each other by “building” numbers using cutouts of digits.</td>
<td>Collaborative learning. Hands-on activity by building numbers using cutouts of digits.</td>
<td>Students learn about the value of digits in decimal numbers. They determine what happens to digits when they are moved around in a number</td>
<td>1. Discussion about Presidential elections 2. Relating decimal numbers to fractions</td>
</tr>
</tbody>
</table>

Continued
<table>
<thead>
<tr>
<th>Unit as per Common Core Standards for Mathematics (Lesson name)</th>
<th>Topics</th>
<th>Activity/Task</th>
<th>Methodology</th>
<th>Mathematical Goals</th>
<th>Additional unplanned-for mathematical explorations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers and operations – fractions and decimals (Fractions)</td>
<td>Representation of numbers in fractional and decimal form</td>
<td>Students come to the board and write down a ‘set’ of representations of a number as a fraction, a decimal, and a percentage</td>
<td>Collaboratively understanding the three types of representations, helping each other write representations correctly</td>
<td>Students learn decimal representation of fractional numbers</td>
<td>Percentage representation of the decimal/fractional number</td>
</tr>
<tr>
<td>Numbers and operations – order and multiplication of decimals (Decimals)</td>
<td>Comparing decimal numbers, and multiplication of decimal numbers</td>
<td>Teacher demonstrates how to compare decimal numbers; students compare decimal numbers, and then review multiplication of decimal numbers.</td>
<td>Lesson begins with teacher modeling. This is followed by students coming up individually to board to write and receive feedback from whole class</td>
<td>Students learn visual alignment of decimals helps order numbers; review multiplication of decimal numbers</td>
<td>New point of interest generated designing an activity to examine how expanding toys expand in water.</td>
</tr>
<tr>
<td>Review lesson (Review)</td>
<td>Numbers and operations, arrays, representation of data, measures of central tendency, ratios and proportions, probability, and estimation</td>
<td>Students generate a list of review topics using a bag of candy hearts</td>
<td>Group discussion and students taking turns with review activities</td>
<td>Review of topics students are familiar with</td>
<td>Topics the teacher had not thought about were reviewed: ratios, probability, and estimation.</td>
</tr>
</tbody>
</table>
Figure 4. Data Analysis Flowchart
Data analysis

I carried out data analysis in different levels as displayed in the design model (Figure 4.). First I completed a fine-grained analysis of the lessons and interviews using the codebook. Next, I generated models of lessons identifying lesson goals pertaining to the four categories of equitable mathematics teaching in the codebook. I used these models, along with interview data, to determine goals and intentions of the teacher during particular episodes pertaining to the four categories. In the final stage of the analysis, I used the emergent themes of Ms. Lara’s practice to address the research questions.

Interviews

Initial interviews with the participant were largely open-ended, with the objective of getting to know the teacher’s background, her beliefs about teaching, her goals and intentions in her work, and her perspectives about her role in the lives of her students. I designed and conducted follow-up interviews as part of the analysis. I viewed and coded video recordings of lessons, and based on the coding, prepared protocols for the follow-up interviews, an example of which is provided in the methodology of my study.

Coding Scheme

I coded videos of lessons using the ‘Using mathematics to teach for equity and social justice’ codebook (Table 5) described in the previous chapter. I similarly coded the transcriptions from follow-up interviews. I provide examples of Ms. Lara’s statements during one of her lessons [Video] and in the follow-up interview [Interview] as an example of the use of coding scheme.
Example 1:

[Video] Ms. Lara: Someone at your own table might have an answer.

[V: Oct 25th, Measurement & Data]

[Interview] Ms. Lara: I think it was important for them to work as a group on this, you know. And to realize that somebody else knew something that they wanted to know. I mean they didn't have to ask me.

[I: Nov 25th, Measurement & Data]

Coded OCK, SVA, EMR

The codes for the above statement were OCK (Opportunity to co-construct knowledge), SVA (Student Voice and Agency), and EMR (Explicit attention to mutual respect). Ms. Lara intentionally directed a student’s question back to the group, demonstrating that she wanted them to have agency and voice. She stepped down from her leadership position in the classroom. She intended for her students to work together to help each other construct knowledge and respect each other’s mathematical understanding through listening to one another.

Example 2:

The following is an interaction between Ms. Lara and her students as they were sitting around a table reviewing content previously taught in the class. The session began with the teacher asking the students what topics they would like to review using a bag of candy hearts.
Andy: Arrays.

Ms. Lara: Oh that is very cool. Make arrays. How could I do that?

Andy: You could put three going this way and three going this way (gestures horizontally and vertically).

Ms. Lara: And that would be an array of what?

Andy: An array of 3 times 3.

Ms. Lara: 3 times 3. Nice.

Don: That's 3 times itself.

Sara: 9.

Ms. Lara: And what do you call it when a number is times itself?

Andy: A three two.

Sara: Three to the power of two.

Don: Umm.. three squared.

Ms. Lara: We call it three squared, because when we make that array, it makes what shape?

Sara: A square.

[V: Feb 8th, Review lesson]

[Interview]

Ms. Lara: It gives them more things to fall back on. If they have an image, they have the vocabulary, they understand
how they go together…. It is critical for students who learn differently… if they don’t catch it this way, they might catch it this way or they might catch it this way. So even though it might seem like it’s linking things together, it gives a lot of different opportunities for kids to latch onto something. [I: Apr 6th, Review lesson]

Coded ETR, ETL, ETMP, OCK, SVA, EMR

I coded the section as ETR (Explicit Talk about ways of Reasoning), ETL (Explicit Talk about the meaning and use of mathematical Language), ETMP (Explicit Talk about Mathematical Practices), OCK (Opportunity for Co-construction of Knowledge), SVA (Fore-grounding Student Voice and Agency), EMR (Explicit attention to Mutual Respect). Ms. Lara acknowledges the validity of the idea provided by the student (SVA), and asked questions to push the students to a richer mathematical understanding (ETR) and use of appropriate mathematical language (ETL). The students moved from thinking of types of arrays and related squared numbers to square arrays. The student provided a perceptual understanding of an array. Ms. Lara asked three key questions in this section to help students make connections from perceptual understanding to the squared number and then to a visual representation, and thus provided opportunities for students’ deeper understanding and connectedness (ETMP). The line of questioning, moreover, was one that respected student thinking (EMR), using the student’s prior knowledge and building on it to enable a fuller conceptual understanding. During the interview Ms. Lara clarified her intent, saying that she wanted
students to have different representations so that they could understand the concept in whatever way they were most comfortable with (OCK).

**Observations from code counts**

**Summary of code counts**

I coded lesson video recordings and interview transcriptions using the Using mathematics to teach for equity and social justice codebook (Table 5). The summary of the counts are given in the table 7.
<table>
<thead>
<tr>
<th>LESSONS</th>
<th>TYPE OF DATA</th>
<th>CATEGORY-I</th>
<th>Total-I</th>
<th>CATEGORY-II</th>
<th>Total-II</th>
<th>CATEGORY-III</th>
<th>Total-III</th>
<th>CATEGORY-IV</th>
<th>Total-IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CONTENT</td>
<td>PEDAGOGY</td>
<td>CONTEXT</td>
<td>SOCIAL JUSTICE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ETL</td>
<td>ETR</td>
<td>ETMP</td>
<td>EST</td>
<td>IT</td>
<td>EDC</td>
<td>AU</td>
<td>RWP</td>
</tr>
<tr>
<td>Measurement and Data</td>
<td>Lesson Video</td>
<td>26</td>
<td>31</td>
<td>22</td>
<td>79</td>
<td>43</td>
<td>11</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Interview</td>
<td>6</td>
<td>11</td>
<td>30</td>
<td>47</td>
<td>5</td>
<td>9</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers and operations – place value</td>
<td>Lesson Audio</td>
<td>9</td>
<td>18</td>
<td>2</td>
<td>29</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Interview</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>10</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers and operations - fractions and decimals</td>
<td>Lesson Video</td>
<td>26</td>
<td>34</td>
<td>14</td>
<td>74</td>
<td>23</td>
<td>12</td>
<td>5</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Interview</td>
<td>6</td>
<td>21</td>
<td>13</td>
<td>40</td>
<td>13</td>
<td>6</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers and operations - comparing decimals</td>
<td>Lesson Video</td>
<td>24</td>
<td>38</td>
<td>23</td>
<td>85</td>
<td>20</td>
<td>13</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Interview</td>
<td>6</td>
<td>16</td>
<td>10</td>
<td>32</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review lesson</td>
<td>Lesson Video</td>
<td>25</td>
<td>36</td>
<td>40</td>
<td>101</td>
<td>31</td>
<td>24</td>
<td>17</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Interview</td>
<td>5</td>
<td>20</td>
<td>10</td>
<td>35</td>
<td>9</td>
<td>8</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td></td>
<td>135</td>
<td>231</td>
<td>166</td>
<td>532</td>
<td>162</td>
<td>99</td>
<td>106</td>
<td>193</td>
</tr>
</tbody>
</table>

Table 7. Total counts of codes
Social justice objectives codes maximum

The maximum number of codes emerged from the fourth category, “social justice objectives”. During her lessons Ms. Lara intentionally attended to attributes of pedagogy that have implications for social justice, including: a) Opportunity for Co-construction of Knowledge; b) Fore-grounding Student Voice and Agency; c) Explicit attention to Mutual Respect; d) Encouraging Critical Thinking.

Ms. Lara often began her sessions by asking students questions to determine what their interests were and what they would like to learn or investigate. Ms. Lara claimed that she had no perfectly laid out lesson plan. She always began with an overarching objective, but was flexible based on what she ascertained from her students. She allowed the lesson to take its course based on what she perceived as her students’ need. During this initial period of the lesson, she compiled all the information the students gave her to understand their needs. She allowed them to ask questions they were curious about, giving them the opportunity to co-construct knowledge. Students became the locus of authority, having voice and agency.

She respected their views and required them to respect one another’s views. She invited and used students’ ideas to develop her lessons. For the review lesson, Ms. Lara placed a bag of candy hearts in front of the group and said, “I want to know what can I do with this to make this some kind of a math lesson maybe, that would help us review things we already know?” [V: Feb 8th, Review lesson]. Students contributed ideas, which she then used to cover the concepts they had learned that year. In introducing the lesson in this way, Ms. Lara was intentional in encouraging students to take ownership of instructional decisions. She considered students to be her partners and participants with
voice in her classroom. The question opened Ms. Lara’s class for full and equal student participation (Bell, 2007). Students contributed ideas about concepts in mathematics they could review using the bag of candy hearts. The concepts ranged from operations on numbers to data analysis and probability. Ms. Lara wrote down each suggestion and facilitated the discussion to review them. She allocated leadership roles to the students who made suggestions by referring any questions about the activity to that particular student. In doing so, Ms. Lara demonstrated how she was building student agency in her class.

Ms. Lara listened to students’ questions and implemented ideas that addressed them in her lessons. There are several objects in her classroom that the students find interesting and curious. The objects trigger their imagination and questions, and Ms. Lara takes them to build lessons around them. One such object is a glass bowl with a grow-in-water toy caterpillar. The children watched the toy grow, and one day, Sophia told Ms. Lara that she wondered if it would grow large enough to fill the entire room.

“Ms. Lara picked up the water bowl and placed it in front of the class today. She took the toy out of the water, and asked, “That’s an interesting question! Let’s talk about that!” She led a discussion about what they would want to know and how they might determine that.” [FN: Dec 4th, Decimals].

The project continued for several days, with students recording data and investigating how much the toy grew. Students and teacher became co-constructors in the discovery and mathematical investigation. Again, Ms. Lara credited the student who
initially asked the question with the leadership role in answering follow-up questions. She helped him to pose the question more explicitly as well: did he want to know how much the worm was growing or how much it would shrink if kept out of the water? Once the investigation began, the student led the group in finding measurements and recording data. The students had ownership in the project while they were engaged in learning mathematics.

**Contextual elements codes minimum**

Contextual elements of Ms. Lara’s pedagogy were the least observed. From this result, it might appear that Ms. Lara was not paying attention to the contextual elements of her pedagogy. However, while coding for contextual elements such as “RWP: real world problems or examples”, one single code was placed over an entire segment of data that involved the real world problem. In other words, a section of data that had to do with a real world problem used in Ms. Lara’s lesson was accounted for by one single contextual code. I treated other codes differently as I further coded smaller segments of lessons using the content, pedagogical, and social justice codes. Therefore, although the contextual codes are few, they are “weighted” more than the others. Except one, all the recorded sessions of Ms. Lara’s classroom had a real-world contextual element. In the first lesson, Ms. Lara used pumpkins to teach about measurement and data analysis. Lesson 2 was recorded on the day of the US elections and Ms. Lara facilitated a discussion about the elections. She encouraged them to think about issues they might consider when choosing a leader, and what they might need to accomplish to become leaders. In lesson 3, there were no specific references to real-world problems or contexts. In lesson 4, Ms. Lara helped students understand decimal numbers by relating them to
money. They also began their investigation of the rate at which an expanding water toy was growing. During Lesson 5, Ms. Lara used candy hearts to review mathematical concepts. Using a context as familiar as candy, Ms. Lara helped students access mathematics. Real world context is therefore weighted more heavily in these instances, to emphasize Ms. Lara’s attention to the everyday lives of the students and helping them access mathematics through their real world experiences.

**Content and pedagogical codes balanced**

Ms. Lara’s content objectives (attention to mathematics) and her pedagogical orientation codes (purposeful support of students as learners) were equally balanced. In terms of content, Ms. Lara’s mathematics classroom discourse covered a range of content areas. The mathematical tasks she chose provided opportunities for the students to move into and make connections between multiple content areas. She explicitly made connections between concepts when such opportunities arose. She asked questions that led students to consider connections among different representations. As noted in an earlier example (on page 112) she facilitated a discussion to connect the visual and mental representations of square arrays and square numbers. Simultaneously, Ms. Lara initiated pedagogy aimed at building a learning community classroom culture. Pedagogical actions like collaborative work and project-based learning opportunities were integrated with a focus on rich content and mathematical reasoning. Group activities also did not distract from Ms. Lara’s goal of attending to individual students’ needs. While students worked in groups, she worked with particular students who may have been struggling with a mathematical concept. Ms. Lara began lessons with clear and explicit instructions for students’ tasks, making sure every one of her students
understood. She also sought student voice and ownership by asking questions like “Is everyone ok with that?” “Does anyone have a problem with that?” and “Does anyone have a different suggestion?”. When speaking of mathematical concepts, she clarified meanings by using different phrases, words, or representations. In doing so, she explained that her intention was to provide all students with different representations or ideas they could ‘latch on to’ based off of their own ways of thinking. Ms. Lara also pushed students to move forward in their mathematical understanding to as much complexity as they were capable of. She encouraged a diverse array of mathematical competencies by choosing rich tasks that students could access at multiple levels while intentionally using student thinking to plan her next instructional move. She never closed a lesson without an effort to “at least push something a tiny bit further, unless they're all confused.” She watched to see if they were confused or if they understood, and based on that, took the lesson further. “If it looks like we're getting there, then at least I want them to think of one more thing.” [I: Apr 6th, Review lesson]. In this way, Ms. Lara was pushing her students to think further towards higher levels of understanding.

Summary of observations from code counts

The overview of the total counts of codes indicated that Ms. Lara’s teaching practice provided a ‘rich’ case for equitable mathematics teaching. Her content objectives for mathematical practices, reasoning, and language are evident in her teaching. Moreover, an investigation into the pedagogy of creating an environment of a ‘learning community’ provided me, as researcher, with vivid images. Ms. Lara planned her teaching based on an understanding of the context of students’ lives and needs coupled with high expectations for them. She explicitly attempted to relate mathematics learned in
the classroom to lived experiences. Ms. Lara’s pedagogy was strongest in the objectives that had implications for social justice. Through providing opportunities for students to co-construct knowledge and become the locus of authority for both mathematics learned and instructional time, Ms. Lara activated the social justice objectives of teaching.

**Teaching episodes: lesson goals mapped with codebook**

Adapting Schoenfeld's (1999) representation of the teaching process, I created models of the five lessons to identify the teacher’s actions and goals. The models outline goals achieved under the four categories of the codebook – mathematics content, pedagogical orientation, contextual relevance, and social justice objectives (Table 5). I identified episodes and sub-episodes of the lessons where these goals were activated/achieved and mapped Ms. Lara’s practices onto the goals to identify key attributes of her teaching. A generalized model is given below:

<table>
<thead>
<tr>
<th>The Lesson</th>
<th>First level of decomposition (major episodes)</th>
<th>Second level of decomposition (sub-episodes)</th>
<th>Major lesson goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of lesson</td>
<td>Episode 1 Sub-episode 1.1 Sub-episode 1.2 Where relevant, episode pedagogy, assessment, content, discourse is described</td>
<td>Major lesson goals</td>
<td></td>
</tr>
<tr>
<td>Episode 2 Sub-episode 2.1 Sub-episode 2.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>........</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8. General format of lesson models
The reader will see that the lesson goals are identified by the four major categories of the codebook (Table 5), and are abbreviated as M (Mathematics content objectives), P (Pedagogical orientation), C (Contextual relevance), and S (Social Justice objectives). When a goal is activated/achieved it is identified by the number of the lesson followed by the letter signifying the category. For example, L1M1 signifies that a mathematical content objective was observed during the episode in lesson 1. In the event that a mathematical content goal is observed more than once, it is sequentially assigned a number, for example L1M1, L1M2. The lines in the column are placed in the position corresponding to the episodes or sub-episodes where the goals were observed as being achieved.

**Lesson 1: Measurement & Data**

The model and summary of the lesson “Measurement and Data” is provided below in Table 9. The lesson used pumpkins to learn measurement, data collection, and measures of central tendency.
<table>
<thead>
<tr>
<th>The Lesson</th>
<th>First level of decomposition (major episodes)</th>
<th>Second level of decomposition (sub-episodes)</th>
<th>Major lesson goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L1S1</td>
</tr>
<tr>
<td>1. “Brain gym” action song</td>
<td>Teacher lets the students decide to participate or not in the “brain gym” action song</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Students form teams</td>
<td>2.1 Teacher asks students suggestions as to how they would like to be grouped 2.2 Students sign up for their groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Instructions</td>
<td>Teacher gives clear instructions to student groups and distributes objects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Group work</td>
<td><strong>Pedagogy:</strong> Students work in groups to measure, separate seeds from the pulp, distribute the seeds among themselves, and count them <strong>Content:</strong> Students find weight, circumference, radius, diameter, and capacity of pumpkin; students share and use efficient strategies to count <strong>Discourse:</strong> Students share ideas; teacher moves among groups prompting them to think about accuracy, units</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9. Model of Lesson 1: Measurement & Data
I identified the lesson goals achieved with the categories from the ‘Using mathematics to teach for equity and social justice’ codebook (Table. 5) as follows:

L1S1. Social Justice goal: Students think and make decisions independently, teacher respects student choice. Social Justice objective codes: SVA, EMR
L1S2. Social Justice goal: Students choose their own groups by signing into teams. Social Justice codes: SVA
L1M1, L1C1, L1S3. Lesson goal: Students measure using measuring instruments and record measurements in CGS and Customary units. Students working in groups learn and use different strategies to count. Content, Contextual, and Social Justice codes: ETR, ETMP, ETL, RWP, OCK, EMR
L1P1, L1C2. Pedagogical and contextual goal: Students collaborate as they work in groups. Pedagogical orientation codes: EDC, AU, EST
L1S4. Social Justice goal: Students respect each other as they share ideas in their groups. Social Justice objective codes: EMR, OCK, SVA
L1C3. Contextual goal: Student mathematical and social identities are built. High expectation and student effort. Contextual relevance codes: ESE, EE

Lesson 1 Summary

The Measurement & Data lesson began with an action song entitled ‘brain gym’. The song included actions such as jumping, stretching, and dancing to a spritely tune, supposedly to provide exercise to energize the body and the mind. The activity had become part of the morning routine in the school. The song was aired over the audio system and the students were expected to stand up and dance to it. Some students refused
to participate and Ms. Lara began the session saying she was going to leave it to the students to decide if they wanted to do it or not, thus respecting their choice (EMR), and building student agency and voice (SVA).

Then she got students to give ideas on how they would form groups for the next activity. They were given pumpkins for the activity, connecting it to their lived experiences (RWP). Working in groups autonomously (AU), bringing a diverse range of mathematical competencies (EDC), they had to measure the circumference, diameter, radius, weight, and the capacity of their pumpkin, focusing on mathematical reasoning (ETR) and mathematical practices (ETMP). They also counted the number of seeds and record their findings. Then, as a whole group, they determined the mean number of seeds for the set of four pumpkins. They also explored, as a matter of curiosity, if there was any relationship between the weight and number of seeds in the pumpkin, an opportunity to construct knowledge (OCK). Mathematics content goals included learning about measurement in CGS and customary units, using measuring instruments, data collection and analysis. Pedagogical goals included students working autonomously in groups, listening and helping each other learn. Ms. Lara went around asking questions and making sure they were on task and listening to one another, building agency (SVA), mutual respect (EMR), co-constructing knowledge (OCK). Students could go to multiples sources for the answers to their questions. The teacher was constantly assessing her students, having high expectations (EE), encouraging their effort (ESE) through the entire activity.
Lesson 2: Place value

I provide the model and summary of the lesson “Place Value” in Table 10. The lesson involved students learning the place value of the digits within a decimal number.

<table>
<thead>
<tr>
<th>The Lesson</th>
<th>First level of decomposition (major episodes)</th>
<th>Second level of decomposition (sub-episodes)</th>
<th>Major lesson goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers and operations – Place value</td>
<td>1. Teacher leads discussion about elections</td>
<td>Students bring up issues they heard in media. Teacher leads them to think what information they would consider to choose a leader, and what they need to do to become leaders.</td>
<td>L2 S1 L2 M1 L2 M2 L2 P1 L2 P2 L2 S2</td>
</tr>
<tr>
<td></td>
<td>1. Students review reading decimal numbers</td>
<td>Teacher writes decimal numbers on the board and asks students to read them</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Students challenge each other</td>
<td>Students come up to the board and write numbers to challenge their friends to read them (eg. 0.002098)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Building numbers</td>
<td>Students are given cutouts of digits to ‘build’ their own numbers and order them</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Share most difficult numbers</td>
<td>Students come to board and write their most challenging number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Ordering numbers</td>
<td>Teacher leads whole class to order the numbers on the board</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Pair-share</td>
<td>Students worked in pairs to build numbers for their partner to read while teacher circulates class</td>
<td></td>
</tr>
</tbody>
</table>

Table 10. Model of Lesson 2: Place Value

I identified the lesson goals achieved with the categories from the ‘Using mathematics to teach for equity and social justice’ codebook (Table 5) as follows:

L2S1 Social justice goal: Student think critically about electing a leader and what they will do if they stood for President one day. Social justice codes:

ECT, EMR
Lesson 2 Summary

The lesson was recorded on the day of the US elections. Students had a sign-in posted for them on the board, in which they had to write down who they thought would win the election. All of them signed under President Obama’s name, and learned the word ‘unanimous’. Then they discussed things they heard in the news about the candidates. Ms. Lara told them that both parties had said some ‘not so nice things’, but she asked them to think and state who they would believe and why. This was followed by a discussion about what they would consider while selecting a leader. The children said they would consider if they knew the person or not, whether they were honest, and whether they were helping the community. Then she asked them what they would need to do in the present if they wanted to be President one day. Students talked about studying, going to college, staying out of prison, doing good for their communities. The entire
discussion was coded for ECT (encouraging critical thinking) and EMR (mutual respect) and SVA (student voice and agency).

After this, the lesson proceeded with decimal numbers, reading and ordering them. Ms. Lara taught them to line the decimals and read aloud. She made them all read each number loudly to hear them as she assessed their knowledge. She allowed all students to give feedback without interrupting each other, encouraging mathematical reasoning (ETR), language (ETL), and mathematical practices (ETMP). This was her way of assessing if they understood the concept. Children then built numbers and quizzed each other. This built agency (SVA), and students had the opportunity to co-construct knowledge (OCK).

**Lesson 3: Fractions**

I provide the model and summary of the lesson “Fractions” in Table 11. The lesson involved students learning to represent fractions as decimals and percentages.
<table>
<thead>
<tr>
<th>The Lesson</th>
<th>First level of decomposition (major episodes)</th>
<th>Second level of decomposition (sub-episodes)</th>
<th>Major lesson goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Review with examples of a fractional number and its equivalent decimal</td>
<td>Students take turns to come to the board and write a ‘pair’: a fraction and its equivalent decimal</td>
<td>L3M1 L3M2 L3S1L3P1 L3S2</td>
</tr>
<tr>
<td></td>
<td>2. Fraction, decimal and percentage representation</td>
<td>2.1 Teacher adds the percentage representation to a fraction-decimal pair. Eg. .05 = 5/100 = 5% 2.2 Students come to board and write their examples of ‘sets’ of numbers 2.3 Whole group discussion to support student in making corrections to the representations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Ordering set of decimal numbers</td>
<td>Teacher models ordering a set of decimal numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Students build and order decimal numbers</td>
<td><strong>Pedagogy:</strong> Students work individually with cutouts of decimal numbers. They make ‘sets’ of three numbers and order them  <strong>Content:</strong> Decimal numbers and featuring numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Whole-class discussion</td>
<td>Students come up to the board and share their sets of ordered numbers <strong>Assessment:</strong> Teacher asks them to read the numbers aloud</td>
<td></td>
</tr>
</tbody>
</table>

Table 11. Model of Lesson 3: Fractions

I identified the lesson goals achieved with the categories from the ‘Using mathematics to teach for equity and social justice’ codebook (Table 5) as follows:

L3M1  **Content goal:** Students review how to represent a fraction as a decimal and percentage. **Content objectives codes:** ETL, ETR, ETMP

L3M2  **Content goal:** Students learn ordering of numbers. **Content objectives codes:** ETR
L3S1, L3P1  Lesson goal: Students correct their own mistakes with the help of the teacher and other students. Pedagogical and Social Justice codes: AU, OCK, SVA, EMR, ESE, EE

L3S2  Social justice goal: Students build agency as they help each other. Social Justice objectives codes: OCK, SVA

**Lesson 3 Summary**

Students came to the board and wrote numbers in the form of fractions, percentages, and decimals. Some students wrote one or other of them wrongly. Ms. Lara helped and supported them to think autonomously (AU) through the representations, reason (ETR), learn the language (ETL) and make corrections. She gave the student at the board time and space by isolating him from others, so he could think, having high expectations of all students (EE), and commending student effort (ESE). Although she provides several opportunities for students to collaboratively learn (OCK), at certain times she provides them with opportunities to learn individually and work autonomously (AU). She provided the opportunity for students to co-construct knowledge (OCK) through the activity.

**Lesson 4: Decimals**

I provide the model and summary of the lesson “Decimals” in Table 12. The lesson involved students comparing decimal numbers, and learning how to multiply numbers with decimals.
The lesson goals achieved were identified and mapped with the categories from the ‘Using mathematics to teach for equity and social justice’ codebook (Table 5) as follows:

<table>
<thead>
<tr>
<th>Major lesson goals</th>
<th>L4 M1</th>
<th>L4 M2</th>
<th>L4 P1, L4 S1</th>
<th>L4 S2</th>
<th>L4 S3</th>
<th>L4 S4, L4 C1</th>
</tr>
</thead>
<tbody>
<tr>
<td>L4 M1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L4 M2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L4 P1, L4 S1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L4 S2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L4 S3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L4 S4, L4 C1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 12. Model of Lesson 4: Decimals

The lesson goals achieved were identified and mapped with the categories from the ‘Using mathematics to teach for equity and social justice’ codebook (Table 5) as follows:

L4M1 Lesson goal: Students learn the procedure to help them compare decimal numbers. Content objectives codes: ETR, ETMP

137
Lesson 4 Summary

Ms. Lara began the lesson by reviewing decimal numbers, place value, and how they are to be read. She then guided them to line up the decimals to compare numbers, providing a visual to help them, recognizing their diverse ways of learning (EDC) and expecting all to learn (EE). She also helped them to reason mathematically (ETR), and help one other as a community of learners. Mathematical practices (ETMP) including precision, effort, etc. were emphasized. Students also learned to multiply decimal numbers, and the teacher paid attention to language (ETL), reasoning (ETR), and precision. She helped them work as a group in supporting one another to construct knowledge (OCK), respect each other (EMR), and think critically (ECT) by giving them alternate numbers to think about. By relating decimal numbers to money, she connected the lesson to their experiences (RWP). Towards the end of the lesson, one student said
that she was curious about the expanding water toy that was in a bowl of water at the back of the class. Ms. Lara took the question, giving student voice (SVA) and led a discussion about how they can investigate the question of how much the toy was expanding. They made a plan for the project, thus constructing new knowledge (OCK), students having voice and agency (SVA).

**Lesson 5: Review**

I provide the model and summary of the lesson “Review” in Table 13. The lesson involved students using a bag of candy hearts to review concepts that they had previously learned.
<table>
<thead>
<tr>
<th>The Lesson</th>
<th>First level of decomposition (major episodes)</th>
<th>Second level of decomposition (sub-episodes)</th>
<th>Major lesson goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L5 M1</td>
</tr>
<tr>
<td>1. Students suggest topics to review</td>
<td>Students suggest topics to review using the bag of candy hearts and explain how. Eg. Making arrays, combinations, probability, estimation. <strong>Pedagogy:</strong> group sitting around a table and brainstorming ideas. <strong>Discourse:</strong> Teacher acknowledges and uses student ideas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Making arrays</td>
<td><strong>Content:</strong> Teacher provides prompts for students to connect geometric and mathematical representation of square numbers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Data representation and analysis</td>
<td><strong>Content:</strong> With teacher providing minimal guidance, students represent data of candy hearts of different colors with tally marks, frequency table, line plot, bar graph.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Probability</td>
<td>Teacher leads student-suggested game to finding probability of picking a particular color.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Ratios</td>
<td>Teacher helps students find ratios in which particular colors occur.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Which representation is most accurate</td>
<td>Teacher leads a discussion on which representation students would choose as most accurate.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 13. Model of Lesson 5: Review
I identified and mapped the lesson goals achieved with the categories from the ‘Using mathematics to teach for equity and social justice’ codebook (Table 5) as follows:

L5M1  Content goals: students recall concepts, and provide details of the activity for their suggested concept. Content objectives codes: ETMP, ETR

L5P1  Pedagogical goals: Students think and contribute ideas. Pedagogical orientation codes: EDC, AU, IT

L5P2, L5S1  Pedagogical and Social Justice goal: Students asked to pay attention and wait as one speaks or is thinking to clarify their ideas. Pedagogical and Social Justice codes: EDC, AU, EMR

L5S2  Social Justice goals: Student agency and voice as teacher recognizes ideas and credits student contributing a particular idea. Social justice objectives codes: EMR, SVA

L5S3  Social Justice goals: Thinking critically about representations. Social justice objectives codes: ECT

**Lesson 5 Summary**

The review lesson began with Ms. Lara placing a bag of candy hearts and asking how they might use it to review some of the concepts the students had learnt that year. This was a means of providing students voice (SVA), and respecting their thinking (EMR). Students suggested various concepts. Ms. Lara wrote all of them down and went through them one by one in the group. She provided opportunity to construct knowledge (OCK), encouraged diverse mathematical competencies (EDC), helped them reason mathematically (ETR), and work as a group (ETMP). She concluded the lesson by asking them to think critically (ECT) about the representation that would be the most accurate.
I created the above five models of lessons to map the lesson goals of each episode and sub-episode of the lessons with the four categories of equitable teaching practices of the codebook. I used follow-up interviews with Ms. Lara to map the goals of her pedagogy with her intentions during each episode. Consolidating the information thus collected, I identified the goals and intentions of the teacher’s practice and pedagogy pertaining to the four characteristics of equitable mathematics teaching – content objectives, pedagogical orientation, contextual relevance, and social justice objectives. I further clarified these goals and intentions during the follow-up interviews and present them in the following section.

**Goals and intentions of Ms. Lara’s practice and pedagogy**

In the following section, I will describe Ms. Lara’s goals and intentions pertaining to the four categories of equitable teaching practices from the codebook: content objectives, pedagogical orientation, contextual relevance, and social justice objectives (Table 5). I ascertained the goals and intentions of Ms. Lara’s practice and pedagogy pertaining to the four characteristics by consolidating information from the lessons (for her goals) and interviews (for her intentions). This chapter provides the account interwoven in standard font with transcripts of classroom videos, interviews, and field notes. Extended quotes are indented with the identifiers as described in the methodology chapter, at the end of the quote.

**Category I: Content objectives (Attention to mathematics)**

**Codes ETL, ETR, ETMP**

Content objectives identified with equitable mathematics teaching include: the teacher’s attention to mathematical language (ETL), mathematical reasoning (ETR), and
mathematical practices (ETMP). In achieving these objectives, the following intentions
behind Ms. Lara’s practice played a major role: a) making connections using language
and multiple representations b) integrating procedural and conceptual understanding; b)
having a continuous (in)formative assessment. Ms. Lara’s goals in her practice and her
intentions corroborated in what the researcher saw in her classroom, and what she
clarified in her interviews.

Making connections with language and multiple representations

Ms. Lara believed that individual children learn differently, and therefore, she
made sure to present ideas in multiple ways so that students would make connections that
best suited them. Her approach was based on her own experience of learning by making
connections, as she stated in a follow-up interview:

“I always like to just make connections, and if I'm up there
teaching something and I make a connection then I'm
figuring somebody else will too. So I might as well share it
with them.” [I: Apr 6th, Decimals]

In order to help students’ connected knowing (Becker, 1995), Ms. Lara was often
found defining and clarifying terms using multiple ways. She did this intentionally, based
on her understanding that when students make one connection, multiple connections can
evolve and help their conceptual understanding. According to her, she could “explain
something given a term they already know, then you get all these connections that start to
happen,” This also stems from her own way of “getting it”, as she explains, “I might not
understand something, and someone might say it differently, and suddenly, I get it!
Students also have different ways they’ll get it. So I make sure they see things in many different ways” [I: Nov 25th, Measurement & Data].

Particularly as Ms. Lara began working with ELL students, she began to pay attention to language. She shared with the researcher in an early interview how she realized early in the school year that she needed to change the way she was communicating with them. She realized that the language she was using, which was conventional to mathematics was not getting her the results she was hoping to see. Her students did not have the background in conventional mathematical language that would be expected of students at fifth grade level of mathematical understanding. She shared with the researcher her experience of how she had no success when she was using language that was familiar and common to school mathematics,

“using words like, if you see the word altogether it means you add. They were just gone. I would try and do things like just simple addition and I was using the typical plus and counting on, and number lines and things like that, and or even if I tried to put it in words, like a word problem, there was just nothing. And I thought I was simplifying it. I really did. I thought I was down to bare bones simple. And I still didn’t have them.” [Initial Interview: Oct 15th, 2012]

Ms. Lara reflected on her experience of feeling frustrated when she thought she was not able to communicate with her students and watched how the team of educators used manipulatives to help students make connections with the mathematics. She saw a
new “third language start to develop” as they worked with objects and started communicating the mathematics they were learning.

“Sometimes I would ask them things, and I’d get this total blank look, and I didn’t know whether they weren’t understanding me, they weren’t understanding the question or they weren’t used to answering. I couldn’t even figure out the breakdown. And when you guys came, you got things in their hands right away and umm. I watched this vocabulary start to develop that it was almost like.. you know a language that like a third language between us all.”

[Initial Interview: Oct 15th, 2012]

The team of teacher educators working with the students used CGI (Carpenter et al., 1994) to frame mathematical questions in language that students could easily access. Students then began to use representations that they understood and that best suited their ways of learning. After the teacher educators had stopped teaching the students, Ms. Lara continued to attend to language and vocabulary.

Besides language, Ms. Lara sought to make connections between students’ visual and conceptual understanding. During the review lesson, one student suggested they review arrays by placing candy hearts in the form of an array. In the subsequent conversation with the student, Ms. Lara posed questions to push the students to a richer and more connected mathematical understanding (Baroody et al., 2007). The following interaction shows how the student provided a visual perception of an array, and the
teacher asked three key questions to help the students make connections between their visual perception of a square array and a square number.

Ms. Lara: Make arrays. How could I do that?

Andy: You could put three going this way and three going this way (gestures horizontally and vertically).

Ms. Lara: And that would be an array of what?

Andy: An array of 3 times 3.

Ms. Lara: 3 times 3. Nice.

Don: That’s 3 times itself.

Sara: 9.

Ms. Lara: And what do you call it when a number is times itself?

Andy: A three two.

Sara: three to the power of two.

Don: umm.. three squared.

Ms. Lara: We call it three squared, because when we make that array, it makes what shape?

Sara: A square.

[V: Feb 8th, Review lesson]

As part of implementing making connections, Ms. Lara helped students verbalize decimal numbers. She made students read numbers they had written and also write numbers they said. If they read a number wrongly, she wrote the number they spoke beside the one they were reading, so that they could distinguish between the two. Making
connections between visual representations and verbal readings of decimal numbers was observed during the decimals lesson. Students came up to the board and wrote numbers they thought were difficult to read in order to challenge their classmates. One student wrote “4.501”. It was John’s turn to read it and he read:

John: Four and fifty one thousandths.

Ms. Lara: Four and fifty one thousandths. Anyone have a different idea? Han?

Han: Four and five hundred and one thousandths.

Ms. Lara: Four and five hundred and one thousandths.

Alright. That’s what we got. If we had this, John, it would have looked like what you said.

Ms. Lara writes 4.051

Ms. Lara: This is what four and fifty one thousandths would look like. Now read what you had before.

[V: Nov 6th, Place value]

Ms. Lara helped John make a connection from what he said verbally to what the number visually looked like. This action provided an opportunity for him to connect the written and spoken number. In subsequent examples, the student was successful in interpreting other numbers exemplifying the growth he experienced through this interaction.

Ms. Lara provided support to students with multiple ways of learning, through language, visual representations, and conceptual meanings. She believed that in doing so,
students would have something that they could connect with and associate with, that would enable them to access the mathematics. It gave them

“more things to fall back on. If they have an image, they have the vocabulary; they understand how they go together.

It is critical for students who learn differently. If they don’t catch it this way, they might catch it this way or they might catch it this way. So even though it might seem like it’s linking things together, it gives a lot of different opportunities for kids to latch onto something.” [I: Apr 6th, Review lesson]

**Integrating procedural and conceptual understanding**

Ms. Lara emphasized procedural fluency as a means to access conceptual understanding. While introducing a procedural strategy to order decimal numbers she intended to provide students with a visual model to access the concept. The procedure she demonstrated was to first line up the decimals, then fill in zeros for missing digits, and lastly, to start reading the numbers from left to right, in order to identify the greatest. Since the method utilized was very procedural, I asked Ms. Lara about what certain part of mathematics might need to be taught procedurally, and how students would then reach conceptual understanding. Ms. Lara elaborated that a procedural method was only one way of providing students with a visual representation as a step towards conceptual understanding. She asserted that:

“knowing these kids, I think they need something visual, and if that's what procedural means exactly, yeah, do this
and then do this and then look here. I think it's very important…this might be a scaffolding thing, it be something for the kids who learn more visually.” [I: Dec 4th, Decimals]

Ms. Lara’s instructional decision in making the procedural-conceptual connection was based on her assessment of how her students learn. “Knowing these kids, I know they need something visual,” she said. After they learned the procedure, she gave them the task of reading the numbers. This task was again a deliberate decision. She believed it was the next step toward telling which one number is greater or less. When they read the numbers aloud, she reasoned they could connect the number they see and the number they read (aloud), and correct themselves if the two do not match.

Ms. Lara thought that once students understood a concept conceptually, and developed procedural fluency, they would be able to move to the next without using the procedure as a “crutch”. After they master the procedure of lining up the numbers and reading them, they will be able to skip the step of lining up the decimals, she said. For her students

“to take this to the next step where they don't need to do this, they need to be able to read those numbers. And now, looking at this they can even quickly tell which one's larger and which one's smaller.” [I: Dec 4th, Decimals].

The same thing applied to memorizing facts, she added: “knowing how to skip count and how to do things like that it eventually becomes not so much a crutch and then they can move into the next step.” [I: Dec 4th, Decimals]
Her Montessori training helped Ms. Lara to support students move from procedural (which she understood as another visual representation) to conceptual understandings. She considered moving from procedural fluency to conceptual understanding similar to moving from using manipulatives to abstracting. She clarified that the procedure of lining up decimals was like using a manipulative. She needed to hear the numbers from the students because only then she was able to determine if they were abstracting or not. She explained this as her intention:

“...use manipulatives and the idea is to go from the concrete to the abstract, and I think what's happening is I can't tell if they are abstracting unless I hear it. I can look at the numbers, I can look at what they manipulated, I can look at how they lined things up, but until I hear them say it, I'm not sure they're getting it abstractly, or they're making that transition.” [I: Dec 4th, Decimals]

Ms. Lara further explained that she understood the procedural-conceptual connection as being similar to “finding patterns,” a concept that came from her Montessori training.

“If they catch on to a pattern, then they’ve got the next thing. And once they know what I’m doing, they can go farther. They can probably predict what the next thing’s gonna be, then they’ve got that answer. It’s almost a Montessori thing for me, ‘cause a lot of the Montessori thing is about finding the pattern.” [I: Dec 4th, Decimals]
In her endeavor to help students understand conceptually, even though students had produced mathematically correct answers, Ms. Lara pushed her students to reason more complexly and think further about the problems. For example, even when students multiplied decimal numbers correctly, she helped them to consider ‘what if’ questions. In this way, she helped students to begin the mathematical process of generalizing. Below is an example of how Ms. Lara achieved this in the decimals lesson. Students were multiplying decimal numbers, and even if they had correctly multiplied, she asked how the answer would change if the decimal were in a different place, or if the zero were added. The problem on the board was to multiply the numbers 511.0 × 43.

Ms. Lara: Would we have the same answer if I took out the zero and the decimal from the first number?

Tai: Yes, because then it would be the whole number.

Next they all worked on 506.6 × .52 and 333.4 × .043

Ms. Lara: Am I going to get the same answer if I get rid of the 0 in the second problem?

Some students said yes while others disagreed. More students said it would be the same because of what happened the last time in 511.0 × 43.

Ms. Lara wrote 333.4 × .43 on the board. Students multiplied the numbers and found the two products 333.4 × .043 and 333.4 × .43 were the same because they had the same digits in the answers. Without disputing them, Ms. Lara asked them to look at the numbers paying special attention to the place of the decimal and read the numbers aloud.

Sam: Oh it will make a difference because the decimal is in a different place. That is 14.3362 (14 and 3 tenths, 3
hundredths, 6 thousandths, 2 ten thousandths), and this one’s 143.362 (143 and 3 tenths, 6 hundredths, 2 thousandths). [FN: Dec 11th, 2012]

*Adopting continuous informal assessment*

Ms. Lara continuously assessed her students’ knowledge with respect to the content. Her forms of assessment were casual, yet informative, and were conducted using daily classroom conversation. Her assessments consisted of having students explain their answer, teach one another, read numbers aloud, or use different representations. She used the results from her assessments to guide her next instructional steps. Ms. Lara thought standardized paper and pencil tests in the present educational system were unfair and demoralizing to students and not an appropriate tool to assess student understanding. The tests were especially harsh on the ELL students who had difficulty reading and understanding the language, if they were administered with some parts being read to the students. She explained why she felt this way:

“I think it's demoralizing. They get discouraged. And if they're given the way that they’re supposed to be given, only parts of it are read to them so that doesn't help them. And then I'm not even sure that even when something's read to them, there's no guarantee that they're understanding it as fast as it's being read. So you know, just reading something to them doesn't equalize anything. I hate it. I hate it. I hate the formative tests. It's not fair.” [Initial interview: March 15th, 2012]
Alternately, Ms. Lara suggested that there needs to be instead “some kind of alternative assessment that measures their growth, more in an autobiographical way, or by documenting where they are and what they're learning and what they're building on.”

[Initial interview: March 15\textsuperscript{th}, 2012]

Ms. Lara assessed her students through carefully observing and attentively listening while they performed and talked about mathematical tasks in the classroom. She was able to examine and determine at any time where her students were in their mathematical understanding. She admitted that she gets her information through observation: “through observation and through working with them, and then at any given time, I am able to tell you what they can do. I don't think it's something that you can give them a test they can do.” She went on to give examples of what she saw her ELL students doing that helped her understand how they were thinking:

“They're starting not needing the number line. You know, I see them being able to take a greater number and add on, or, as they are thinking I can see them drawing the pictures that are more appropriate, to solve their problems. But that would only be preserved in a portfolio of some kind. I'm guessing that there's a huge gap between testing and people with a different language being tested in a language that's not native to them.” [Initial interview: March 15\textsuperscript{th}, 2012]

Moreover, Ms. Lara’s assessments were individualized. During the measurement and data lesson, she repeated the same question to different students even though one
student in the class had already given an answer. It was her way of assessing which
students “got it” and how they were thinking. She was not satisfied by hearing all the
students shout out the answer, because, she said,

“I wouldn't have any understanding of who had it and who
didn't… So if I just pose the question again and then
somebody says it then that's a little bit more information I
have about them. Because they don't respond if I give them
a paper and pencil test and that doesn’t tell me who got it.”

[I: Nov 25th, Measurement & Data]

One of the strategies Ms. Lara used while they were on the unit on decimal
numbers was asking her students to read numbers aloud. Even when students wrote the
numbers correctly, she insisted she heard them read the numbers aloud. This was one
more way of knowing where her students “got it”. Reading numbers aloud, to Ms. Lara,
would be “the next thing that they need to do.” She explained that she used the same
strategy for assessing her students’ comprehension as they were reading: “[Y]ou can
write anything, and like I was talking about reading, if they don't go back and re-read
they're not gonna catch mistakes” [I: Dec 19th, Fractions]. She went on to give an
example of Peter, who had been making spelling errors, leaving out the endings of his
words. It was only when he read the words aloud, that he realized what his mistake was,
and was able to correct his own mistakes. Ms. Lara found that “its the same thing, like I
don't know what the problem is until I hear them say it” [I: Dec 19th, Fractions].

However informal Ms. Lara’s assessments were, they were informative,
and helped her to assess her students’ understanding at any given time. She used the
results from her assessments to find points of difficulty for her students, to see how far she could push the concepts of lessons, and help her students make progress in their learning.

**Summary of attributes of content objectives**

Supporting students’ multiple ways of learning and making connections was a key attribute to Ms. Lara’s teaching contributing to her content objectives. Ms. Lara made connections between students’ perceptions with mathematical language, different mathematical representations, and visual procedures (which she considered to be similar to using visual manipulatives). Ms. Lara explained that she could make these connections because she herself learned by making connections. She was aware of her personal life experiences and thought similar methods might help her students. Another aspect of Ms. Lara’s teaching was staying connected with her students by assessing them informally. She rejected the idea that paper-pencil tests provided the necessary information about her students. Instead, she depended on the feedback from lessons as her way of summatively assessing students’ mathematical understanding. She relied heavily on this type of assessment since she based all future instructional decisions on the collected knowledge.

**Category II: Pedagogical orientation (Support students as learners)**

**Codes - EST, IT, EDC, AU**

In supporting students as learners, Ms. Lara focused on key aspects of equitable pedagogical orientation identified in the codebook: giving clear instructions to students on their tasks (EST), spending quality instructional time on mathematics (IT), encouraging a diverse array of competencies (EDC), and providing opportunities for students’ autonomous work (AU). In summary, Ms. Lara’s pedagogical orientation was
focused on providing an environment for a learning and caring community in the classroom. In achieving the objectives, the following key intentions behind her pedagogy were observed: a) positioning students at the core of decision-making; b) inviting student diversity to support each other’s learning c) paying attention to individual students needs during group activities

**Positioning students at the core of decision-making**

Students in Ms. Lara’s classroom were at the core of decisions about mathematical content introduced and how instructional time was structured. Shared decision-making was a regular characteristic of her classroom. Students helped make decisions about how they wanted instructional time to be structured, which groups they worked in, how to form those groups, and mathematical investigations. Ms. Lara began with an open and flexible lesson plan and allowed the class to unfold based on student responses. “A lot of it depends on what kind of response I get from the kids,” she said. “If I see that they are making a connection, then I'll just push it just a little bit farther, see if I can get them to take it to the next step.” [I: Apr 6th, Decimals]. This kind of decision-making did not mean she had no classroom control, but rather that decisions were made based on students’ thinking and needs. Ms. Lara intentionally asked students to participate in instructional decisions because she treated them as partners and equal participants. She asked questions that opened the class for full student participation (Bell, 2007).

Lessons always began with whole class conversations with students talking and sharing ideas they were curious about. Ms. Lara gathered information and planned the course of action based on that information. Sometimes she allowed the lesson to flow in
the direction of students’ questions, and at other times she noted their questions for future reference. One such example is how Ms. Lara started the review lesson. She began the session with a broad question to the whole class, “I want to know what can I do with this to make this some kind of a math lesson maybe, that would help us review things we already know?” [V: Feb 8th, Review lesson] Students contributed ideas to what mathematical concepts they could review with candy hearts. The concepts ranged from operations on numbers to data analysis and probability. Ms. Lara wrote very suggestion on the board and facilitated the review discussion.

Student questions turned into ideas for learning through investigations. She took advantage when ideas for exploration presented themselves. The researcher’s field notes described an episode during the decimals lesson when an idea given by a student was utilized to plan and execute a mathematical exploration:

Ms. Lara has a water bowl in the corner of her classroom with an expanding-in-water toy caterpillar in it. The caterpillar has been growing larger every day. Today, a student mentioned that she was curious to see how much more the caterpillar would grow, and if it would fill the room. Ms. Lara immediately picked up the water trough and placed it in front of the class. She took the toy out of the water, and asked, “That’s an interesting question! Let’s talk about that!” I wonder where she will go with this. She is having a discussion about what they want to know and how they would go about finding answers. Do they want to
know how large it would grow in the water, or how much it
would shrink when taken out of the water? They designed a
plan for data collection and recording over the next few
days. [FN: Dec 4th, Decimals]

The proposed project continued for several days, with students recording data and
investigating how much the toy grew. Students and teacher became co-investigators in
the discovery and mathematical investigation. In addition, Ms. Lara credited the student,
Sonia who first brought up the question with a leadership role. Once the investigation
began, she led the group in finding measurements and recording data.

Ms. Lara sometimes moved the lesson into a direction she had not previously
planned, based on conversations with students during the lesson. During the pumpkin
lesson, while students weighed and counted the seeds inside pumpkins, one student
expressed curiosity about the relationship between the weight and number of seeds in a
pumpkin. Ms. Lara immediately opened presented the question to the class and they
compared the measurements to find that the heaviest pumpkin had the smallest number of
seeds and the lightest one had the greatest. In ascertaining Ms. Lara’s intentions in
pursuing the student’s question, the interview revealed that in opening the classroom for
student questions, she herself found enjoyment, and found that when everyone was
interested and having fun, they were more engaged in learning. She admitted,

“it was purely self-serving. And I think by just indulging
myself in that for a minute, they probably figured, well
she’s interested in it. This is interesting. And I think that's
what makes them fun. I mean that's what makes the lessons
fun.” [I: Nov 25th, Measurement & Data].

Ms. Lara believed that scripted programs of teaching restricted creativity. By not providing the kind of flexibility that teachers needed to open the classrooms for student ideas, such programs left little room for spontaneous ideas that both students and teachers had. She allowed herself to "Aahh, I wonder!" along with her students. She pointed out to the researcher that she allowed the philosophy of the words that were written on a poster above her bulletin board, "Wisdom begins with wonder" [I: Nov 25th, Measurement & Data] to guide her.

Ms. Lara credited her viewpoint of having students at the core of decision-making in the classroom to her Montessori training. She explained that she follows a pattern as she allows student-thinking to guide her lessons:

“I do think a lot of that is Montessori. There’s a sequential pattern to what you taking something and then taking it a little bit farther, and a little bit farther, and it’s like building on a foundation, and I have such respect for those materials and that philosophy, and when I have a chance to do something like that, I do” [I: Apr 6th, Decimals].

As a consequence of basing her instruction on students’ responses, Ms. Lara had to contend with the diversity among her students, and differentiated her instruction accordingly.

“I know that it's never going to be all the kids in the room, so you have to watch. And at times you wind up teaching like two and three things at the same time because these
kids are ready to go and get farther with it, and somebody is not really in that place.” In order to help her communicate and connect with individual students, she emphasized again that she “always like[d] to just make connections” [I: Apr 6th, Decimals].

**Inviting student diversity to support each other’s learning**

Ms. Lara supported student diversity and provided opportunities for them to support each other’s learning as a means of achieving her overarching goal of building a learning community. She often had students working in teams, emphasizing that they communicate with one another and help each other to learn. For example, when individual students worked out problems on the board, she encouraged all students to give feedback or help the student correct any errors. While working in groups, Ms. Lara watched and listened carefully to ascertain how they were ‘help’-ing each other. During the Measurement & Data lesson, the video of the lesson captured Ms. Lara watching one student closely as he made his way across to help another group. She stopped him and said, “They will figure it out, honey!” The following excerpt from her follow-up interview clarified Ms. Lara’s intentions:

“I'll talk to them about helping somebody else, and what that means. And it doesn't mean doing. I always say, "Helping somebody doesn't mean doing it for them. It means helping them figure out how to do it.” And they all know that. I must say that probably everyday a couple times a day. And.. because I want them to help somebody
else if they need it, but I don't want them to do it for them,
and my guess is I was watching to see what he was doing.”

[I: Nov 25th, Measurement & Data]

Ms. Lara recognized the value of diversity in students’ ideas and brought unique ideas to the attention of other students so that they could adopt new useful strategies or understand concepts in different ways. One such example occurred in how the students found different strategies to count a large number of pumpkin seeds. One student counted by tens, and once she reached 100, drew a circle around them and moved ahead to the next set of 100. Another student counted by fives and counted ten groups of five, setting them aside as 50 before moving on to the next set of 50. Ms. Lara noticed that one student was counting the seeds one at a time and losing track of the numbers. She suggested that the student observe the student next to her as she counted in twos until she got to 10 and grouped them in 10s. This enabled the student who was counting by ones to adopt a new strategy, thus learning to skip count by twos and accurately count pumpkin seeds.

_Paying attention to individual students’ needs during group activities_

Although Ms. Lara provided several opportunities for students to learn collaboratively, she also monitored individual learning. Her approach to fostering student learning was to provide both group learning and individualized instruction. She achieved this goal by ‘isolate’ing individual students to listen to them and help them through their personal sense-making process. By giving students individual attention, Ms. Lara communicated she was there to support her students, not by giving them the right answer,
but by scaffolding their own thinking through the frustration. Her respect for student thinking and their learning provided students with the confidence they needed to persist.

An example of how Ms. Lara provided individual students opportunities to ‘construct’ knowledge while they were in groups (Ernest, 1993) was demonstrated during the fractions lesson. Ms. Lara invited students to write their example of an equivalent fraction-percentage-decimal set on the board. Alan wrote:

\[ \frac{40}{100} = 40\% = .040. \]

Ms. Lara asked him to stand by the board, and read aloud what he had written.

Alan reads: 40 out of a hundred, 40 percent and 40 hundredths.

Ms. Lara: Look at that. What does it say? Everybody look at that.

[Some students raise hands to answer, but Ms. Lara does not allow them to speak]

Ms. Lara (to Alan): What do you think it says?”

Alan stared at the numbers on the board for a whole minute, while Ms. Lara insisted the other students remain silent. Finally, he spoke:

Alan: 40 thousandths.

Teacher: Good job. 40 thousandths. Why? Why does it say 40 thousandths?
Alan: Because it is (pointing and counting off the place of the decimal) tenths, hundredths, thousandths. So 40 thousandths.

Ms. Lara: Good job! How do you want to fix that?
Alan erases the number and writes .40.
Ms. Lara: Good job. So what does 40 percent mean?
Alan: 40 out of a hundred or 40 hundredths.
Ms. Lara: Good job!

[V: Nov 20th, Fractions]

Even though Ms. Lara asked everyone to look at the writing on the board, she specifically wanted Alan to answer her question. She provided Alan time and space by isolating the other students allowing him to think through the numbers on his own.

The following episode is another demonstration of how Ms. Lara attended to an individual student need by ‘isolating’ them. Linda, a student often observed as being distracted, was having difficulty focusing. Ms. Lara ‘isolated’ her to help her concentrate on the task.

Linda started playing with her pencil.

Ms. Lara: Linda what is this called? What is it? If a heart equals 2 or a heart equals 5? Now I have to make a point here.
Linda: ummm…

Ms. Lara: (Marty raises hand) Marty, put your hand down.
I have to make a point.
Linda: (not clear)

Ms. Lara: At the bottom of the pictograph sometimes there's a little box, and in the box it'll say this picture means every time you see a heart it equals 5. What is this?

Linda: Oh the key!

Ms. Lara: Thank you, thank you, thank you. Now.. (moves on with lesson)

[V: Feb 8th, Review lesson]

Summary of teaching attributes for pedagogical objectives

Students formed the core of the decision-making process in Ms. Lara’s class. Students contributed ideas they want to think, talk, and learn about. Ms. Lara incorporated their ideas in her lessons. Students were encouraged to share their findings, strategies, and methods with one another as they brought diversity and supported each other’s learning. While students worked as groups, Ms. Lara recognized individual students’ needs and found ways of supporting their learning. She used strategies to provide students with time and space (often silencing other students) when she sensed a student needed to think through something she or he was grappling with. Thus, Ms. Lara’s classroom was a place where diverse mathematical competencies were shared, instructional time was shaped by students’ input, and students had the opportunity to learn individually and in a group.
Category III: Contextual Relevance (Awareness of instructional context)

Codes – RWP, ESE, EE

Contextual objectives of pedagogy for equity and social justice were identified in the codebook as teaching centered around using real-world contexts and problems (RWP), expecting that all students were capable of doing mathematics (EE), and emphasizing student effort (ESE). Ms. Lara’s intentions that were associated in achieving these objectives were: a) making connections with students’ lived experiences; b) having high expectations for all students; and c) undergirding and commending student effort.

Making connections with students’ lived experiences

Ms. Lara’s mathematics lessons revolved around students’ lived experiences. During the month of October, the lesson centered on using pumpkins to measure, gather, and analyze data. Most of the class activities and projects had a real-world focus. In the month of November, while the United States were preparing for elections, Ms. Lara had the students do an ‘opinion poll’ to facilitate a discussion about predictions. During the month of February (around Valentine’s day), they reviewed what they had studied over the year using a bag of candy hearts. During lessons, Ms. Lara facilitated discussions about life experiences as well as mathematics. Students were constantly using new mathematical knowledge as a way of making sense of their lives outside the classroom. Even lessons that Ms. Lara did not plan around a real-world context included them because of her attention to student questions. Ms. Lara shaped the lessons as she incorporated student input. She admitted to changing her plans significantly at times to accommodate student curiosity about real-world phenomenon. One such project was to
track the growth of an expanding water toy immersed in a water trough based on a question raised by a student.

Ms. Lara thought it was critical to make connections to real-world contexts. She often found herself moving away from the lesson that she had planned in order to accommodate students’ questions and interest. She gave the example of the time she deviated from her lesson to talk about hurricanes:

“we were talking about hurricanes the other day just because of the news and, and right in the middle of doing this there was something that registered with me about explaining to them about the hurricane itself and about the way it moved and about, and so we kind of went off on a tangent into something else” [I: Apr 6th, Place value].

When students expressed curiosity, Ms. Lara saw it as an opportunity to make connections with what they were learning in the classroom. She believed that:

“If it makes sense to me, for some reason, it would make sense to them, or if I made that connection then that might be something that they should make too, because they are always talking about making connections with the world and everything else. So we do a lot of news, a lot of trying to make sense of things.” [I: Apr 6th, Place value]

She helped students therefore, to make connections that she herself made in order to understand real-world phenomenon.
Any topic that triggered students’ interest was acceptable for Ms. Lara’s class. She shared with the researcher how she discussed the events of 9/11 because it was something she wanted them to understand. When I asked her if she thought there were some topics that she would not discuss with the students. To that, she said, “I think topics are sensitive but I think it’s how you discuss them and, umm, now if I were told not to do it then I wouldn’t do it. Umm, but … I just think it strictly depends on how you talk about it. And part of that is that I think the Montessorian in me because you can explain things, umm, in… in a very basic simple way, umm, without getting, you know, too involved or too graphic. But clearly, you know, I work for a system and there’d be things that if I wasn’t supposed to do I wouldn’t do.” [I: Apr 6th, Place value]

Ms. Lara also used everyday objects to increase students’ interest in mathematical concepts. When they were learning about estimation, she told the researcher that she brought a jar of candy to class and provided clues for them to estimate the number of candy in the jar. She made it an interesting game for the students, by giving them clues such as “the number's between 50 and 106. The number is an odd number. It's greater than something.” Students would write their guesses on the board, and then they would find out who had the closest estimate. Ms. Lara’s students became “pretty good at making those kinds of estimates” [I: Apr 6th, Review lesson]. In this way, she found creative ways to connect everyday objects and life experiences with what the students were learning in their classes.
**Having high expectations for all students**

Ms. Lara expected all students to be able to learn and do mathematics. Her students came from diverse cultural and linguistic backgrounds. Many were from recent immigrant families, and were placed in grade-levels by age. They had little to no mathematics instruction before they came to her class and lacked basics that were needed for grade-level mathematical knowledge. Ms. Lara tried to understand the reasons for their lack of mathematical skills:

“What happens is, when they go to the ELL classes, and then depending on the time of day they go, they miss whatever's going on in their home room, and even if they were in their home room for math, you know how difficult the language is you know that traditional math teachers use, or teachers use to teach math, and they just they didn't have it.” [Initial Interview: March 15th, 2012]

Two things emerged from Ms. Lara’s understanding of her ELL students’ context. First, that she believed her students were capable of learning and doing mathematics, but were not given the support they needed because of the way the school system and schedules were set up for them. She rejected the idea that her students were less capable than other students. Second, she believed that “language used by traditional math teachers” was difficult and only made matters worse for the students. Consequently, they tended to disengage. Therefore, Ms. Lara reflected on and made adjustments to the language she used to communicate mathematical ideas.
It is possible that given the situation, a teacher might accept the lack of mathematical proficiency of her students as inevitable (Bartolomé, 2007) and feel helpless or give up on trying to help them learn mathematics. This was not the case with Ms. Lara. Refusing to accept the situation in which her students were not learning, she continued to have high expectations and outlined her strategies to help them succeed. She wanted them to know that “(learning math) not off-limits, it's not something strictly for everybody else. I'd like for them to learn how to think, visualize, whatever the problem is, to be able to, somehow be able to put it in their own language” [Initial interview: March 15th, 2012].

One of the strategies that she used with her ELL students was to use pictures and flashcards of number equations to generate their “stories”. She found that when she gave them the opportunity, students could develop their understanding of mathematics in a manner that they could access on their terms.

“It was fascinating because you could see them trying to think of not just receiving it, but to think of how can I use these numbers to make a story? That was one of the more fun things that we had done. So I think it's giving them access and a right to take part in math, because I don't think they thought it's theirs” [Initial interview: March 15th, 2012].

All that Ms. Lara expected from her students is that they would be willing to participate wholeheartedly. She called it ‘being present’. She thought that “If I am going to work so hard to reach each one of them where there are with what they need, then they
need to work hard to help me do that and let me see who they really are.” She expected them to put in their best effort. She was aware that some students would not work to their full potential. She told her students that she expected the best from them, placing the responsibility for their learning squarely on their shoulders.

“I don’t have the time to sit down with each one to figure out: are you playing with me, do you really not know this? It’s like I want everybody to ante up and do the best they can. It’s like a truth culture. I want them to get the best of me and I want to get the best of them. And I can’t do it when they’re only half here. If I don’t have their attention I can’t do anything. It’s an honesty…what do they call it?

It’s like when you’re ‘present’. Like being present somehow” [Initial interview: Oct 10th, 2012].

No students in Ms. Lara’s classroom had permission to be laid back and not put in their best effort, or to allow someone who knew the answer to tell them what to do or how to do it. During the measurement and data activity, one student from a group started to walk to another group to assist them. Ms. Lara watched him carefully and then she stopped him. On being asked why she stopped him, she said she believed Andy was going to ‘help’ them by doing the task for them, which was not how she wanted them to help each other. She realized that Andy

“was on a real power team where anyone could have done the whole thing by themselves. And I know this (the other group) was not quite so dominant. And if he went over
there, they were just gonna throw their hands up and let him do it, which wasn't good. Which is really another reason for not putting somebody strong in each team. You know, ‘cause they'll step down.” [I: Nov 25th, Measurement & Data]

Ms. Lara observed her students carefully, and based on her in-depth knowledge of her students, monitored their participation, so that everyone had the opportunity to learn. She expected all her students to not only be able to participate, but also to take responsibility for their own learning. Her belief that all students have the right to learn guided her pursuit of meeting her students at their point of need and provide the needed support in order to learn.

**Undergirding and commending student effort**

Ms. Lara supported her students’ efforts. During group work, she moved between groups and asked questions. She demanded everyone’s participation, and if she found that anyone was disengaged, she tried to understand the problem they were having, and help the student to participate and learn. She believed in giving her best to the students and she demanded reciprocal action from her students. She understood students found different aspects of the lessons interesting and did not expect that all students would be working in the same manner. While she gave the students enough freedom to work, she also expected honest and full attention:

“Ideally, I think that if there’s a particular skill we are working on, I want to see evidence, now that I can see them thinking, or hear them thinking, I want to see they’re
engaged. It doesn’t have to be exactly what I’m asking them to do, but I want to know that they’re engaged in what’s going on. If they’re just going to be gone, I can’t let that happen. So it’s within the perimeter of what we’re doing.” [Initial interview: Oct 10th, 2012]

When she found students struggling with a particular concept, Ms. Lara supported them without telling them what to do. From a constructivist perspective, one might understand her intention was for the student to ‘construct’ (Ernest, 1993) their own knowledge. Activities were set up in a variety of formats – sometimes the whole class worked together, at times they worked in groups, at times in pairs, and sometimes individually. Whatever the format, Ms. Lara was cognizant of individual students’ needs and did all she could to support their learning. An example of how she did this follows:

During the fractions lesson, Sam’s difficulty relating percentages and decimal numbers was evident. Ms. Lara saw his struggle and helped scaffold his thinking. She intended for Sam to recognize and correct his own misconceptions. Ms. Lara had her students present examples of a number written in its fractional, decimal and percentage form on the board. Sam came up to the board and wrote:

$$\frac{1}{10} \quad 0.1 \quad 1\%$$

Ms. Lara: Hmmm… read to us what you have. Where’s that little equal sign?

Sam adds the = signs in between the numbers.

Sam: One-tenth equals…. Hmmm…..
Ms. Lara: Alright. This part is true (\( \frac{1}{10} = .1 \)), this part.. (= 1\%) eeee, not so sure. Alright. Now what does one percent mean? Perrrrcent. What does perrrcent mean?

Sam: oh oh.. one out of a hundred.

Ms. Lara: One percent means one out of a hundred.

Remember? Is that the same as that (points to 1/10)? So now how would you change that?

Sam changes 1/10 to 1/100.

Ms. Lara: Oh. You could do that. Now what do you have?

Sam: One out of a hundred equals one tenth.

Ms. Lara: Is one out of a hundred equals one tenth? So you have to fix something else. What do you want to fix now? 1 hundredths equals?

Sam writes now \( \frac{1}{100} = .01 = 01\% \)

Ms. Lara: Ok. Not so bad. We don’t need the zero. Now I want you to read the whole thing over again.

Sam: One out of a hundred equals one hundredths equals one percent.

Ms. Lara: Nice. Good job. Thank you.

[V: Nov 20th, Fractions]

As the lesson continued and the line of students came up one by one, some of them continued to make mistakes in writing the three forms of the numbers. Ms. Lara called on other students in the class to help them correct their mistakes, and let them
continue to struggle till they arrived at a solution that was agreeable to all. She intervened only when she saw necessary. Following is another section of the lesson during which she helped Amanda through her thinking to identify and correct her own misconception.

Amanda stepped up to the board and wrote $\frac{8}{10} = .8$ and then said, “It also equals 8%.”

Ms. Lara: Ok. Are you sure? You want to write that down?

Amanda writes $\frac{8}{10} = 8\% = .8$.

Ms. Lara: What do you think guys? What does percent mean again?

Amanda: Out of a hundred. Oh!

Ms. Lara: So 8% is $\frac{8}{100}$ (writes). So what do you need to change to match all three.

Amanda changes $\frac{8}{10}$ to $\frac{8}{100}$. Now it reads: $\frac{8}{100} = 8\% = .8$

Ms. Lara: Closer, but not there yet. So what does it say now?

Amanda: 8 out of a hundred is 8 percent.

Ms. Lara: And then what?

Amanda looks at what is written, realizes what she has written, and changes .8 to .08 and says 8 hundredths.

[V: Nov 20th, Fractions]

Ms. Lara remained patient as each student wrote on the board and thought through the multiple representations. She continued to ask questions to help them think about the
numbers and make corrections. When asked how she felt about the students continuing to make mistakes, Ms. Lara reflected on how she might present the content to the students differently. She said she “was just trying to think how can I say this differently…it should have just led him into the right thing and it wasn't and I couldn't figure out what I needed to say it in a different way.” When she watched the section of the video, she noticed that she repeated “peeer-cent” and saw that it did not help the students to understand. She admitted that this was one of those occasions when she did not know what else she could do. Her intention was for students to “make that connection before just giving them decimals abstractly. I wanted them to make sure that they understood they were the same thing. They were just fractions over a hundred. So I think that was just my main concern” [I: Dec 19th, Fractions]. This kind of reflective practice helped Ms. Lara to continue to find new ways to support her students’ learning.

Ms. Lara continued to reflect on her practices to make mathematics more accessible to her students. She traced each student’s understanding, and focused on single students until they were able to understand. When she had difficulty reaching the student, she stepped back and reflected, reassessed her methodology, and tried a different approach. Ms. Lara admitted she had difficulty communicating certain concepts to the students and called upon Montessori methods and manipulatives whenever possible.

**Summary of teaching attributes for contextual objectives**

Ms. Lara made pedagogical choices based on her understanding of the context of her students. After reflecting on her own need to make connections in understanding the real world, she helped her students to make connections as well. Ms. Lara’s classes were planned around real world phenomenon and ideas that her students were inquisitive
about. Her lessons were often observed as being ‘unplanned’ because she allowed them fluidity and flexibility to accommodate student curiosity and interests. Ms. Lara was keenly aware of the context of her students as ELLs and recent immigrants. She knew that they brought a unique set of challenges, and through reflecting and observation, adjusted her methods to help all students learn.

**Category IV: Social Justice objectives (Student self-empowerment)**

**Codes – OCK, SVA, EMR, ECT**

Social justice objectives identified in the codebook were providing opportunities for students to co-construct knowledge (OCK), fore-grounding student voice and agency (SVA), emphasizing mutual respect (EMR), and providing opportunities for students’ critical thinking (ECT). All of these features were evident in Ms. Lara’s teaching practice and deliberate actions. Through them, she provided opportunity for student self-empowerment. Ms. Lara’s intentions that helped her work towards social justice objectives were: a) recognizing and building student potential; b) providing students leadership opportunities; and c) helping students develop critical thinking as a personal process.

**Recognizing and building student potential**

Ms. Lara’s intention to attend to student thinking formed the basis for all instructional decisions she made. She recognized student potential and respected their thinking. Students were provided with opportunities to co-construct knowledge and build agency. Ms. Lara attended to student ideas as they were expressed, even in casual conversation. She was constantly learning about them, what they wondered about, and what mattered to them the most. For those who were not up to grade-level in
mathematical proficiency, she was able to relate to the contexts of their lives, the challenges they faced, and the opportunities they lacked. She also was conscious of the obstacles of students who spoke languages other than English at home. Early in the year, she recognized that the primary instruction for the ELL students was language and they had almost no mathematics instruction. Most of them had no number sense and she felt a breakdown in communication as she would “say things and they had a very blank expression.” Ms. Lara decided that she needed help because of the apparent “disparity between their age and what they knew and what their peers knew and they weren’t even trying, they were just totally shut down” [Initial interview: Oct 10th, 2012].

Ms. Lara recognized that students who were capable of learning were “shutting down” because they felt like they had a deficit. They shut down due to various reasons, according to her: “If they weren't understanding what I was saying, they shut down, if I didn't understand what they were saying, they shut down. If they couldn't express it, they shut down.” She also reflected on why the students were taking longer to respond to questions. They were

“really having to think something through. So they're not only having to think the question through, but they have to think the answer through and then they have to figure out how to say it. And I don't think they are given enough time often, to do that.” [Initial interview: March 15th, 2012]

Ms. Lara reached out for help knowing that her students were capable and wanted to provide an opportunity for them to learn. Her goal was to understand her students, and
learn how to help them. When the teacher educators worked with the students, she began “learning what they need.” Her goal for her students was that they know “that they can learn math, that it's not off-limits, it's not something strictly for everybody else. I'd like for them to learn how to think, visualize, whatever the problem is, to be able to, somehow be able to put it in their own language.”

[Initial interview: March 15th, 2012]

Ms. Lara observed as the team worked with the students and saw the students’ potential as they worked on mathematical tasks. She learned strategies to support the ELLs. She saw the students grow in their mathematical understanding. She expressed her joy as she watched them. In an interview, she recounted how Mark, one of the ELL students “would take it to the next step himself. He would take twelve, and then I’d see him group them, and he would figure out that it wasn’t just six plus six, it was two groups of six, you know. And his face would light up, and there was one comment he made and I read through it when I was going through these notes the other night too and he said “It matters how you learn it. You have to know how to do it. If someone asks you nine and four then you have to know what to do.” And I don’t know, I think he just began to realize that he could do something.” [Initial interview: Oct 10th, 2012]
For Ms. Lara, the objective of mathematics instruction was more than proficiency; it was students learning the “how” as much as the “what of mathematics and becoming confident in their ability.

Ms. Lara’s decisions were based on her assessment of her students’ prior knowledge and their potential for learning. She used many strategies to spark their interest, one of which was interesting objects placed in her classroom. There was a cage with Ms. Lara’s pet mouse Ellie, which the children are fascinated with. There were colorful posters on the walls, puzzles and games, plants, curious-looking animal toys, and several books on various topics. There were four computers off to a side, which the students were allowed to use to play a math or spelling game if they had time after they finished their assigned task. Student work was displayed on a board just outside the classroom door. For example, they displayed all possible combinations of certain digits to make up the number 24. Children entered Ms. Lara’s room to find something new and interesting every day. [FN: Sept 18th, 2012]

Having assessed students’ prior knowledge and understanding, Ms. Lara used the information to shaped what she taught and how she taught it. She found points that she needed to review or emphasize. She became conscious of students’ common misconceptions, and made sure that she provided the support they needed to think through the concepts. She observed them carefully to see if she could provide them with something that would move them further in their learning.

“I don't think I bring lessons to a close,” she stated,

“without trying to at least push something a tiny bit further,

unless they're all confused. If I look at 'em and they're all
confused, then you know, that's not the time. If it looks like we're getting there, then at least I want them to think of one more thing.” [I: Apr 6\textsuperscript{th}, Review lesson]

Ms. Lara’s practice of “pushing something a tiny bit further” was what Vygotsky (1978) termed working in children’s ‘zone of proximal development’. She assessed student prior knowledge, worked within their ‘zone of proximal development’, and pushed their thinking further in order to widen the zone to include a more complex concept.

Ms. Lara’s interest in her students continued even after they had moved to the next grade. Having understood the students and observed their progress, Ms. Lara was disappointed whenever other teachers did not recognize their potential. She knew what they were capable of. She heard the teacher complain about one of her students, Sara, saying, “she's not good at this, and she doesn't do that!” On the other hand, Ms. Lara knew that Sara was “really really sharp. And she's got some major practical life skills. And she's already bilingual” [I: Nov 25\textsuperscript{th}, Measurement & Data]. She hoped that the students’ future teachers would continue to build on their learning.

\textit{Providing student leadership opportunities}

Besides acknowledging her students’ ideas, Ms. Lara assigned leadership roles when they contributed a new or different idea. If a student had an idea, she allowed that student to take ownership and play a leading role. When other students had questions, she directed their questions to the leader. These actions boosted the students’ confidence. Other students recognized and respected the leader. It also encouraged everyone to participate and contribute ideas more readily.
The ‘expanding toy’ project is an example of how Ms. Lara assigned leadership roles to students. The student who gave the idea was assigned to be leader for the project. For several days, the leader directed the investigation, ensuring that the data was collected at the same time every day. The student also checked that the measurements were precise and accurately recorded.

Ms. Lara recognized and acknowledged ideas provided by students, and used those ideas in her lessons. Moreover, she asserted the student who made the suggestion as a leader among his colleagues. During the review lesson, students drew different representations of their data using tally marks, pie chart, bar graph, line graph, and a pictograph. At the end of the lesson, she asked the students to suggest any additional questions they would like to add. Stan suggested asking which depiction would best represent the data. When another student Tim wanted to clarify the question, Ms. Lara directed his question to Stan (excerpt from the classroom interaction is given below).

Stan: We can ask the question which table is the best.

Ms. Lara: Which table, yeah ok. (She begins to write down the question) Which table gives us the..

Tim: More data?

Ms. Lara: Not more

Tim: less?

Ms. Lara: Not less

Tim: Equal?

Ms. Lara: Ask him (points to Stan).

Tim: What is it?
Stan: Which table gives us the most accurate data?

Ms. Lara: Most accurate.

Stan: Data from the top.

[V: Feb 8th, Review lesson]

Ms. Lara thus acknowledged Stan as the originator of the idea and helped other students also to recognize his leadership. When Tim had questions, she intentionally directed his questions to Stan, so that he recognized his leadership position. This happened for all the instances that students contributed ideas during the review lesson. Ms. Lara’s action of positioning students as leaders and owners of knowledge was deliberate.

Another instance of Ms. Lara’s intentional positioning of student leadership occurred during the review lesson when student Mark suggested reviewing the concept of probability. Ms. Lara wrote down the idea and demonstrated it, first by asking Mark (acknowledging that it was his suggestion) to pick a color with his eyes closed. By the color that was picked, students determined whether a color with a low or high probability was chosen. She then suggested it could be a game to play during their free time.

In affording leadership positions to students, Ms. Lara intended to build their self-confidence. She shared her observation that the practice changed her students’ actions in the classroom. She identified her student’s transformation: “It changed her position in the room from being not as skilled and affluent to being right on top,” she said, with a certain degree of pride in her student. “I love that when that can happen, when these kids can change their role or change their position, everything about them changes. How often are they given an opportunity to do that?” [Initial interview: Oct 10th, 2012]
Helping students develop critical thinking as a personal process

Ms. Lara believed that students should have opportunities to develop critical thinking as a personal decision-making process. She made it possible for students to make decisions in her classroom. Students were asked to think and reason about all the information introduced to them. For example, students decided whether they would participate in the ‘brain gym’ activity that was mandated by the school every morning. They were provided with all the information about the activity, which was the research on how the activity made them more active and better learners. And then Ms. Lara gave them the choice: “If you don’t wanna do it, you have that choice. But then you have to do it the way it’s supposed to be done. Does that make sense to everybody?” Ms. Lara went on to explain to the students that she understood how they felt about the activity, placing herself in their situation.

“How if somebody came in here and told me I had to get up and do this, some days I might want to do it, and I might be like a Mark (who had his head down) some days. I might want to put my head down and say leave me alone, ‘cause some days you feel like it, and sometimes you don’t. So I’m giving it to you, I’m handing it back to you. It’s your choice. Does that sound good to you?” [V: Oct 25th, Measurement & Data]

After giving them the choice, she respected and accepted their decision regarding their participation in the activity.
Ms. Lara applied the same strategy to help students think about societal issues in their lives outside of school. In Ms. Lara’s classroom, students were given the opportunity to critically examine the situations in their lives, communities, and country. Most of the students in the class were first generation immigrants and had questions they were wondering about. Ms. Lara provided a safe environment for them in which they could ask questions and make informed decisions about answers to those questions. One example is the incidents around 9/11. She discussed subjects that students confronted in their day-to-day lives. No topic was unacceptable or beyond the scope of being included in their discussions. She clarified that if she were asked not to discuss certain topics, she wouldn’t, but thought that even though some topics are sensitive, she could talk about them in a manner simple enough for the students to understand and think about them. She credited her ability to explain things in a “basic and simple way” to “the Montessorian in me because you can explain things in a very basic simple way, without getting, you know, too involved or too graphic” [I: Apr 6th, Place value].

Critical thinking as a personal process Ms. Lara believed, is something children needed to develop at an early age. She thought they were capable of thinking critically and needed to be provided with opportunities so that it becomes part of their thinking and decision-making process. As future citizens of the country, Ms. Lara’s students were being prepared to think critically about choosing a leader. On the day of the US elections, Ms. Lara led a discussion in her classroom about qualities of a leader, what kinds of things voters might consider in selecting a leader, and what the students might need to do if they chose to run for office one day. The rich discussion involved the students thinking about issues facing their communities and reflecting on their own actions that would
impact their future. Students brought up controversial current issues being discussed in
the news during the elections, and Ms. Lara asked questions to help them look for facts
versus opinions. She led a discussion on “who to believe”. In the follow-up interview, I
asked her why it was important for the students to think about “who to believe”. She said,

“First of all, it doesn’t even occur to them that it’s a matter
of believing one person or the other. It’s just a matter of
“I’m for Obama” or “I’m for Romney”, and it might not be
that they are telling the whole truth. That I think is
important for them to know.” [I: Apr 6th, Place value]

Ms. Lara expected the best for her students. She believed them to be leaders, and
therefore not only provided them opportunities for leadership in the classroom, but also
prodded them to think about leadership in their communities and the country. One of the
follow-up questions that Ms. Lara asked her students after their conversation regarding
the elections was what they would need to do if they wanted to be President of the
country some day. This made the students think about their own personal life choices,
and reflect on how those choices can impact their future. In the discussion that followed,
students thought about how they would have to “work really hard in school”, “get into
college”, “help their community” and “stay out of prison”. At another time, Ms. Lara
asked her students what they would ask for if they had the opportunity to ask the
President to do one thing for their community. They wrote their letters to the President as
a written assignment. Ms. Lara reported, “They all had different ideas. One of them said
something about raise the income tax or lower the tax, or something. He had an idea.
What’s important is, he had an idea” [I: Apr 6th, Place value]. What impressed me about
these discussions was that all the ideas emerged naturally from the students without Ms. Lara prompting them. She merely provided the opportunity, space and time, she listened to them, and asked questions to make them think. Ms. Lara’s objective was to help her students develop the process of thinking critically in order to make informed decisions.

Ms. Lara also applied the principle of having students making informed choices to her mathematics classroom. Students were asked to think about information they received, and decide whether they agreed or disagreed with strategies or solutions. Students were constantly reminded to reflect on what they were learning, and ask questions they might still have. One such example is the Review lesson. Students prepared different representations of the data: bar graph, pie chart, line graph, frequency table, and pictograph. Ms. Lara then asked the students to think of a question they would want to ask about the various representations. Stan asked which representation provided the most accurate representation of the data. He also wondered if his question would be an “opinion”. It is interesting that Ms. Lara without providing an answer to his question suggested he could add “explain your answer” as a means of determining how the decision was reached.

Stan: It's probably like a opinion.

Ms. Lara: Well. mmmm... it might be. So then you could say explain your answer.

[V: Feb 8th, Review lesson]

During the interview following the lesson, Ms. Lara clarified that her intent was to push the students further in mathematical sophistication with every lesson. She
encouraged them to reason at a deeper level and to question why they were doing what they were doing. She wanted them to think about the “why” questions like

“Why do you collect data? Why do you organize it? Why do you do any of these things? And then having them write questions, that's the interpreting of the data. Yeah, I think having them each think about a question, again that's one of those higher levels.” [I: Apr 6th, Review lesson]

Hence, whether it was mathematics or politics, Ms. Lara ensured that students were developing decision-making through questioning and critical thinking as a personal process.

**Summary of teaching attributes for social justice objectives**

Ms. Lara’s lessons provided the largest number of social justice codes when they were coded for OCK (opportunities to co-construct), SVA (student voice and agency, EMR (emphasizing mutual respect), and ECT (explicit attention to critical thinking). The frequency with which these social justice codes appeared in her lessons, though not surprising, became a matter of particular interest for the researcher. Ms. Lara’s intentionality became primary to her pedagogy to achieve social justice objectives. She recognized the potential of her students and began her work by getting to know and understand their thinking. Her primary concern before and during teaching was to focus on student thinking. What and how students were thinking and learning became the foundation for her instructional choices. Secondly, she built student confidence by intentionally providing student leadership opportunities. Students took ownership in the mathematics they were learning as well instructional time use. Lastly, by presenting
students with facts and critical thinking, Ms. Lara helped students to learn to make informed choices.

Towards addressing the research questions

An analysis of the lesson goals of Ms. Lara’s practice provided an understanding of her intentions that align with equitable mathematics teaching goals. In the following section, I proceed to address the research questions based on those findings. I reiterate my research questions:

a. What instructional decisions does the teacher make that contribute to equitable teaching practices for students from low SES and ELL populations?

b. How does the teacher's disposition towards mathematics content and pedagogy influence her instructional and pedagogical choices for student self-empowerment in mathematics?

c. What goals are central to the teacher's pedagogy for equity and social justice?

Research Question 1

What instructional decisions does the teacher make that contribute to equitable teaching practices for students from low SES and ELL populations?

Ms. Lara’s knowledge of her students’ backgrounds prompted instructional decisions particular to students from immigrant and low SES populations. These were to provide opportunities for students to a) decide participation in their own learning, b) share leadership in construction and ownership of knowledge, and c) build mathematical and social identities. These choices were deliberate, even though they were not a result of having knowledge of research background to support her decisions. They stemmed from her pedagogy of care. I will proceed to explain how she achieved her objectives and how
they contribute to equity for the population of students who are of particular interest to me.

“You decide”: Student ownership and participation

Ms. Lara believed in providing opportunities for student to decide their participation in their own learning. She theorized that students learn better if they have ownership in what they are learning, especially those from poverty. She explicitly stated that students needed to take responsibility for their own learning and participation. In a context where most of her students come from homes where their parents have not gone to college, Ms. Lara understood that to improve their conditions, her students needed to make a conscious decision to do so. Students choosing to succeed (Ladson-Billings, 1995c) appears to be an important factor leading to their success in culturally relevant classrooms. Ms. Lara wanted her students to have ownership so that they might be more engaged in their learning.

Ms. Lara’s knowledge of her students’ homes gave her a better understanding of what they needed. She was aware of their challenges and found ways to help them focus on learning. By helping her students learn, she built their confidence in themselves and helped them succeed. The Liberty Elementary School was reconstituted three times, which means the students have been academically underperforming, and the school has been on ‘academic watch’ for over nine years. At the beginning of the year, the school had been reconstituted for the third time, and most of the teachers were new to the building. Students wanted to know, “why is everybody gone?” And Ms. Lara

“wanted to give them an honest answer. I said we are all

brought in here to change the way the school is running and
now it means its your job too. So things are going to be
different. And they felt that. And there was a lot more
engagement.” [Initial interview: Oct 10th, 2012]

So she wanted to get her students on board, have ownership, and feel the
responsibility to help the school produce better outcomes.

Ms. Lara said that if she had not placed the responsibility squarely on their
shoulders, her students might have not put in any effort. “They would have sat back all
year long without asking for help. Because I know that there are some who will work
below their levels. They’ll just give you minimum effort if any effort at all”, and she was
not going to allow it. She made sure that her students understood that she was not
expecting from them something that she herself was not willing to do. Since she was
willing to “work so hard to reach each one of them where there are with what they need,
then they need to work hard to help me do that and let me see who they really are.” She
took her responsibility seriously and expected the same from them.

“I want everybody to ante up and do the best they can. It’s
like a truth culture. I want them to get the best of me and I
want to get the best of them. And I can’t do it when they’re
only half here. If I don’t have their attention I can’t do
anything. It’s an honesty…what do they call it? It’s like
when you’re present. Like being present somehow” [Initial
interview: Oct 10th, 2012].

For Ms. Lara, students being “present” meant that she wanted
“to see they’re engaged. It doesn’t have to be exactly what
I’m asking them to do, but I want to know that they’re
engaged in what’s’ going on. If they’re just going to be
gone, I can’t let that happen. So it’s within the perimeter of
what we’re doing” [Initial interview: Oct 10th, 2012].

Ms. Lara’s practice corroborated with what she said. I have seen how students
were given multiple options and flexibility to choose their task or method.

Ms. Lara believed that students from disadvantaged groups especially
should be provided decision-making opportunities.

“It empowers the kids to have some decision you know in
their day-to-day life,” she believed. “It might be good for
me, I might want to do it, I might not do it, I might not feel
like it. The more I think about these kids, I don't think they
have very many good choices to make” [I: Nov 25th,
Measurement & Data].

Ms. Lara allowed her own need to make her own decisions to guide her in
providing her students with the same choice. “I think too it's a huge part of me.. if that's
how I want it, I imagine that's how they want it. They would like to have some choices in
their lives in the day.” Her desire to help students choose to learn came from her own
experience of getting “the most out of the ones where I had some ownership in it” [I: Nov
25th, Measurement & Data].

As an example of Ms. Lara helping her students take responsibility, I describe the
case of Linda. Linda was a student who was distracted during one of Ms. Lara’s teaching
sessions. She was twisting a pair of pencils between the strings on her dress. Ms. Lara noticed that she was not paying attention to the lesson and interacted with her three times to try to help her focus on the task. During the first two interactions, Ms. Lara questioned Linda with the intention of making her concentrate on the mathematical concept they were discussing. When Linda continued to be distracted, Ms. Lara stopped the lesson, and asked her to make a decision:

“Honey,” she said, looking directly at Linda, I am gonna have to ask you to leave or show me that you're serious about being here, because this kind of stuff makes me crazy. So you decide. You decide if you wanna be in this lesson or just go work on your own. You got about 10 seconds to straighten up what you need to straighten up if you're gonna do this. (Silence while Linda looks defiant). Alright take your pencil and your tie and go and tie yourself up in knots somewhere else. Or quit. Get rid of the pencil. Get rid of the strings (Linda puts them away), and don't make me want to stop because you wanna play instead of learn. You said you wanna stay, is that true?”

Ms. Lara waited with her eyes on Linda till she saw her nod, before she continued with the lesson. [V: Feb 8th, Review lesson]

Culturally relevant pedagogy is also associated with the concept of tough love (Bartolomé, 2007) in which students are asked to make the decision to learn, which might
be a hard one for some. Addressing Linda by looking directly at her, and keeping her
eyes on her, Ms. Lara communicated that she expected to be heard, that she expected
attention from her, and that she expected her to take responsibility for her own learning.
After this interaction, Linda’s behavior changed and she participated in the discussions.
The classroom video showed her leaning forward to listen to her companions and
contributing to the conversations around the table. During Ms. Lara’s follow-up
interview, she explained why it was important in the context of students who have
“little”.

“It's like when you don't have very much, whether it's
possessions or freedoms or rights or whatever, to have
somebody say this is your choice whether you sit at this
lesson or go play with your strings on your shirt. This is
your choice whether you line them up this way or line them
up that way. It's like giving them something that I don't
think they have very much of. It's a right to participate in
their own learning” [I: Apr 6th, Review lesson].

Another occasion when Ms. Lara provided students with the opportunity for their
participation was in selecting their own groups to work in. She believed that when
students choose their group, they have ownership, and ownership leads to a more
engaged participation. She believed that random selection of groups did not provide
equity as some might assume, but rather that people having the choice brought about
better outcomes. She explained,
“You go to Professional development meetings and somebody goes, 'every fourth person's going to sit here' or...and it's like who does that? What is that about? I think it's somebody thinking that it's more equitable. It's not…. I don't think you work harder, I don't think you get a better product. I hate this thing where you go in and there's somebody to structure everything and you're supposed to have this natural outcome and you don't” [I: Nov 25th, Measurement & Data].

Her objective was for students to participate in their learning, and in order to achieve that objective, she intended to provide the environment. She believed that students having ownership as a consequence of their choice provided an environment conducive for learning.

“Ask around”: Student leadership and knowledge co-construction

Ms. Lara’s classroom culture allowed students to share in leadership. She made it clear that she was not the only source of information or knowledge. She stepped back so that students did not depend on her alone, but were aware that they can own the knowledge generated in the classroom. When students worked in groups, they generated ‘shared’ and ‘owned’ knowledge. In a classroom of ELL students, it was important to consider the implications of the teacher sharing authority. Students saw that the teacher admitted she did not have all the answers, that she made mistakes, and got the message that errors are acceptable. One such occurrence was when Ms. Lara mistakenly placed the ruler to measure a length. The students noticed and pointed it out. “You don't have it on
the one mark!” Betty pointed out. Then all the students chimed in, “You don't have it on
the one mark!! Ms. Lara acknowledged her mistake and corrected herself without making
excuses or giving an explanation for why she might have made the error [V: Feb 8th,
Review lesson]. The environment in Ms. Lara’s room is one in which students did not see
wrong answers as a lack of knowledge, but rather as an opportunity to learn. And as Ms.
Lara said, “students get a big kick out of correcting their teacher.” [I: Apr 6th, Review
Lesson]. Ms. Lara’s classroom culture was one of acceptance and mutual respect, where
everyone shared the responsibility for each another’s learning (Ladson-Billings, 1995a).

Ms. Lara often directed questions away from herself to other students or other
resources. During the Measurement & Data lesson, while the students were working in
their groups, one of them asked Ms. Lara a question. She responded, “Someone at your
own table has an answer” [V: Oct 25th, Measurement & Data]. During the follow-up
interview, Ms. Lara explained that she thought “it was important for them to work as a
group, and to realize that somebody else knew something that they wanted to know. And
it was right there” [I: Nov 25th, Measurement & Data]. The second reason was based on
her belief that her students had access to information from multiple sources. “They didn't
have to ask me. And I do that a lot. Who else can you ask? Where can you find that out?
How do you know? Who else can you ask?” [I: Nov 25th, Measurement & Data].

An interaction I overheard in Ms. Lara’s class is another good example of her
directing students to multiple sources of information. One morning, Katie wanted to
know what the word “recession” meant. Ms. Lara directed her to where she might start
looking for an answer.
Katie: When you have the time, please, can you help me find out about “recession”? My mom asked me to find out and she said she’ll give me $5.

Teacher: And if I tell you, what do I get? (☺). There is a dictionary there (points) and you can begin by looking up the word.

[FN: Nov 6th, 2012].

I shared with Ms. Lara, that coming from India, I find it very unusual that a teacher has her students seeking information from places and persons other than herself. An Indian teacher is commonly understood to be a “guru”, the epitome of knowledge and wisdom. Students look to the teacher for ‘answers’, parents expect teachers to give sound advice their wards, and society thinks of teachers as ‘good’ only if they have sound content knowledge and are able to help their students achieve academic success. They are perceived as weak if they admit to not having all the knowledge or not answer students’ questions. Teachers are often told that they should let the students know, in no uncertain terms, that the ‘authority’ in the classroom is the teacher. Ms. Lara was surprised at this, and confessed that she did not see herself as being an ‘authority’ and wanted her students to seek out any source for information. In that case, she thought

“If teachers don't know the answer, it's not important. So then it's not like you're question's not important; it is important. And if it's something that they can just ask around a little bit and figure out, I don't wanna be the
authority, I don't wanna be the only authority in that room”

[I: Nov 25th, Measurement & Data].

She wanted her students to not depend entirely on the teacher. She did not have all the answers, but recognized that students’ questions were important and needed to be addressed.

Students in Ms. Lara’s class played leadership roles during their classroom activities and tasks. Often, those who contributed new ideas were placed lead on investigations pertaining to that idea. Like in the expanding-in-water toy project that inquired into how much the toy expanded in water over a period of time, Sonia, whose idea it was, made sure that the measurements were taken precisely and recorded accurately. When a student had an idea during the Review Lesson, Ms. Lara recognized the idea as valid, noteworthy, and directed all questions about it to that student. Without official assignment of roles as some researchers suggest as being effective for small group learning (Cohen, 1994), Ms. Lara implicitly ascribed leadership. Moreover, students were leaders for different aspects of the lessons at different times, which gave all of them opportunity to lead.

“Think about it”: Student mathematical and social identities

Ms. Lara provided opportunities for students to learn both collaboratively and individually and thus build their mathematical and social identities. Boaler & Greeno (2000) propose a broader understanding of mathematics learning as a process of identity formation through participation in social practices (p. 172). These practices would include collaborative group work as well as individuals working alone, to use and develop mathematical concepts and representations. Student identities were being built in
Ms. Lara’s class through social interactions with one another, the teacher and other materials. Her lessons were often structured to provide both independent and group explorations based on student interests. Ms. Lara believed that students learn differently, but that students working collaboratively, communicating their ideas with one another produced the best results. In their groups, students were expected to listen to each other’s ideas, respecting one another’s views, and learning from each other. If students had questions while they were working in groups, she would say, “Someone at your own table might have an answer” [V: Oct. 25th, Measurement & Data] as a way of getting the students to collaborate.

Ms. Lara also knew that students sometimes needed their own personal time to develop their mathematical thinking. She encouraged an array of mathematical competencies, which emerged while observing students working on problems independently. Several times while she taught or when students were in groups, she ‘isolated’ students as a means to allow them to think without interruption. Thus, even while students worked in groups, she provided independent ‘space’ for her students to develop mathematical identities. An example of this was observed during the Decimals lesson. Andy made a mistake as he was working on the board multiplying decimal numbers while his classmates watched. Some students caught the mistake and started to point out his mistake, but Ms. Lara asked Andy to check his work. Andy did, and found the error he had made and corrected it. Ms. Lara’s intention was for Andy to have “ownership of the calculating itself, of the problem itself.” She said that if she went up and wrote something, it would not serve the purpose, Andy would not be happy that the
teacher corrected his work. Therefore, “he still owns the problem, and now he recognized the mistake and he fixed it” [I: Apr 6\textsuperscript{th}, Decimals].

As described above, Linda was the student who was distracted before Ms. Lara encouraged her to make a decision to actively participate. Everyone was expected to contribute ideas. When Linda was called upon, she suggested, “Division.” Ms. Lara asked her how they might review the concept of division using candy hearts.

Linda was not sure, but hesitantly said, “like 3 divide 4?, adding a question mark in the end of her sentence, obviously not convinced of the answer herself.

Ms. Lara, knowing that Linda was not sure of her answer, asked, “3 divide 4, how would I? Put out 3 hearts and divide it into 4 groups? Will you think some more, and we will get back to you?”

The conversation around the table continued, and suddenly Linda had an idea and raised her hand. Ms. Lara listened as Linda gave her example: “3 divided 9, You have 9 candy hearts and divide it into 3 groups.”

“So it’s 9 divided by 3. Ok. There you go,” said Ms. Lara. “We could have 9 candy hearts and we could divide them into 3 groups. And then we see how many is what? in each group. Good thank you” [V: Feb 8\textsuperscript{th}, Review lesson].

Ms. Lara thus pursued Linda’s idea and helped validate her as a contributor of shared knowledge. This provided an opportunity for Linda to build her mathematical and her social identity. Unfortunately, after this incident, Linda went back to being distracted, playing with her pencils. Ms. Lara, vigilant about her students’ engagement, called on her, “Linda what is this called? What is it? If a heart equals 2 or a heart equals 5?” Linda, who was not focused, did not know what she was being asked, and looked puzzled. Other
students raised their hands to answer, but Ms. Lara stopped them, saying, “Put your hand down. I have to make a point here.” She then repeated the question, providing Linda with more information this time. Linda then successfully answered the question, extracting a “Thank you. Thank you thank you” from Ms. Lara. [V: Feb 8th, Review lesson]. In this way, Linda was provided with another opportunity to participate and engage in the lesson, building her identity both as a learner of mathematics and as a member of the group.

Providing for students’ independent mathematical explorations built their identities as mathematicians. During the Review lesson, one student suggested “estimation” as one of the topics that could be reviewed. The student lined up the candy hearts and Ms. Lara asked the students seated around the table to estimate what the length of the string of candy could be. By posing the question, Ms. Lara opened the discussion for students to use any means to estimate. Marty placed his little finger against the line of candy and moved it along counting the total number of finger measures as 15. He presumed his finger was about an inch long, and although he counted 15 times, he estimated 16 inches, adding an inch for ‘good measure’. Don used an alternative unit iteration to estimate. He estimated each candy heart to be half an inch wide. He started counting the line of candies in pairs (since a pair was an inch by his estimate) and since there were 31 candy hearts, he explained the length of the line was 15 and a half. Both estimates were close [V: Feb 8th, Review lesson]. The students were reasoning with mathematics, exploring mathematical ideas, and had the opportunity to build mathematical identities through developing their own mathematical thinking.
Research Question 2

How does the teacher's disposition towards mathematics content and pedagogy influence her instructional and pedagogical choices for student self-empowerment in mathematics?

Ms. Lara’s perception of the content that students needed to learn was a richly connected, integrated one (Baroody et al., 2007). Learning content was all about making connections. Based on this understanding, in her teaching she attempted to make various kinds of connections: to student ideas, multiple representations, different content areas, and students’ lived experiences. In order to make connections, she kept her lessons open and flexible, connecting what students knew with what they wanted to learn. Ms. Lara’s pedagogical choices for student self-empowerment were based on her understanding that learning takes place in a collaborative environment through sharing ideas, listening, and respecting each other, as well as individually, as time is spent in isolation. Therefore, she provided group-work opportunities as well as opportunity for individual students to learn at their own pace using their own method.

“Just make connections”: A richly connected curriculum

Ms. Lara’s comfort with a richly connected mathematics content emerged through her willingness to open her classroom: to other teachers (she invited the team of teacher educators), to students’ ideas, to other sources of information, and to an open and flexible curriculum. When she needed help, she reached out to the team of teacher educators and was open to observing and learning. She found that the conventional language of mathematics did not work for her ELL students. She would
“try and do things like just simple addition using the typical plus, and counting on, and number lines and things like that… I was saying if you see the word ‘altogether’ it means you add, and they were gone. They were just gone”

[Initial Interview: Oct 10th].

When there was this breakdown in communication, Ms. Lara did not hesitate to ask for help.

During the period of intervention in her class, Ms. Lara reflected on her teaching practices and was eager to learn to communicate with students more effectively. She shared how she continued to grow as a teacher. She observed how the team used manipulatives and language familiar to her students. She noticed that her students, especially her ELL students were engaged, and able to make connections with the content. She “was looking at the number line as being a manipulative and when [the team got those blocks out and they had things, a new language, a third language emerged” [Initial Interview: Oct 10th]. She observed that the language gap was no longer a hindrance in students’ mathematical understanding, and her learning provided her with more strategies she could use to make connections.

Ms. Lara asked questions to learn more about her students. The more information she had, the better she became of providing the support they needed to learn. She knew that her students learned better visually, and therefore made certain that visual clues were provided. For example, in comparing decimals, she showed them how to “line up the decimals” and then “fill the spaces with zeros” and then read the numbers “from left to right” [V: Nov 10th, Decimals]. Knowing that some of her students were audio learners,
she “defined terms at least in three different ways” [I: Nov 25th, Measurement & Data]. Believing that students learned best by doing, she had projects and activities that involved working with their hands like in the Measurement & Data lesson where they measured pumpkins, counted seeds and created their data tables.

As a way of opening her classroom, Ms. Lara shared leadership and authority with her students. That also meant that she had to be flexible with her lessons in order to accommodate student ideas. She did not strictly adhere to a planned curriculum if the students needed to learn a concept that was outside of the particular unit she was working on. During a follow-up interview of a lesson, Ms. Lara reflected on deviating from the scheduled order of topics. Familiarity with the curriculum enabled her to provide students with what they needed as it came up in the classroom. For example, by the way students responded to a word she used, she knew whether it was familiar or unfamiliar to them. If it seemed unfamiliar, she did not “wait until it is time to teach them something. If [she] hadn't shown them that already, this was a good time, so [they] just do it. It just makes sense. [I: Apr 6th, Review lesson]. This kind of flexibility with content meant that Ms. Lara had to be familiar with the content across the curriculum, and how they are connected. She said it meant that she had to know

“how does this go together with this? If I show it to 'em now, it doesn't mean I can't show it to 'em again and again and again when it applies later on. The more times I think you can throw something out, the better you are.” [I: Apr 6th, Review lesson]
Having a connected understanding of the curriculum herself, Ms. Lara was able to make those connections multiple times, so that the students also see the connections and become familiar with them.

Ms. Lara kept her lessons flexible because her instruction was entirely student-focused. She didn’t “always plan where these things are gonna go”. She emphasized, “A lot of it depends on what kind of response I get from the kids. If I see that they are making a connection, then I just push it just a little bit farther, to see if I can get them to take it to the next step. So my planning is how far can I take this and with whom? [I: Dec 19th, Fractions].

Another manner in which Ms. Lara worked towards student self-empowerment was to expose her students to various sources of information such as a dictionary, the textbook, the computer, another student or teacher. She encouraged students to access answers and information from sources other than herself. She directed their inquiries to other sources even when she could answer their questions because she wanted them to know how to access information and to learn on their own. She thought, “it was important for them to realize that somebody else knew something that they wanted to know. They didn't have to ask me. I don't care if I'm the authority or not. It just means that somewhere there's an answer.” As a result of Ms. Lara repeatedly directing her students to multiple sources of information, students had become quite good at “running for the dictionary”. When that happened, when she saw that her students were looking for information in different places, be it in the dictionary, or the computer, or another
student, Ms. Lara liked it, because her objective was fulfilled. She said when Stan ran “for the dictionary, I like that. I like it” [I: Nov 25th, Measurement & Data].

Ms. Lara defined teaching as helping students make connections. Her plan was to always “make sure that [her students] could make that just to make the connection” [I: Dec 19th, Fractions]. Therefore, she brought together different content areas, multiple representations, and experiences outside the classroom in her lessons. She used what Clinchy (2000) termed “connected knowing” (p. 31) in which one tries to understand the other by connecting with their experience. Ms. Lara connected with her students by understanding their points of view and experiences, and associated their learning with their out-of-classroom experiences. She reflected on her own way of knowing through making connections, and said “If I'm up there teaching something and I make a connection then I'm figuring somebody else will too” [I: Dec 19th, Fractions].

Ms. Lara’s efforts to help students learn kept her open to her own learning. During the first year when the team of teacher educators worked in Ms. Lara’s classroom, she observed them, learning as much as she could. She also asserted that she was still learning and continued to be a student as she observed other classrooms as often as she could and learned from other teachers/educators:

“I am such the student when I'm in school or not, that when I can stop and see what other people are seeing, it makes it that much easier what the kids need or what I need to change, what I need to do, it gives you a chance to just to understand. Teachers don't get to observe very much. So
when somebody else comes in and I can watch little bit, it's a huge difference” [Initial interview: March 15\textsuperscript{th}, 2012].

“Hold on to different things”: Individual and collaborative learning

Ms. Lara’s classroom was one where students and teacher collaborated and learned together. Students asked questions, worked in groups, contributed ideas, and had ownership of what they learned. They explored and investigated ideas they were interested in, supported one another’s learning, and had the opportunity to individually learn in their own way at the same time. Students had freedom to perform mathematical investigations using their own unique and different methods. During the Review Lesson, for example, students estimated the length of a string of candy hearts. Students used different strategies to estimate. Ms. Lara saw this as an illustration of how different students “learn differently and they hang on to what makes sense to them….it speaks to me of the fact that they hold onto different things, all of which are reasonable” [I: Apr 6\textsuperscript{th}, Review lesson]. Diversity in Ms. Lara’s classroom was not only acceptable, but welcome.

In the learning community, everyone has the opportunity to learn at their own pace. Ms. Lara supported students’ independent learning even through collaborative project-based learning opportunities. In one of the activities during the Review lesson, a group of students was finding the mean (average) of a set of numbers. While one student reached for a dictionary to find the meaning of the word ‘mean’, another student calculated the average. Ms. Lara waited for both students to understand and learn in their own way. She provided the environment in such a way that “somebody might be a little farther along in one area, but we're all still there together and we're doing it together.” I commented to Ms. Lara that in a way, she was providing differentiated instruction, and
wondered if she had planned for it. She responded, “That's almost something that you can't plan. They always talk about how are you planning for differentiation - you almost can't. You have to see who's stepping up to do what and what's needed” [I: Apr 6th, Review lesson]. Hence, her individualized instruction was dependent on her observation of her students at all times, determining what they needed at any given moment.

Even though Ms. Lara’s class learned together, everyone was responsible for his or her own learning. She became concerned if even one student was off task or not learning. Ms. Lara spoke to me about her need to be aware of her students to make sure they do not escape her attention. Linda, a student about whom I have spoken before, was generally distracted, and had her concerned.

“I'm real aware because I think you have to be aware of who's trying to hide. I know she's sitting there hoping I'll just skip over her. She's gotta be thinking, ‘I just don't wanna do this.’ You have to be able to recognize who's gonna slip through the cracks. She would definitely be one. She's one of these little guys that you can't tell what she's thinking.” Ms. Lara knew her students well enough to know this about Linda: “She can look like she's paying attention, but unless I hear from her I don’t know whether she's got something or not. Somebody else you can see them kind of excited about it or going off and trying to come up with ideas on their own, but I can't tell from her unless I hear her” [I: Apr 6th, Review lesson].

207
Her attentiveness to individual needs and the connections she made supported Ms. Lara’s students’ diverse ways of learning. By providing an atmosphere of a learning community, she also supported students’ individual and collective self-empowerment in mathematics.

**Research Question 3**

*What goals are central to the teacher’s pedagogy for equity and social justice?*

Ms. Lara’s goals for her followed a sequence: first, she tried to understand her students, their lives, their needs, things they are interested in, and how they learn and think; second, from her understanding of students, she ‘opened up her classroom’ to accommodate the needs of her students and create a safe environment for them to learn from and with each other; third, she continued to build relationships with her students, care for them, and made connections based on her perception of what her students needed; and fourth, she wanted to see her students ‘light up’ as more confident individuals.

*“Connect with them”: Know and understand students*

Ms. Lara believed that equitable teaching is necessarily based on a better understanding of students – their backgrounds, their home environments, their interests, and their ways of knowing. So that is where she began her work: getting to know her students. Students in her class came from different ethnic, language, and cultural backgrounds. Most of them were from recent immigrant families, and although they were able to verbally communicate in English, they were considered English Language Learners (ELLs). Several factors helped her as she endeavored to get a better
understanding of her students: her own background coming from a Russian immigrant family, her experience as a special educator, and her Montessori training.

Ms. Lara’s grandparents were Russian immigrants, and her mother was therefore, first generation immigrant. From her mother, Ms. Lara learned about respecting people from different cultural backgrounds. Another key factor she pointed out was her experiences working as a special educator,

“In Special Ed you never have a homogenous group, or we never did. I mean you had just this huge range of not only capabilities, but parents from—in one class, you could have a family that was really dysfunctional to almost society families. It's just like this acceptance of whatever, whoever you’re with, you just respect where they are” [I: Apr 6th, Place value].

Although her background and her experiences made her respectful of others and accepting of diversity, she was still unprepared when a majority of her students were ELLs. Through her experience of struggling to understand and communicate with them, it “was the first time [she] really realized that looking at them from their point of view how important it was, how important” [I: Apr 6th, Place value]. She began to understand them as individuals who were challenged in many ways, and did not have advantages many other students had.

“They have so many things in their lives that are stumbling blocks and that are keeping them from learning and it's such a challenge, and it's such a push of mine to get
through to them and then to figure out what is the problem, you know what is it that's stopping you. And it makes it more of a challenge you know, to be able to get through to the children who have so many things against them sometimes” [Initial Interview: March 15th, 2012].

Thus it began, Ms. Lara’s quest to ‘connect’ with her students that left her feeling helpless when the barriers to these connections blocked her. The first barrier that presented itself was her students’ challenging home circumstances. She was concerned and confused about how she could provide the support and understanding needed as well as teach the content. She affirmed that the students had the right to knowledge and she wanted to provide them the opportunity to learn, but she also was aware of circumstances beyond her control that interfered with her endeavor. Explaining the situation to me, Ms. Lara said,

“A lot of the kids have serious issues this year. A large number of my kids are on meds for AD, ADD, or ADHD. And then there's that compounded problem of parents not getting it to them. So then there's a double whammy there…. the kids are the ones who really really need them are having terrible attention problems and behavior problems” [I: Nov 25th, Measurement & Data].

Besides this, Ms. Lara also noted from her observation during parent-teacher conferences, that some of her students were being abused and neglected. This left her feeling even more frustrated, since “they're bringing so much of it into the classroom that
I can't teach... It's to a point where I can't get in that rhythm of teaching like I usually do” [I: Nov 25th, Measurement & Data]. During that interview, Ms. Lara was very sad that she was unable to connect with her students or help them in a way she thought she could have been able to otherwise, due to the disturbing circumstances of their health and home lives.

Another situation that provided challenging to Ms. Lara was the fact that because of her special education background, students with special needs were being sent to her classroom without any other support. Even though she knew what their needs were, she was unable to provide them the support they needed, and that led to her increased sense of despair. My field notes on the day she shared this with me reflect the intensity of her emotions:

With tears in her eyes, Ms. Lara told me about the special children who have recently been placed in her class. The students had learning difficulties and needed an intervention specialist have been recently placed in her class because “she is so good with the kids”. She feels bad that the kids need support that she cannot provide. She has to attend to the other “normal” children. I can see she is really upset and unhappy. It is obvious this is very disturbing. She is saddened that the administration is making decisions without the interest of the students in mind. As she is talking, she has tears in her eyes.

[FN: Sept 18th, 2012]
In spite of the circumstances I described above, Ms. Lara did not give up. The primary reason for her request for help from the teacher educators was to provide her with an understanding of how to make connections with students. Besides home situations and special needs that students had, she knew that especially with her ELL student, the language barrier contributed to a breakdown in communication in the mathematics class. Although the students communicated in English, they had almost no mathematics instruction.

“A lot of them had no number sense or very little number sense, there was no number vocabulary for us to even talk back and forth with about things. I’d say things and they had you know, a very blank expression” [Initial interview: Oct 10th, 2012].

There was a breakdown in communication with students “shutting down”. There seemed to be “blocks”, according to Ms. Lara, in several places: “If they weren't understanding what I was saying, they shut down, if I didn't understand what they were saying, they shut down. If they couldn't express it, they shut down” [Initial Interview: March 15th, 2012]. Besides, “there is a big disparity between their age and what they knew and what their peers knew and they weren’t even trying, they were just totally shut down” [Initial interview: Oct 10th, 2012]. As the team began to work with the students using manipulatives and non-conventional language, Ms. Lara saw how they seemed to develop “a language of their own to think with” [Initial Interview: March 15th, 2012].
Subsequently, when students did ‘shut down’, Ms. Lara tried to understand from the student’s perspective, and in some cases, gave them what she thought they needed – time. During one episode, the students were signing up to be in different groups. Each of them stepped up to the board to sign their name into one of four groups. Amanda (an ELL) refused to do so. It was clear that Amanda was not a willing participant in the group activity. Ms. Lara simply left her alone. She did not try to convince or cajole or force her in any way. In the follow-up interview, I asked Ms. Lara how she decided to do what she did. She has used different strategies with different students. With Amanda, it was giving her time, with Linda it was keeping a close watch and pulling her into thinking and participating, and with Han it was giving him a ‘time-out’ or a serious talk. How does a teacher decide what to do? Ms. Lara explained her thinking in dealing with each of the students differently:

With Amanda, “there's something she just wasn’t sure about. And you cannot make that little thing talk. She won't. She just clams up. So I guess I just figured when she felt good enough about it she would, you know, she'd find her place.” [I: Nov 25th, Measurement & Data]

With Linda, “she's sitting there hoping I'll just skip over her. You have to be able to recognize who's gonna slip through the cracks. She would definitely be one. She's one of these little guys that you can't tell what she's thinking. She can look like she's paying attention, but unless I hear
from her I don’t know whether she's got something or not.”

[I: Apr 6th, Review lesson]

And with Han, “He's got like compulsive issues where he's not gonna sit in somebody else's chair, he's not gonna pick up somebody else's pencil and if somebody picks up his pencil then he's not happy. But it's very hard to accommodate that.” [I: Nov 25th, Measurement & Data]

Ms. Lara did her best to know her students before she planned what to do. From her in-depth understanding of her students, Ms. Lara chose to manage behavioral problems differently with individual students. From her knowledge of how her students learned, she supported their ways of learning, and from her understanding of their needs, she provided opportunities she thought best enabled their learning.

“Open the classroom up”: Rich learning environment

For Ms. Lara, being an activist meant to see that her classroom was a space where all students had the opportunity to learn in a manner that best suited their ways of learning. This meant that she was able to “open up” her classroom more. She reiterated that she was able to do this from knowing her students individually:

“I think if you're gonna open your classroom up to this kind of project learning, you really have to know the kids. It's like I have to know whether Andy's gonna take over somebody's work, or why Han's doing what he's doing, and it makes it harder. I know there are a lot of teachers who are really really good at that. And they're able to open up
their activities a little bit more.” [I: Nov 25th, Measurement & Data]

Based on her understanding of students, Ms. Lara endeavored to provide the environment they needed in order to learn. She tried to understand the challenges of all her students. Students who were not up to expected proficiency found in her an ally. She knew their situations, but neither did she give up on them, nor did she make them feel less than the others. She supported their learning by providing what they needed. With the ELL students, she understood why they were missing out on mathematics instruction and falling behind. She observed,

“When they go to the ELL classes, they miss whatever's going on in their home room. And even if they were in their home room for math, you know how difficult the language is that traditional math teachers use, or teachers use to teach math, and they just they didn't have it” [Initial Interview: March 15th, 2012].

And so she knew she needed a different approach. She opened her classroom up to different strategies.

With regard to ELL students she provided them the opportunity to think more deeply by giving them more time. She rationalized that

“they are really having to think something through. They're not only having to think the question through, but they have to think the answer through and then they have to figure out
how to say it. And I don't think they are given enough time often, to do that” [Initial Interview: March 15\textsuperscript{th}, 2012].

Ms. Lara also kept her lessons flexible. Even though she began with a broad goal in mind, she moved the lesson into a direction not previously planned based on the responses of her students. If students were “making a connection,” she thought she could, “push it just a little bit farther, see if [she] can get them to you know take it to the next step.” It meant that she observed the students closely. She had to know how her students learned differently, and based on the progress they made, she supported them even if it meant differentiating her instruction. She observed, “At times you wind up teaching at two and three things at the same time because these kids are ready to go and get farther with it, and somebody is not really in that place” [Initial Interview: March 15\textsuperscript{th}, 2012].

Although opening up the classroom might sometimes result in what looked like chaos, Ms. Lara maintained that the spontaneity produced the best outcomes. She allowed her students to speak freely, to “not have to raise their hand until they get called on.” She also justified letting them speak when they needed to since “they cannot hold their thoughts that long, and wait their turn, and listen to what somebody else was saying, and listen to [the teacher’s] input.” Therefore, by allowing that “erupting spontaneous kind of talk”, she said she was able to get more out of them [I: Apr 6\textsuperscript{th}, Place value].

Opening her classroom also meant opening herself up to her students, especially to her human side. She shared laughter with them, and her frustrations. She would admit to them that her spelling was not very good, and that she made mistakes that they needed to watch out for. During interviews, Ms. Lara admitted there were times when students pointed errors she made in mathematics. She told me during one interview [I: Dec 19\textsuperscript{th},
Fractions] of an occasion when she made a mistake in plotting a point on the co-ordinate plane. Several students raised their hands to point out her mistake, but realizing she seemed displeased, became very quiet. Only one student kept his hand up, and showed her where she had made a mistake. This made her burst out laughing, and eased the tension in the room. Such occasions brought her closer to her students and helped them understand each other better. Students understood the teacher made mistakes, that errors are acceptable, and they could help each other to correct them. Ms. Lara conveyed to her students that she was also learning, like them, and mistakes helped develop an open line of communication.

Opening up her classroom also meant that they discussed topics that the students were interested in. There might be controversial issues that come up in the discussion and she needed to allow it. This was another way in which she developed a better understanding of her students and also helped them develop a better understanding of each other. She did not avoid any topic since she thought “it strictly depends on how you talk about it….because you can explain things in a very basic simple way without getting too involved or too graphic” [I: Apr 6th, Place value]. Ms. Lara maintained that discussions about everything the students were interested in was another way of getting to know them better and learn from those conversations.

Opening up the classroom also meant that the students were better able to communicate and learn about each other. Discussions about sociopolitical issues she thought provided an opportunity to help students understand each other, especially those from different cultures. She asked students to speak openly and honestly about questions they had in a respectful manner and be accepting of one another’s views. I wanted to
know from Ms. Lara how she facilitated understanding among students from different backgrounds. She explained that she had to “take their background and their families and their history and be respectful of that.” She also was careful not to be “offensive or to be dismissive,” since she thought if she were to speak from a “know-it-all position or authoritative position,” it would only silence them, and she could not let that happen. Ms. Lara maintained that her goal was to see that the students were engaged, that she remained connected to them, and provide an environment of openness and acceptance for all students.

“Follow the child”: Learner-responsive pedagogy

The phrase Ms. Lara used to identify her pedagogy, “follow the child” came from the Montessori philosophy. This was something she not only professed when she was teaching in a Montessori school, but she continued to use in teaching wherever she went. She believed that teaching should aim to meet the needs of all students. Hers was a learner-responsive orientation, and towards achieving it, she continued to learn about her students and build relationships with them. She understood that students learn best when she was able to “connect” with them by first getting to know them. She first learned as much as she could about what the students were doing/learning before moving on to the next step. She wanted “information to come from the kids so that I know, once again, that's the only way I really know what they're getting and what they're not getting” [I: Apr 6th, Review lesson]. Towards that end, she had her own form of continuous informal assessment. She assessed her students through carefully observing and attentively listening while they performed and talked about mathematical tasks in the classroom as well as while engaged in casual conversation.
From information that Ms. Lara gathered about her students, she assessed where the barriers were to their learning. For instance, she understood how her ELL students were “shutting down” when they were unable to connect with the conventional language of mathematics, when they were unable to communicate their ideas with fluency in an unfamiliar language, and when they knew little compared to their more advanced counterparts. Ms. Lara better understood students who exhibited attention-seeking behavior in the classroom from learning about their difficult and fragile homes. She also observed how they learned as she followed their work on tasks and listened to their questions. She asked them questions that would elicit more information about their ways of learning. Based on all the information she thus gathered, she made decisions to remove obstacles to their progress, and support their learning.

Ms. Lara’s instructional choices were driven by “following” her students. She identified with the philosophy of CGI (Cognitively Guided Instruction) to focus on student thinking while she taught. She believed in getting “down and dirty with the kids” in trying to understand them, how they are learning, and the misconceptions they might have. She held that “if you just gather up the work and grade it in the evening, you don’t see where they are and where the problem is” [Initial Interview: Sept 14\textsuperscript{th}]. In order to really guide a student’s learning, one must understand how they are thinking in the context of the problem-solving activity. Ms. Lara thought that the best time to teach students was when they were “ready to understand something or has a curiosity about it.” By asking a student to wait or refuse to address a question not directly related to the unit being taught, she thought that a teacher could easily thwart their curiosity [Initial Interview: Sept 14\textsuperscript{th}].
To Ms. Lara, teaching meant helping students not only to learn but also to enjoy learning. For students to enjoy their learning, she thought it was necessary they connect with the materials, with one another, and be able to find meaning and relevance of what they learn to their daily lives. She looked at teaching as finding out where the students were in their learning and development and provide just the amount of support they needed to move to the next level. She defined teaching as

“getting them to want to learn something and to get some joy out of it. And give them something that they can jump off of to the next level. I guess the typical term is scaffolding, that talks about giving them just a leg up to the next level. But I think it's also wanting them to enjoy it”

[Initial interview: March, 2012].

“See them light up”: Student self-confidence

Ms. Lara told me how much satisfaction she derived from seeing her students ‘get it’ and ‘light up’. She saw new confidence in them when they did, and to her, that is what teaching was all about; knowing that the students were learning and enjoying themselves while they learned. “It's the reason you teach,” she stated emphatically. “When you know that somebody's gotten something and enjoy it at the same time, while they're having fun with it. That's teaching!” [I: Dec 19th, Fractions]. When her students learned something, Ms. Lara observed that there was a transformation. “Don, when he's excited about something, his everything about him is better. The confidence is better, and Marty, when he succeeds at something, he's just a different kid. He's just a kid again; he's not like a
tough whatever” [I: Dec 19th, Fractions]. Her goal was to see her students transform to become more confident, assertive individuals.

Ms. Lara provided opportunities for students to build confidence. Her classroom environment provided safety and security where students were able to ask questions freely and be validated. She provided assurance and encouragement by saying “Good. I'll say 'good girl' or 'good boy' or 'you got it'. That's it. And they just light up” [I: Dec 19th, Fractions].

Ms. Lara told me that she felt grateful that she had received much in working with her students who were disadvantaged in one way or another. Most of her teaching experience has been in schools located in poor/violent/marginalized neighborhoods. She saw the children in these schools as having many factors working against them. When she was able to help them learn, when she saw their joy and confidence rising, she saw it as “an opportunity to give something back” [Initial Interview: March 15th, 2012].

Ms. Lara spoke proudly of all her students. In the following excerpts, she shared her thoughts and pride as she watched her students’ confidence rise when as they learned.

One little girl was making all of these hand gestures that were the same ones that I used. She literally changed from being a really struggling student to somebody who was in a teaching position. That really left an impression on me for a long time. When she shifted into the role of being a teacher, she already knew she had it. And there was a lot more confidence when you go to explain something to someone.
else it puts you in a different role, one that has a lot of confidence with it. [Initial Interview: Sept 14th]

Oh my God, Marty bless his heart, would take something and he would take it to the next step himself. And his face would light up, and there was one comment he made “it matters how you learn it. You have to know how to do it. If someone asks you nine and four then you have to know what to do.” I think he just began to realize that he could do something, it was like a language appeared that wasn’t there. [Initial Interview: Oct 10th]

I was just so proud of them, and so happy that they were feeling good about themselves. When they are in a class where they’re secondary to the kids who know what’s going on, they just sit back, and they’re just so reserved. So it was a pleasure, and I watched them just brighten up. [Initial Interview: Oct 10th]

Circumstances that might hinder equitable teaching

In the following section, I present the challenging circumstances in Ms. Lara’s school that might have hindered equitable teaching and learning. Although Liberty Elementary has its own specific problems, the following circumstances may be common to populations across the country, and the world: a) standardized testing, b) scripted programs, and c) systems that do not meet the needs of all students.
Standardized testing

Standardized testing has become the primary way of assessing students, which frustrated Ms. Lara. She perceived standardized tests as being demoralizing and a deterrent to learning to the diverse population of students in a school like Liberty Elementary. “I think it's outrageous! I think it's absolutely outrageous!” she exclaimed. “And I think it's demoralizing. They get discouraged. Mo, Mike, they get angry.” Even if the tests were administered in the manner they are supposed to be, with portions read to the students, Ms. Lara thought it did not help them. “Even when something's read to them, there's no guarantee that they're understanding it as fast as it's being read. So you know, just reading something to them doesn't equalize anything. I hate it!” [Initial interview: March 15th, 2012].

As an alternative, Ms. Lara developed a continuous and formative assessment to use for her students, details of which were provided elsewhere in the chapter. She used questions directed at individual students, listened to student explanations, attended to students communicating within groups, and watched as students work. This continuous and strategic assessment formed a critical part of Ms. Lara’s teaching since she based every instructional decision on the knowledge she thus ascertained.

‘Scripted’ programs and ‘behaviorist’ teachers

According to Ms. Lara, she was able to create the “open” classroom environment because of the flexibility she was allowed. She admitted to having the support of her Principal to do some things differently. Unfortunately, this support did not last. The school had regular assessments and students were being ‘assessed’ in a way that made her uncomfortable. Moreover, students were being moved around between classrooms.
Students who showed greater potential were moved to a room where they were expected to focus on getting better test results. When some of Ms. Lara’s students were moved, they exhibited disorderly behavior and were sent back. Moving students between classes disrupted her flow of teaching, and proved to impede her progress.

Today Ms. Lara shared that some of her ‘smarter’ students were moved to another classroom to put them on a track so that they could produce better test results. The students did not like it because the classroom was run in a teacher-directed manner with emphasis on academic performance and results. They started causing behavior problems and were brought back to her classroom. The administrative authorities told her that she was good with the students and could handle their behavior. In the process, the kids missed what she did in this class. All this is upsetting to the teacher and impedes her work. She is not able to make the progress that she would normally have made by this time in the academic year. [FN: Sept 18th, 2012]

Scripted programs that sometimes dictate how teachers should teach, following step-by-step instructions tend to impede a teachers’ work for equity, according to Ms. Lara. “One of the things that makes me so outraged about these scripted programs where the teachers are to say this and this and this and this, you know, and then you get this response.” These programs supposedly lead to a positive outcome, but instead, they
restrict a teacher’s work. An equitable teacher would first want to know her students and make decisions based on that knowledge; such programs only are a hindrance to that endeavor.

“I think it takes away the chance for new teachers to get a sense of what works in the room. I mean you have to make mistakes, and you have to get a feel for the kids. I think they take away the you know the teacher's autonomy and opportunity to become better have a better sense of what people need” [I: Dec 19th, Fractions].

On the day of the US elections, Ms. Lara led a discussion in her classroom about qualities of a leader, what kinds of things one might consider in selecting a leader, and what the students might need to do in order to run for office, if they chose to. The rich discussion involved the students’ thoughts about issues facing their communities and reflections on their actions that might impact their future. In the following interview with Ms. Lara, I commended her on providing the opportunity for the students to think about such issues. She responded that it made her sad that such discussions were no longer possible in the new school circumstances. She said that the Principal had assigned a retired teacher to be in the class with her. The teacher had

“these rigid ideas, she’s more of a behaviorist. So now when [the students] come in they’ve got writing on their desks, and they’ve got something else on their desks, and they have to meet with her or they meet with me, and there’s been no discussion of anything. I mean it’s just like
this chance to have, I had almost forgotten what it felt like.

And it’s gone, and it’s gone for the sake of behavior control and writing” [I: Apr 6th, Place value lesson]

Ms. Lara was saddened that they were not able to deliberate freely any more. She thought that when classrooms were opened for such discussions, they allowed for more spontaneity. For an outside viewer, on the other hand, it might also look “a little bit more like chaos, and when you have students that are easily distracted, it could lead to more chaos, so it’s a fine line, but I think it’s incredibly important” [I: Apr 6th, Review lesson]. Having this aspect of her pedagogy taken away disturbed and disappointed Ms. Lara.

**Systems not focused on student needs**

Students come to school with many different needs. Some students in Ms. Lara’s class were ELL students, others had special needs, and some were on medication. 98% of the students were low SES. Ms. Lara expressed the view that school system structure was did not address the students’ needs well enough.

Firstly, Ms. Lara did not think it was helping the special needs students by placing them in her classroom without another intervention specialist to support them. Since Ms. Lara had training in special education, students with special needs were dropped into her classroom. Ms. Lara expressed frustration in not being able to help them even though she knew how. She had her hands full with teaching the other students in the class and had little time to address the additional needs.

Secondly, some students in Ms. Lara’s class needed medication because of conditions like ADHD and ADD. She perceived that they were not receiving the medicines they needed in the needed dosage causing behavioral issues. Ms. Lara
attempted to address the issue by reporting the behavioral problems she faced in the classroom through the administrative channel. In spite of it, the parent of the student with the medication problem blamed the teacher for not voicing the problem to her.

Thirdly, there were several ELL students in Ms. Lara’s school and class, who came with their own set of needs. The school system, in her opinion, was again, not set up for their success. The focus for them was on acquiring language skills, because of which, depending on the time of day they went to their language room, they missed what was being taught in their homerooms. This only went to make matters worse for the students. Most teachers, having accepted the situation as inevitable, left the students alone. As a consequence, the ELL students who came into Ms. Lara’s class in the fifth grade had almost no mathematics instruction, and were far below grade-level.

Lastly, Policies governing the school’s lunch distribution were a disturbing factor in a poverty school like Liberty Elementary. Ms. Lara was upset that extra food from the lunchroom was thrown away while students went hungry. Liberty Elementary provided food to children from poverty and many ELL students. For many of the students, the meal they got in school was the only one for the day. Ms. Lara told me about the argument she had with the people in the lunchroom. It was Thanksgiving week, and many students were not present. Subsequently, many lunch boxes were remaining after they had distributed the food. Ms. Lara suggested that instead of throwing them away, they could offer extra to students who wanted to eat more or who might want take some home. She said that some of her students in her class were big and she knew that they would be hungry even after their allotted portion. The food that they got at lunchtime could be the
only meal some of them had in the day. In such a situation, the lunch policy seemed unreasonable.

**Summary of hindrances to equitable teaching**

My study was an investigation into Ms. Lara’s pedagogy for equity and social justice. Her work in the classroom cannot be considered separated from the context of the school and community where she practiced. Some circumstances have been highlighted to provide the reader with an understanding of what a teacher like Ms. Lara would have to face under similar conditions. A school having a large population of low SES, ELL, and special needs students offers many challenges for teachers. Students with special needs must have a special educator to address their particular needs or else it can be a hindrance to learning of all students. Students who have medical problems need additional attention, which often the parents are unable to provide. ELL students are without the needed support because of their language barrier. They often fall behind in the classes they miss while attending their English language classes. These circumstances stood in the way of Ms. Lara’s efforts, but she navigated through them despite the frustration she felt. This emergent finding might have implications for teacher education and inform considerations for supportive systems for teachers.
Chapter 5. Discussion

The purpose of this study was to provide a vignette of teaching mathematics for equity and social justice and to make it accessible to teachers and teacher educators. To accomplish that purpose, I traced the work of one experienced teacher’s mathematics classroom of low socioeconomic and ELL students. I studied the teacher’s intentions and practices in order to understand the reasons for the teacher’s pedagogical decisions aimed at equity and reflect on their implications for social justice. Through interpretive ethnography and case study methods, I designed the study to provide a rich description of the teacher’s practice. The study came about as the result of classroom intervention by a team of teacher educators in Ms. Lara’s class.

As part of the team of teacher educators, I supported Ms. Lara’s classroom through one academic year using Cognitively Guided Instruction (CGI), described in Chapter 3, to teach mathematics to ELL students. The teacher, Ms. Lara, observed and made reflective notes while the team worked with students. At the end of the first academic year and through the second academic year, Ms. Lara taught while I observed and provided minimal support. Data was collected in the form of three initial interviews, five classroom observation videos, five follow-up interviews, student work samples, researcher field notes, teacher reflective notes, and a final interview. Initial interviews provided information about Ms. Lara’s background, her goals of teaching in high-needs
environments, and her perspectives about mathematics, teaching mathematics, and how students learn. After a first level of analysis of the lesson videos, follow-up interviews sought a more in-depth knowledge of Ms. Lara’s intentions and goals for teaching in the context of her students from ELL and low SES populations, and her choices that might have positively impacted student self-empowerment. Chapter 4 presented responses to the following research questions:

a. *What instructional decisions does the teacher make that contribute to equitable teaching practices for students from low SES and ELL populations?*

b. *How does the teacher's disposition towards mathematics content and pedagogy influence her instructional and pedagogical choices for student self-empowerment in mathematics?*

c. *What goals are central to the teacher's pedagogy for equity and social justice?*

This concluding chapter provides an analytical discussion of key findings from the investigation of Ms. Lara’s pedagogy for equity and implications for social justice in her mathematics classroom. Following a discussion of the key findings, I offer a model for teaching mathematics for equity and social justice, the “CCI Triangular Framework” for teaching (Figure 5). When I have described the model, I will present implications for theory, teacher education, and practice as well as report an emergent finding. Next, I discuss limitations of the study and recommendations for future research. Lastly, I will argue for a broader understanding of mathematics teaching for equity and social justice and elements of teachers’ pedagogy that may enhance their implementation.
Discussion of key findings

My study provided a rich description of Ms. Lara’s practice and pedagogy for equity and social justice. Based on this investigation, the following key aspects of her work were identified:

1) Developing students’ critical thinking as a personal process;
2) Having informal and informative assessment strategies helping her to, in a colloquial phrase, ‘keep her finger on the pulse’ of her classroom and learners;
3) Intentionality in getting to know her students, their context, their aspirations, and making instructional decisions based on that knowledge;
4) Helping students build mathematical and social identities;
5) Students as the locus of authority for both mathematics and instruction;
6) Paying explicit attention to “connected knowledge”.

The significance of these findings is seen in the fact that I observed all of the aspects as a systemic and comprehensive package in Ms. Lara’s teaching. Although the findings are not new to mathematics education literature in isolated pieces, having an example that is an encompassing one is rare. Moreover, even though the above findings have been identified in literature in mathematics education, how they are implemented in practice in the particular context of low SES and ELL populations is not specifically described. My study provides a systemic picture, and specificity in understanding in equitable mathematics pedagogy.

1. Critical thinking as a personal process in decision-making

A significant feature of Ms. Lara’s classroom involved engaging students in thinking critically. Whether it was about information they received, mathematical
processes, or social realities, students were encouraged to ask questions and voice their wonder. No topic was out of bounds for Ms. Lara’s classroom because she believed students should be able to say what they wondered about and teachers should address their questions fairly and sensitively. Through the process, Ms. Lara portrayed Paulo Freire’s (1973) “conscientização” (p. 67), an aspect of the problem-posing model of education in which students are critical thinkers instead of passive receivers of knowledge as in the “banking” model (p.79).

Ms. Lara required students to reflect on their realities and make the conscious decision to learn. Freire's (1973) “conscientização” (p. 67) is a process that engages students in developing critical awareness of one’s social reality. The process began with students making a conscious decision to learn. Getting students to “choose” academic success is a key characteristic and a “trick” (p.160) of culturally relevant teachers (Ladson-Billings, 1995). Teachers in culturally responsive classrooms adopt strategies to demonstrate “tough love” (Gay, 2002, p. 621) to help their students learn and succeed academically. The gap in the literature is of examples of how all these aspects are incorporated in mathematics pedagogy especially in the context of low SES and ELL populations. My study in the case of Ms. Lara fills that gap.

Ms. Lara asked students to make that choice, to voice their decision, and she “followed” them to help them stand by their decision. When students seemed disinterested, distracted, or resistant to instruction, she differentiated strategies to engage individuals based on her knowledge of them. While she gave time to one student who she thought needed it, she spoke firmly to another and expected to hear the student’s decision to pay attention. When a student continued to be distracted after being given time and
reminders, Ms. Lara reminded the student of the earlier occasion when she had decided to fully participate and learn. She also reminded the student of her (the teacher’s) commitment to support the student’s learning if the student would hold up her end of the bargain.

This aspect of Ms. Lara’s work is important because the context of Ms. Lara’s classroom of low SES and ELL students is significantly related to this finding. Allow me to explain. In an exploration of how curriculum development was related to socioeconomically diverse students, Lubienski (2000) showed that while high SES students viewed discussions as useful to exchange ideas, low SES students said they “became confused by conflicting ideas and preferred more teacher direction.” (p. 377). Lubeinski further concluded that reforms in mathematics instruction “have the potential to promote equity in some important ways” but that “issues of socioeconomic class also need to be considered.” (p. 378). My study points out that low SES students’ participation in the classroom focused on students thinking critically is not only possible, but also necessary for learning. Moreover, when critical thinking is an everyday process, discussions about their lives outside the classroom are natural, as in Ms. Lara’s class. Students were to think and decide for themselves with regard to all aspects of their learning.

Ms. Lara was aware of the reasons for her students’ difficulty in learning mathematics. For the ELLs, the focus of instruction had been primarily on acquisition of language skills and hence they lacked the language or vocabulary of the mathematics they were expected to know when they entered fifth grade. Ms. Lara believed that because they had thus fallen behind, her students considered others better than
themselves and tended to shut down. In this context, like teachers in culturally relevant classrooms, she used creative ways to support student efforts in achieving reachable targets by raising the standard within reasonable limits (Gay, 2002). She did so by first asking her students to decide to learn. While it would seem that Ms. Lara was giving students the choice, her expectations were clear – she believed in their ability to learn and do mathematics and expected their full participation. Ms. Lara was clear and specific in her expectations and did not proceed until it was clear to her by their own acknowledgment that the students understood.

Ms. Lara asked students to partner with her in their learning. In the beginning of the academic year, Ms. Lara asked the students to ‘help’ her in helping them. She insisted, “We are all in this together.” She reminded them that being in her class meant they had a partnership and she would not be able to fulfill her role unless she had their full attention. Hence, in giving them the choice, she also reminded them of their common responsibility and promise of partnership. The first decision students made was to be “present” (a word Ms. Lara used to describe full participation). After this, Ms. Lara engaged students in critically thinking about various aspects of their learning – information they received, mathematical methods, and issues relating to their lives. Ms. Lara thus helped students develop critical thinking as a personal process.

On the day of the U.S. Presidential elections, Ms. Lara’s attention to her students’ critical thinking ability became particularly evident as she led a discussion about the election process. Students brought up issues that they had seen or heard in the media about each candidate, mostly maligning them. After listening to all of these issues, Ms. Lara drew them into thinking about how they would then go about choosing a leader.
That brought the discussion around to factors they might consider: do they know the person, have they seen evidence of them helping people, does he/she help the community, does what he/she says match up with what he/she does? In this way, Ms. Lara helped them think about what they heard without arguing for any one side, and view the information in the media more objectively and critically.

Ms. Lara’s activism in her classroom was in providing students opportunities for developing critical thinking as a pathway to self-empowerment. She offered a safe space for them to raise questions, concerns, and doubts. Their input and thoughts were valued and respected, and they were free to express themselves. Ms. Lara thought it was important for students to be able to voice their opinions, because, “if they don’t voice those ideas, no matter how fractured they are, if they don’t voice them, then you don’t even know what it is they’re confused about.” [I: Apr 6th, Number sense, Place value]. A significant aspect of teaching for social justice is responsiveness (Gay, 2000), valuing student thought and taking their struggles into consideration. Supporting them through confusion and helping them make good choices is critical to student enrichment and self-empowerment. Ms. Lara’s responsiveness had a positive bearing on students who were from linguistic minority communities and low SES populations with little opportunity to make good choices. Students might believe they were capable of making good choices because Ms. Lara expected them to. Students might become better decision-makers due to this aspect of her pedagogy.

2. Informative and informal continuous assessment

Assessment in mathematics is traditionally based on positivist tradition, with paper and pencil tests that expect students to produce the right answers in an expected
method. The assessments are supposed to objectively and reliably measure student understanding in mathematics, but there is spreading dissatisfaction among teachers and education researchers as to whether they achieve that objective. NCTM’s (1995) Assessment Standards proposes the following principles for assessments:

- reflect the mathematics that all students need to know and be able to do
- enhance mathematics learning
- promote equity
- be an open process
- promote valid inferences about mathematics learning
- be a coherent process

While these principles are clearly aimed at assessing student understanding, many assessments do not fulfill that objective, since the text of the responses does not necessarily provide a complete understanding of the student’s thinking. Morgan (1999) suggests that in order to pay attention to equity and students’ diverse ways of learning and thinking, teachers often rely on concepts like “impression” or “gut reaction” (p. 15). Even if criteria for assessment are clearly defined, such as using visual representations or tables, these are usually framed in such a way that they disadvantage students who are from cultural and linguistic backgrounds different from the school (Morgan, 1999). In this case, how does a teacher use strategies that enable an equitable and realistic evaluation of student work? My study of Ms. Lara’s case provides an example of how informal and informative assessment in a mathematics classroom can prove to be successful.
Ms. Lara’s informative and informal continuous assessment of her students updated her of their progress at all times. She did so, not with the help of standardized paper and pencil tests, but in a variety of other ways, since she believed paper-pencil tests did not provide a true understanding of students’ knowledge to teachers. She thus used strategies like posing questions to individual students and groups, asking students to read the numbers aloud, listening to students as they work on different strategies, and the like. Her questions not only helped students think about their work, but their responses helped her gain information about their learning. She insisted that each student read numbers aloud even if the written form was correct. She asked students to find multiple ways of finding solutions. She asked those who had completed their work to teach other students. She thus constantly gathered information and had a “sense” (as she called it) about how they were engaged and/or learning. Based on this “sense” of the students in her classroom, she made decisions of how she would proceed with her lessons.

By listening to students and watching them work through problems, she was able to anticipate the next progressive step in their learning, and based on that knowledge, Ms. Lara provided the necessary support. If she saw that a particular student was struggling she allowed the struggle but also supported the student through it with thought-provoking questions. She stayed with students in their struggles. Students, from their side, were aware that she was attentive and supportive. They also knew from experience, that she would help them proceed in their understanding without giving them the answer directly, but with assistance to think the problem through in a manner most comfortable for them.

In the case of her ELL students, Ms. Lara became aware from her initial interaction with them that her conventional language and methods were not producing the
results she had hoped for. While observing the team working with the students, she realized they needed more visual clues and a language that helped them connect and access the mathematics. She also saw that when they worked with manipulatives, they were able to conceptualize mathematical ideas and work through problems. When she began to teach them later on, she similarly helped them to make connections between verbal, written, numeric, and visual representations, to develop a conceptual understanding. She also gave them procedures, associated with visuals, such as ‘lining up the decimals’, or writing the word ‘diameter’ along the diameter of a drawn circle. These strategies were particularly useful to engage ELL students in learning mathematics. With all students, Ms. Lara used real-world activities, so that students associated the mathematics they learned with their everyday lived experiences.

Moreover, to use a colloquial expression, Ms. Lara had her ‘finger on the pulse’ of her classroom. She was aware of the atmosphere in the classroom and knew when her students were engaged or disengaged. If she thought they were engaged, she would push concepts further and give them one more question to think about. If they were disengaged, she introduced an alternative strategy or activity to draw their attention back to the lesson.

Having a continuous form of assessing students is at the heart of both equitable instruction and constructivism, and Ms. Lara’s pedagogy portrays them both. Equitable instruction is student-centered; it begins with students’ prior knowledge and builds on it so the student has the opportunity to add to that knowledge in collaboration with others. Constant assessment is also at the heart of the constructivist philosophy. The constructivist view of learning is that knowledge is individually constructed in the mind
of the learner (Ernest, 1993; Piaget, 2003). Since knowledge is individually constructed, at the heart of constructivism is the principle of equity, valuing all learners and providing all students in the classroom with ample opportunity to learn.

In addition, the social constructivist philosophy places special emphasis on social interaction during knowledge construction. Therefore, a constructivist teacher, with her attention to students’ individual construction of knowledge in the context of social interaction, finds ways to help individual students learn in a collaborative atmosphere. This balance of individual and community learning is rarely addressed in mathematics education. Ms. Lara facilitated student learning in collaborative groups while also paying attention to individual students within those groups. She informally assessed her students constantly during group activities and ensured that individual students were engaged and learning. If she noticed students sitting back to allow peers to take over, she stepped in to encourage them to work as a group so that all would fully participate.

Once again, the study is significant because it provides a vision of assessment in the context of low SES and ELL students and how they might learn. Students who had shown poor results in the past may have feelings of inadequacy, and would be prone to become disinterested and disengaged. Poor test results might also mean not having the prior knowledge in order to proceed with the rest of the students in the class. Another reason for their disengagement could have been because of a language barrier. Whatever the reason, most students in Ms. Lara’s class had reason to disengage from learning mathematics. In such a situation, Ms. Lara’s pedagogy based on understanding and support of individual students kept all of them engaged in learning.
3. Teacher intentionality

Freire (1973) identified teacher intentionality as a critical feature of pedagogy for the “problem-posing” model of education, rejecting the “banking” model (p. 72).

Brucknerhoff (1987) proposed that teacher intentionality informs a teacher’s practice and provides a useful perspective in conceptualizing models of teaching. If the intention of teaching is to develop student critical thinking, then there are certain movements in the teacher’s practice that are connected to that intention. Teacher intentionality in mathematics education has not been studied in depth, and neither did I anticipate finding it explicitly in Ms. Lara’s teaching. I found that Ms. Lara’s intentionality emerged as an important aspect of her work. Her deliberate choices included working in high-needs environments, understanding and connecting with students, and helping her students learn. The importance of this finding is for teacher educators and researchers to help teachers develop models of their teaching based on their intentions in order to reflect on their own goals and intentions for teaching and more closely align their actions to them.

Firstly, Ms. Lara deliberately chose to work at a high-needs school because she saw it as an opportunity to “give back”. She told me she had received as much as she had given while working in high-needs environments. She shared how she found fulfillment in helping students who had many factors and “stumbling blocks” working against them keeping them from learning. She considered it a “huge pay off” when she saw the students find enjoyment in their learning.

Secondly, Ms. Lara was intentional in getting to know the challenges in her students’ lives as well as knowing how they learned, their dreams, and aspirations. Based on knowledge of her students, she was then intentional in the choices she made in the
classroom. She began the year frustrated because she was unable to “connect” with her students. For the first time in her career, a majority of her students were ELL students with little or no prior mathematics teaching. She found that the conventional language of mathematics did not produce favorable results. Moreover, she was aware of her students’ troubled home environments. Matters that came up during parent-teacher conferences left her aghast and disturbed. Several of her students were on medications for psychological disorders and having attention problems because parents were not administering the required dosage. She was also disturbed when she became aware of some of her students’ negligent and abusive home environments. This neglect manifested itself in the classrooms through students’ apparent lack of interest and/or ‘macho’ attitude. Ms. Lara expressed her distress at not being able to connect with them and know who they were as individuals and understand their needs. In the midst of this scenario, she was confused about her role, and she expressed that frustration in the interviews. “This whole role of what I’m supposed to be is different than what I want to be, you know,” she said. “I want to teach, but how can I teach a curriculum if I do not even know who the children are?”

Thirdly, although the circumstances were disturbing, they did not lead her to accept the failure of her students as a natural consequence. Unfortunately, this is not the case with many teachers who accept their students’ poor academic results as inevitable, as Bartolomé (2007) says:

[L]ack of political and ideological clarity often translates into teachers uncritically accepting the status quo as “natural”. It also leads educators down an assimilationist path to learning and teaching, rather than a culturally responsive, integrative, and transformative one, and perpetuates
deficit-based views of low-SES, non-White, and linguistic-minority students. (p. 266)

Ms. Lara believed her students had the capacity to learn and succeed in their academic and professional lives and she was determined to help them achieve. This was Ms. Lara’s compassion (करुणा); she was disturbed by the circumstances of her students’ lives and decided to do everything in her power to provide the environment and opportunity for her students’ self-empowerment. This intentionality is also what drove Ms. Lara to take the first step in seeking help from the team of educators from the university.

The concept of teacher intentionality is an important one for mathematics research. While many teachers have the best intentions for their students, many things might stand in the way of providing appropriate learning environments. Therefore, not all good intentions translate into student learning. On the other hand, knowledge without intentionality could be detrimental to learning as well. How intentionality and knowledge are mutually dependent needs to be explored further.

4. **Students’ mathematical and social identities**

Ms. Lara provided opportunities for students to learn both collaboratively and individually and thus build their mathematical and social identities. This finding adds to literature on the role of collaborative learning in student identity building. Boaler & Greeno (2000) propose a broader understanding of mathematics learning, as a “process of identity formation through participation in social practices” (p. 172). They suggest that both collaborative group work as well as individuals working alone are useful in engaging students in mathematics. Student identities are built both through individual
interaction with materials as well as social interactions with one another and the teacher. Although the study addressed individual learning through struggle within collaborative groups, it did not specifically address the topic of identity building for students who were low SES and ELLs. Ms. Lara’s case is set in this particular context and addresses identity formation for these populations.

Studies on collaborative learning suggest strategies teachers might find successful in providing equitable opportunities for students in cooperative groups. These include “structuring group compositions so that students interact with each other productively so that each student is in a group that will help him or her learn” (Esmonde, 2009, p. 1024). Is such a structuring really useful in practice? In my study, I found that Ms. Lara had a different approach, and it worked. She was able to engage students productively even though she allowed them to choose how they would structure their groups. Therefore, students made the decision and she believed that in giving them that choice, the responsibility to be productive rested on their shoulders, leading to a supportive learning community.

Students’ positions as mathematics learners influence how they interact in groups with their peers, and teachers need to negotiate their different positionalities to provide an equitable learning environment (Esmonde, 2009). Exemplars in practice, like that of Ms. Lara, especially in the context of low SES and ELL students who are low performing, are rare. Ms. Lara’s practice characterized student identity building through collaboration. Her classroom represented a ‘learning community’ in which students from all ethnic, cultural, language and ability groups engaged in learning and legitimate participation (Lave & Wenger, 1991) to produce knowledge and benefit in positive ways both
personally and as a community. Students spent about two-thirds of the time working in
groups—either as small groups or pairs. Ms. Lara encouraged communication between
students and attention to one another’s thinking. She believed students learned best by
listening to and learning from each other. One of the elements of collaborative strategies
was assigning leadership roles to students, which Ms. Lara regularly did, implicitly, by
making them lead activities or projects and redirecting other students’ questions to the
leader. For example, when a student provided a new idea, Ms. Lara credited her or him as
the originator of the idea, and directed all questions about it to her or him. The students
who learned and were successful at something were assigned to support another’s
learning (with specific instructions on how the support is given). Ms. Lara’s pedagogy
demonstrated the power of cooperative and communal learning that Ladson-Billings
(1995) also found in her investigation of culturally relevant teachers. Thus, Ms. Lara’s
students increased in both academic understanding and social responsibility.

Boaler & Greeno (2000) posit that not all social interactions lead to mathematics
learning. Individual times of thinking and struggle are also part of the process. Ms. Lara
was insightful in providing students these individual opportunities, sometimes while they
work in groups, and other times when they were working individually. Sometimes she
had them come to the board and work out a problem, and at other times, she had them
work in pairs. No matter what the arrangement, Ms. Lara paid attention to individual
student tasks to make sure they were engaged. If she saw a disengaged student, she took
time to talk to that student and identify the problem. Ms. Lara knew her students well
enough to connect and communicate with them and help them engage. No student was
permitted to “fall through the crack,” as she would say. To keep students engaged, Ms.
Lara had different ways of igniting their imagination and to help trigger their interest. Her classroom had several attention-grabbing objects. When students had questions about what they saw, Ms. Lara helped them find the information. Ms. Lara never completed a lesson without leaving yet another question or thought for students to consider. In this way, she contributed to students’ potentially life-long engagement with mathematics and the possibility of pursuing higher mathematics.

Ms. Lara’s classroom environment also provided community learning opportunity. Students had the opportunity to build individual social as well as mathematical identities while working in groups. During group activities, students shared and listened to one another’s ideas, learned to respect each other’s thinking even as the teacher respected their thinking. At times, by isolating and giving her complete attention to individual students, Ms. Lara provided the support they needed as individuals to build their mathematical identity as learners and doers of mathematics, thus providing a safe and secure space for students to build identities.

5. Student locus of authority for knowledge co-construction

Another key factor that emerged from my observation of Ms. Lara’s classroom was that her students were the locus of authority for both mathematical and instructional decisions. This was another intentional decision on Ms. Lara’s part. She included her students in decisions pertaining to the mathematics they were learning as well as how they were engaged in learning.

Having students as the locus of authority meant that Ms. Lara was not. She considered herself as more of a facilitator in the teaching-learning process. She deliberately directed students to look to sources of information other than herself, often
the students themselves. It was not unusual for students to reach for a dictionary, ask a friend, or look for information in a book or the computer. Students were aware that they had access to multiple sources of information. Ms. Lara also provided opportunities for students to co-construct knowledge and take ownership of that knowledge. Her interactions with her students often included phrases like “ask him”, “it’s her idea”, “oh I like that idea”, “what do you think?” so that not only were the students “constructing” their own knowledge, but also becoming “owners” and “contributors” of shared knowledge, a process contributing to their self-empowerment.

In essence, the students were exposed to how real-world mathematics works: collaboratively, using multiple representations, with diverse interpretations and a variety of solutions (Burton, 1998). Students thus produced and owned knowledge individually and collaboratively.

Having students as the locus of authority meant that Ms. Lara focused on student thinking, a key element of Cognitively Guided Instruction (Carpenter et al., 1994) and found to be effective in developing student mathematical thinking. Ms. Lara took CGI a step further: she considered students to be knowledge producers. Mathematical investigations in Ms. Lara’s class were based on what students were inquisitive about. She used ideas generated from students to guide the mathematics they learned. It is commonly accepted that students in elementary classrooms tend to ask many questions about physical phenomenon. Ms. Lara paid attention to their questions, and from them helped students generate a plan on how they would answer their question: what data they might need, data collecting procedures, and choice of methods. Students also determined how they would like to learn: what kind of grouping they would prefer, how much time
they would need for activities, etc. Ms. Lara’s approach exemplifies how Erchick et al. (2011) define Learner Responsive Pedagogy:

a) a shift, or expansion of each constituents’ responsibilities and roles in the learning process from teacher as authority to authority shared by teacher and learner; and b) action: a resulting and deliberate instruction based on teacher knowledge of learner thinking and understanding. (p. 132)

It is worth considering what being the locus of authority meant to the students in Ms. Lara’s class. Her students (as is the case for the school) had been showing less than adequate progress in academics. Many of Ms. Lara’s students were also ELL students, and had fallen behind their peers in mathematics. Thus, it is possible that poorly performing students would accept this as their fate, and believe that they were not capable of and/or would never be able to do mathematics. In this context, Ms. Lara’s learner-responsive pedagogy made her students the locus of authority, building their self-confidence, and sense of ownership. Students saw their ideas as valued and worthy of consideration, thus contributing to their self-confidence. Students also became more engaged in learning because they felt a sense of ownership. They were aware that when they shared an idea, Ms. Lara would follow that idea through and even place them in a leadership role for that idea or project. They were invigorated to think more deeply and became more responsible for their participation in their classroom. From being often considered ‘deficit’ in their mathematical knowledge, students became endowed with credibility and having their ideas valued. They were being acknowledged as leaders and had ownership of knowledge - something that they need never fear losing.
6. Connected knowledge

The final aspect of Ms. Lara’s pedagogy was using ‘connected knowledge’ as a way of knowing, a process which she herself admittedly used to learn. The concept of making connections, which teachers find challenging to achieve in practice, has been argued strongly for by the National Council of Teachers of Mathematics (NCTM) in their Standards documents as a process to help students learn mathematics. They recommended that students learn to a) recognize and use connections among mathematical ideas; b) understand how mathematical ideas interconnect and build on one another to produce a coherent whole; and c) recognize and apply mathematics in contexts outside of mathematics (National Council of Teachers of Mathematics, 1989).

Ms. Lara’s concept of mathematics was that of a richly connected web of concepts and procedures (Baroody et al., 2007), as well as language, visual and perceptual representations, and real-world connections. Since she herself understood mathematics in this way, she made sure that she also provided students the opportunity to make connections. She believed that since students learn differently, they should be able to access the content in whatever way they found most aligned with their way of knowing. Hence, she provided students the occasion to connect with the content in multiple ways: visually, linguistically, conceptually, procedurally (which to her was also a visual representation), and through real-world experiences.

In providing a model for teachers, Becker (2003) offered “connected teaching”, a process that engages students in problem-solving and inquiry-based learning. Instead of presenting students with procedures and neatly laid out mathematical models, Becker (2003) recommended that teachers help students learn by having them work on
challenging problems that had multiple solutions and covered a range of concepts. Although the study specifically addresses ‘women’s ways of knowing’ (Belenky, Clinchy, Goldberger, & Tarule, 1997) through connected rather than separate knowing, this strategy was found to be useful for all students (Boaler, 2000).

Ms. Lara not only made connections through multiple representations of content and across content areas, but she also made connections with students’ lived experiences. The classic study of children doing mathematical manipulations on the streets of Brazil is an illustration of how students negotiate complex mathematics with ease when they can relate it to their lives (Carraher et al., 1994). This phenomenon was evidenced in Ms. Lara’s classroom. Students investigated questions like ‘what is the relationship between the weight and number of seeds in pumpkins?’ or ‘at what rate does the toy expand in water?’ and in the process learned and engaged in rigorous mathematics.

The connections Ms. Lara made between various mathematical concepts, multiple representations, and lived experiences helped her students make connections with mathematics through ‘connected knowledge’ in their preferred way of learning. Ms. Lara was deliberate in making as many connections as possible, in the belief that students who learn differently would be able to “latch on to” something that made sense to them, and in that way, access the mathematics.

Once again the context of Ms. Lara’s class is an important consideration. Although NCTM’s directive is for a connected curriculum, exactly how teachers might achieve this in mathematics needs to be explored and made specific, and my study provides one such example. This was a group of students who came to believe that they were wanting in mathematical skills and knowledge, and perhaps ability. They had taken
multiple paper-pencil tests administered by external evaluators, and their papers had often returned bearing red markings, poor results, and comments like, “Re-do this”. These are students, who might have given up if it hadn’t been that they were able to access the mathematics in Ms. Lara’s class through her pedagogy of “connected knowing”.

**Towards a vignette: CCI Triangular Framework**

I used the key findings from Ms. Lara’s practice to create a model for teaching for equity and social justice. It is important to note that while mathematics education research indicates that each of these findings are useful for student learning and there are several models for equitable mathematics teaching, we do not know what they look like in the classroom. My study provides that specificity, especially in the context of ELL and low SES populations. Moreover, each finding is an integral part of the whole model of teaching for equity and social justice. The model would not be complete or fulfill its objectives without all of its aspects. All the characteristics described in the model are critical for equitable mathematics teaching and have implications for social justice. For example, without being presented with a connected curriculum, students would continue to have difficulty understanding mathematics as a way of understanding the world around them, which is an important part of social justice education. If students are not provided with opportunities to develop their mathematical and social identities within their collaborative learning groups, it would hinder students’ cultural competency, which is basic to equity pedagogy. If the students are not provided with the opportunity to develop critical thinking as a personal process, having them think critically about the circumstances of their lives and becoming agents of social change would be challenging.
In order to draw the findings of my study into a cohesive model, I used the “CCI Triangular framework”, introduced earlier as a model for research and methodological perspectives (Figures 1 & 2). In Table 14, I show how these findings are aligned with the CCI framework for teaching and briefly reiterate their characteristics that help us understand what the three aspects look like in practice.

<table>
<thead>
<tr>
<th>Key findings</th>
<th>CCI framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing students’ critical thinking as a personal process</td>
<td>CLARITY</td>
</tr>
<tr>
<td>Having informal and informative assessment</td>
<td></td>
</tr>
<tr>
<td>Intentionality in getting to know her students, their context, their aspirations, and making instructional decisions based on that knowledge</td>
<td>COMPASSION</td>
</tr>
<tr>
<td>Helping students build mathematical and social identities</td>
<td></td>
</tr>
<tr>
<td>Students as the locus of authority for both mathematics and instruction</td>
<td>INTEGRITY</td>
</tr>
<tr>
<td>Paying explicit attention to “connected knowledge”</td>
<td></td>
</tr>
</tbody>
</table>

Table 14 : Key findings and the CCI framework

Attributes that define the model are: Clarity (स्पष्टता), Compassion (करुणा), and Integrity (अखंडता). In the case of teaching, Clarity (स्पष्टता) consists of two aspects – a teacher’s continuous informal and informative assessment of students in order to better understand how they think and learn; and second, students developing critical thinking as a personal process in order to better understand their world. Compassion (करुणा) is a call
to action that has objectives - a teacher’s intentionally seeking to understand the students, their hopes, dreams and aspirations, and second, providing a safe environment for students to build their mathematical and social identities. Integrity (अखंडता) in the teacher’s work places students and mathematics at the center – students are the locus of authority and decision-making in the process of knowledge co-construction, and the teacher facilitates a connected understanding of mathematics across content areas, using multiple representations, and making real-world connections.
Figure 5. CCI Triangular Framework for teaching mathematics for equity and social justice

**Clarity (स्पष्टता)**

The element of *Clarity (स्पष्टता)* in a teacher’s work for social justice brings about providing opportunity for students to develop the process of critical thinking. Students engaged in questioning and thinking critically about information they receive and learn assimilate critical thinking as a personal process and begin to apply the same to
their lives. It naturally evolves into “conscientização” (Freire, 1973, p. 67) by which they understand, critique, and question social injustices and oppression where they see it. The second aspect of Clarity (स्पष्टता) is the teacher’s observation and understanding of students through continuous informal and informative assessment. This calls for a teacher’s ‘dialectic view’:

one eye firmly fixed on the students – Who are they? What are their hopes, dreams, and aspirations? Their passions and commitments? What skills, abilities, and capacities does each one bring to the classroom? – and the other eye looking unblinkingly at the concentric circles of context – historical flow, cultural surround, economic reality.” (Ayers, 1998, p.xvii).

Teaching for equity and social justice begins with an understanding of students. Teachers learn about their students’ backgrounds, home environments, dreams, and also what they bring to the classroom and how they learn. Teachers are open to differences and life experiences and tap into the rich “funds of knowledge” (Moll, 1992) that students bring with them at all stages of the educational process.

Compassion (करुणा)

Compassion (करुणा) undergirds the work of teaching for equity and social justice, and stems from a teacher’s intentionality. It is a call to reflection and action. When teachers recognize that students from low SES backgrounds and ethnically diverse populations are academically disadvantaged, they might come to different understandings. While some might blame the students as being incompetent, others might view it as an inevitable consequence of the education system. The first perspective might
be a result of those who consider education as a means of assimilation: getting students to conform to an acceptable ‘standard’, to believe and value the same things, and to act a certain way. In this case, diversity is seen as diverging from that accepted norm, and regarded as something to be done away with. Teachers who profess these views often have unreasonable expectations from students with diverse cultural backgrounds and display an alienating pedagogy leading students to their academic disadvantage (Gay, 2002). The second perspective might lead to a sense of hopelessness and acceptance of students’ academic underperformance as something ‘natural’ (Bartolomé, 2007). In either of these cases, teachers tend to continue to disadvantage the already disadvantaged students.

Social justice pedagogy is one of hope and action, neither accepting things as they are nor having unreasonable standards of students from diverse backgrounds. From an understanding of the context and a commitment to change, the purpose of social justice education is using our imaginations and teach what we believe should be (Greene, 1998), not accepting things as they are, but rather teaching students to become socially conscious and work for social change. Paulo Freire inspired a ‘liberatory’ model of education, by placing power in the hands of the oppressed, for “(o)nly the power that springs from the weakness of the oppressed will be sufficiently strong to free both” (year, p. 44). Moreover, “(i)t is only when the oppressed find the oppressor out and become involved in the organized struggle for their liberation that they begin to believe in themselves” (Freire, 1973, p. 65). bell hooks (1994) advocated a pedagogy of transformation rooted in hope:
Educating is always a vocation rooted in hopefulness. As teachers we believe that learning is possible, that nothing can keep an open mind from seeking after knowledge and finding a way to know. (hooks, 1994, p. xiv).

Teaching for equity and social justice means that teachers believe in their students and hope for their better future. Teachers are intentional in creating opportunities for students to develop their mathematical and social identities. Their pedagogy, while providing spaces for learning through collaboration, also places the individual student at the center of instruction. The classroom becomes a learning community where students are responsible for their individual and collective learning. Caring pedagogy is not about teachers being nice and students feeling good (Cochran-Smith, 2004) but rather, a responsible undertaking of ‘tough love’ (Gay, 2002) in which students choose academic success (Ladson-Billings, 1995), and build identities as learners and doers of mathematics and as social beings.

**Integrity (अखंडता)**

*Integrity (अखंडता)* provides the strength of purpose in teaching mathematics: its rigor and connectedness. Rigorous mathematics is not compromised in equitable environments, neither is quality instructional time. Key to equitable teaching is believing that students can learn and supporting their learning in learner-responsive (Erchick et al., 2011) ways. Hence the learner becomes the center of all decision-making. Students are the locus of authority for both instructional time and mathematics. They choose what and how they learn. By helping students take ownership, the teacher is able to help students achieve greater engagement and deeper understanding.
Teaching for equity requires considering students’ diverse understandings and ways of knowing and provides a rich, connected view of mathematics content. Integration of conceptual and procedural knowledge is key to teaching for understanding (Hiebert & Lefevre, 1986). Becker (1995) proposed a connected web of knowledge through the process of ‘constructed knowing’: learners integrating intuitive knowledge with experience and interactions with others. She suggests that constructed knowing is more effective for diverse learners when compared with silent (students listen while the teacher talks), received knowing (students only play back what the teacher has taught), subjective knowing (students learn from their own experience) and procedural knowing (students evaluating validity of arguments). Equitable teaching provides students the opportunity to construct knowledge through a richer, more connected understanding of mathematics.

Besides connections between content, procedures, and representations, teaching equitably means connecting mathematics with lived experiences (Carraher et al., 1994; D’Ambrosio, 2001; Gutiérrez, 2002). Drawing on students’ experiences to teach mathematics is another aspect of ‘connected knowledge’ (Becker, 1995, 2003). Students can then see how mathematics applies to everyday life and learn to understand the world with mathematics. Making such connections and helping students make connections is another important aspect of equitable teaching.

**Ms. Lara: The Vignette**

The italicized sections in the following section are direct quotes and used as a stylistic preference in the vignette.

*As I entered Ms. Lara's class that day, I saw Sonia peering into the glass bowl placed on a counter at the back of the room.*
“Ms. Lara,” she said, pointing to the grow-in-water toy immersed in the water. "I wonder if this toy will grow as large as this room!"

Ms. Lara smiled, picked up the bowl and placed it in front of the class. "That's an interesting question!" she said. "Let's talk about it!"

Based on the extensive literature available on the subject of equitable mathematics education, it is possible to generate a comprehensive list of instructional and pedagogical strategies for teaching: having students work collaboratively, having high expectations of students from diverse backgrounds and abilities, drawing from students’ cultures, using multiple representations etc. It might be assumed that by adhering to such a list, teachers would be able to achieve equity in teaching mathematics. But Ms. Lara’s case is not about a list of strategies. It is more than that. It is also about her perspectives, her philosophy, her knowledge drawn from her education and experiences. And above all, it is about her intention. Ms. Lara’s intentionality stood out as a distinctive characteristic of her teaching. Admittedly, teachers who make and follow such a list must have the best of intentions, but even with good intentions, how many teachers are able to simultaneously pay attention to all attributes of equitable teaching? Besides simultaneously and effectively putting together all aspects, teachers might be challenged by other circumstances of their work like unreasonable expectations of reporting, standardized assessments, and scripted programs. To add to all this, a teacher’s own perspectives and views might hinder their work for equity and social justice.

The most important aspect of the results of my study is that Ms. Lara has an integrated system. Her model of equitable mathematics teaching needs to be seen in its entirety. There were undoubtedly difficult circumstances and unreasonable expectations that impacted her work, but did not stand in her way of social justice pedagogy. Even if
she might not have had the vocabulary or the literature or theoretical backing for her practice, Ms. Lara’s social justice pedagogy was observable in all her interactions and teaching across content areas. It was systemic, integrated and spontaneous, and seemed to come naturally. And that is why Ms. Lara’s vignette provided a view of one teacher who does it all for teachers and teacher educators!

Students who are disadvantaged for one reason or another are falling out of the education pipeline every day. Ms. Lara’s classroom gives me hope! I see what a teacher who is caring, giving, and unrelenting in the cause for social justice can achieve. There are no walls, no barriers to learning in Ms. Lara’s classroom. All children have the freedom to let their imagination run wild, to explore and discover. This is their world, and they have the right to determine what they learn and how they would learn. Here, their voices are heard, their thinking is valued, and it is safe to question. They are accepted for who they are and respected for what they bring, even when, or perhaps especially when, some of what they bring is pain and struggle. This is their ‘haven of freedom’!

The reader will find the complete vignette in Appendix B.

**Implications for teacher education and practice**

Several questions arise from the vignette: how was Ms. Lara able to achieve what she did? Was it because of Ms. Lara’s specific background and experience in Montessori, special education and educational philosophy? Was it because of her belief that she could make a difference in the lives of her students? Was it her general disposition and attitude? And what are the implications for teacher education and practice? If Ms. Lara did it, is it possible for others to duplicate it? Is it possible for teach student teachers how to teach using this model? If so, how?

Providing equitable learning environments for students in mathematics classrooms is a complex and challenging endeavor for teachers; besides considering the
conditions in the classroom, teachers have to familiarize themselves with students’ lives outside the school and classroom, reflect on their own biases and perspectives, as well as negotiate the challenges in their own work. My study provides a vision of what this might look like in a classroom, where a teacher does it all through her intentionality, her resourcefulness, her careful attention to students, and her continuous assessment. Ms. Lara’s is a pedagogy of hope, that develops student confidence, self-empowerment, and critical thinking as a personal process through mathematics. Teachers will find the rich descriptions Ms. Lara’s work useful in understanding equitable instruction.

Another implication of this study is in providing mathematics teacher educators with a framework for in-service and pre-service teacher development for equitable mathematics teaching. Through this study, we now know what it looks like in the classroom. We have a better understanding and we can present this as a model for others to learn from. While it may be true that Ms. Lara’s background influenced her teaching, it is important to note how it did. She explained to me that her attention to student diversity and thinking came from her training in Special Education and Montessori Education. Although some of the special education courses focused on behaviorist traditions, those that impacted her work the most were the ones focused on individualizing instruction. This concept was reiterated in her experience with Montessori, given its emphasis on “following the child”. Ms. Lara said that her pedagogy was greatly influenced by these aspects of the two traditions. What are the implications for mathematics teacher education? It might be worthwhile for teacher educators to more deeply incorporate certain aspects of the two traditions into teacher education courses and professional development.
Teachers draw on their experiences (Elbaz, 1983) when they make pedagogical decisions. Ms. Lara made many decisions based on her experiences. For instance, she said she wanted to give students the opportunity to make choices since she herself “would like to have choices in my life,” and imagined her students would also want to have that opportunity. She also wanted them to have ownership in what they were learning because she “learnt the most from classes in which I had the most ownership”. Teacher drawing from “experiential knowledge” (Elbaz, 1983) in teaching from social justice is another direction for future research. In other words, what experiences do teachers draw from, or do not draw from in their effort to teach for social justice, and what experiences might it be worth providing teachers in their teacher preparation programs that would be helpful for them to encounter in order to help them in their practice?

I also asked Ms. Lara to reflect on her experiences of the past and tell me what she would like to say to novice teachers. She gave me the following pearls of wisdom, which might be points to consider for teacher educators in general and mathematics teacher educators in particular in their teacher preparation efforts:

a) Teachers need to learn to listen attentively to their students. They have ideas and experiences a teacher might never have and opening oneself to student ideas could exponentially enhance the richness of the learning in the classroom. They would learn more about teaching and learning, and benefit from honest interaction with their students.

b) Teachers need to be resourceful. There are many resources available to them. For Ms. Lara, the university was a place she was able to access on multiple occasions to help her when needed. In doing so, she found that
the education departments at the university had professors and researchers willing to get involved and provide the support she needed.

c) Teachers need to observe other teachers. Ms. Lara reiterated the valuable learning she experienced in observing other teachers and receiving feedback about her teaching from other teachers. She suggested that teachers improve tremendously if they would have the opportunity to observe others teach and also have other observe them and provide feedback.

d) Teachers should “go off script” sometimes to learn to trust their instincts and try something new in their classrooms. They must be allowed to make mistakes and remember that they learn from every mistake, just as children do.

e) Lastly, teachers need to remember that it is a gift to laugh at themselves. “Their students will love them for that!”

The above points might not be new to the thinking that goes into teacher preparation, nor new to the literature, but they are worth revisiting.

**Implications for research**

This study adds to previous research on providing equitable mathematics learning environments to those who are marginalized, particularly ELLs and low SES students, and informs areas of conflict within the field. Several conflicts continue to exist within the field of mathematics education: the math wars dialogue between conceptual and procedural understanding, the diverse views of teaching using traditional and constructivist methods, and social justice in mathematics teaching versus the loss of rigor.
These conflicts are addressed through various aspects of my study. Moreover, my study provides a framework for research and practice specifically in the context of students who find themselves marginalized in mathematics. Research in equity and social justice in these settings is fairly new or at least found in limited contexts, and needs further reflection and investigation. One such subject for research is in the context of challenges that teachers face in their work that might impede their efforts for social justice mathematics teaching. In this regard, I present a compelling emergent finding.

**Emergent finding: Negotiating through “survivance” (Vizenor, 1994)**

Teachers in present day US classrooms face many challenges in their work including policies calling for strict adherence to a curriculum detailing step-by-step instructions, standardized testing, and programs that are not necessarily aligned with student needs. Ms. Lara was frustrated with directions that did not provide teachers the flexibility with the curriculum needed to teach based on their perception of what the students needed. Teachers who prefer having their students work in groups, for example, might be considered as having chaotic classrooms, thus making it difficult for them to ‘open up’ their classrooms, according to Ms. Lara. In this context, she found ways to negotiate those directives. For example, she did not stay with a particular unit as was expected, but taught what she understood as her students’ need at that time. She had her own means of assessing students through verbal communication and representations rather than depend on skill-based paper-pencil tests. Rather than working silently and individually at all times, she had students question, teach, and quiz each other. Essentially, what Ms. Lara was doing in her classroom was closely aligned with Vizenor's (1994) concept of *survivance*. Using two words, ‘survival’ and ‘resistance’,
(Vizenor, 1994) proposed the term that signified both surviving victimization as well as having strategies to envision something new. This is also in line with literature on transformational resistance as a strategy for social justice, in which persons from marginalized communities acquire knowledge and skills through mainstream education and find creative ways to serve their communities.

Teachers in today’s classrooms are constantly faced with challenges of negotiating policies that demand more and more from them. How do they achieve this? How can they still manage to do their work for social justice? Ms. Lara understood that the system was making the situation worse for the ELL population of students as they lagged behind in mathematics even as they were required to work on language skills. Due to this, they could not fully participate along with their peers who had a stronger language and mathematics knowledge base. As a result, they were ‘shutting down’, unwilling to express their thoughts, moving from one situation to another with seemingly no desire to better their situation. In such a context, Ms. Lara stepped in to find ways to help students regain confidence in themselves, their abilities, and take pride in what they know.

Standardized paper and pencil tests continue to show students from linguistically diverse and poverty backgrounds as academically unsuccessful. This has grievous impact on student confidence and leads to students accepting their scores as a sign of inability and giving up. Students’ lack of effort and teachers’ acceptance of their lot may lead to a vicious cycle of a society that continues to marginalize the underserved communities. In such a context, a teacher’s role is critical. Taking the students’ circumstance for granted and being unwilling to change their situations could result in a pedagogy of poverty (Haberman, 1991).
Negotiating circumstances that are challenging to both themselves and their students in a manner that helps them survive the system, while at the same time working for change could be viewed as being similar to that of ‘survivance’ of indigenous and marginalized communities. In understanding the kinds of knowledge teachers bring to their work for equity that include mathematical and pedagogical knowledge, (Gutiérrez, 2012) added political knowledge:

negotiating the world of high stakes testing and standardization,
connecting with and explaining mathematics to community members and district officials, and buffering oneself, reinventing, or subverting the system in order to be an advocate for one’s students (Gutiérrez, 2012, p. 33).

This aspect of a teacher’s work is perhaps a crucial one as teachers come under greater scrutiny for their students’ poor performance in mathematics compared to their global counterparts.

**Limitations of the study**

The conclusions of this investigation can be attributed only to this particular case. However, the choice of qualitative case study was deliberate in order to provide an “information-rich” case (Patton, 1990, p. 169) for teachers and teacher educators to understand an image of teaching mathematics for equity and social justice. The case study method provided the methodology for deep exploration of the teacher’s practice and pedagogy. Although not all aspects of the teacher’s case are applicable to other classrooms, an important point to consider is that student populations are becoming increasingly diverse and low SES students and those from marginalized populations
continue to perform poorly. Hence aspects of the teacher’s pedagogy among these students become relevant to other similar situations. Moreover, aspects of the teacher’s pedagogy applied to these students could also be applied to all learners of mathematics since strategies used for these particular students are useful to support all students (Burton, 1998).

A second limitation of this study was in timing of the interviews. Follow-up interviews with the teacher were originally planned to be conducted soon after the lessons were taught. This did not go according to the plan due to scheduling conflicts. Only two of the follow-up interviews were conducted within a week after the lesson. The other three follow-up interviews were all conducted on one day, and may have led the participant to forget occurrences during the lesson or provide shorter responses. To minimize the impact of these possible short fallings, the interviews were conducted on a Saturday morning in the relaxed atmosphere of a friend’s home. Secondly, before the interview questions were asked, videos of the lessons were played back to the participant to refresh her memory of events during the lesson.

A third possible limitation of the study was that although the teacher’s pedagogy inside her classroom was the main focus of the study, conditions outside the classroom that contributed to her attention to equity were not. Undoubtedly, there were circumstances like administrative support and peer collaboration that may have positively supported Ms. Lara’s work. Even though the conditions that were challenging to her were taken into account, those that impacted her work positively were not.
Conclusion

In conclusion, I draw the reader’s attention to some key questions for equity and social justice teaching. I begin by reminding the reader about the big ideas that guided the logical sequence for the study. The “CCI Triangular” Framework for the theoretical perspectives of my research (Figure 1) comprised of the three elements, *Clarity* (स्पष्टता), *Compassion* (करुणा), and *Integrity* (अखंडता). The framework guided the choice of literature that informed the codebook, “Using mathematics to teach for equity and social justice” (Table 5). The “CCI Triangular” framework and the codebook guided me in developing methodological perspectives (Figure 2) for my study as well as the analysis. Key findings from the analysis led me to develop the ‘vignette’ of equitable mathematics teaching (Figure 5), keeping the concepts of the “CCI Triangular” as a framework. This vignette now culminates in the following questions: What does this mean for teaching mathematics for proficiency, for equity, and for social justice? How are these three kinds of mathematics teaching related to one other, and what features of teaching in the vignette are key to implementing teaching for equity and social justice? I conclude with an attempt to address these questions by using Venn diagrams (Figures 6 and 7). This could also provide a basis for future research.

I present a representative Venn diagram (Figure 6), depicting the relationship between what is traditionally good mathematics teaching aimed at proficiency, teaching mathematics for equity, and teaching mathematics for social justice. While mathematics teaching for proficiency emphasizes mathematical literacy through reform-based practices emphasized in NCTM’s standards for mathematical practices (National Council of Teachers of Mathematics, 1989, 2000), teaching for equity expands the focus to
include cultural competence and community literacy as is the case for culturally relevant teaching (Ladson-Billings, 1995a). Teaching for social justice, while embracing mathematical and community literacy objectives, also emphasizes the critical component of teaching and building students’ critical consciousness (Gutstein, 2006). Allow me to elaborate, by looking more closely at how evolution in the field of mathematics influenced its teaching.

Figure 6. Representative model of mathematics teaching

Mathematics, as the language of ‘hard’ science, evolved through a Eurocentric positivist epistemology. This categorically placed power in the hands of some and disempowered others. In mathematics education, power in the hands of the positivist
teacher produces what Paulo Freire (1973, pg. 72) called a “banking” approach in which
the teacher deposits information into the minds of the passive receiver, the learner.
Research in cognitive science witnessed a shift from positivist toward constructivist
epistemology positioning the individual learner at the center of knowing. Even though
the constructivist view could potentially transform classrooms, producing ‘good
mathematics teaching’, some groups have been kept out of mathematics-related fields
because of cultural insensitivity, or by accepting them as being ‘deficit’. This is how
mathematics continues to be the ‘gate-keeper’, creating centers and peripheries,
privileging some, while excluding others. The last two decades brought the growth of
place-based and culturally relevant (Ladson-Billings, 1995) pedagogy, with the
understanding that knowledge is ‘situated’ in the context in which it is known.
Mathematicians work collaboratively and in ‘communities of practice’ (Lave & Wenger,
1991), and adopting the same principle in education, mathematics teaching has the
potential of becoming more culturally sensitive. Cultural sensitivity of teachers does not
 guarantee equitable teaching mainly because teaching is complex, requiring teachers to
be proficient in multiple areas like content knowledge, pedagogical knowledge, and
political knowledge (Gutiérrez, 2012). Teachers also have many challenges including
their own perspectives on what mathematics is and how it should be taught. As a result,
school mathematics tends to be largely teacher-directed. In the recent decade, literature
on teaching for social justice has been integrated into the field of mathematics education.
Many researchers posit social justice mathematics pedagogy that addresses academic
success, cultural competence, and critical consciousness by using mathematics to ‘read’
and ‘write’ the world (Gutstein, 2006). The emphasis here is to use mathematics to
understand the world, to critically examine issues of injustice and oppression, and use that knowledge to seek social change. But this concept is a difficult one for teachers to understand, since some researchers emphasize culturally relevant practices (Ladson-Billing, 1995), while others highlight reflection on questions about the knowledge that is being taught in schools (Apple, 1979). Due to these multiple interpretations, teachers are confused and have no clear understanding of what teaching mathematics for social justice looks like in the classroom.

My study helps to answer some of these lingering questions. In my investigation of Ms. Lara’s pedagogy that clearly moved beyond mathematics teaching for proficiency to include cultural and critical competence, I analyzed her teaching and interviews to find the six key features. Those six key features led me to the CCI model for equitable mathematics teaching but going back to my analysis of her teaching, it was my codebook that helped me identify characteristics of the interactions in her classroom that were integral to achieving those key features. Aspects of Ms. Lara’s pedagogy that were aimed at social justice objectives identified by the codebook – that is the place where the story began. Four key ingredients. They are: a) providing opportunities for students to co-construct knowledge, b) fore-grounding student voice and agency, c) emphasize mutual respect, and d) encourage critical thinking. These four aspects of Ms. Lara’s pedagogy emerged strongly in her practice. So they must be related to the key findings of my study. These are the key features that then led to the key findings, and hence the model. I therefore propose that in order for teachers to teach mathematics for cultural competency and critical consciousness besides proficiency, they must explicitly practice and profess the four aspects in their pedagogy. The Venn diagram in Figure 7 is a depiction.
The case of Ms. Lara provides a complete vision of culturally relevant pedagogy with implications for social justice. By this I mean that in implementing the above-mentioned key equity principles, Ms. Lara’s pedagogy was helping students build mathematical and social identities (Boaler, 2000), helping them build critical identities, and influencing students’ lives for good (Esposito & Swain, 2009). Students chose academic success, were being self-empowered, and learned values useful for their own and their community’s improvement. From this investigation of Ms. Lara’s practice, I posit that teaching for social justice is the teacher’s activist role in her classroom, and encompasses all aspects described in the CCI model (Figure 5). The teacher who
intentionally and actively seeks student self-empowerment, explicitly exhibits the four social justice objectives as identified by the codebook, and combines the three core aspects described in the CCI model for teaching (Figure 5) Clarity (स्पष्टता), Compassion (करुणा), and Integrity (अखंडता), would undoubtedly create classrooms that are havens for our young mathematicians.
References


doi:10.1080/10665680701793360


Appendix A. “Using mathematics to teach for equity and social justice” Codebook

Table 15. Using mathematics to teach for equity and social justice codebook (elaborated)

<table>
<thead>
<tr>
<th>Category I</th>
<th>Content objectives (Attention to mathematics)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Code</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Concept</strong></td>
</tr>
<tr>
<td>ETL</td>
<td>Explicit Talk about the meaning and use of mathematical Language</td>
</tr>
<tr>
<td></td>
<td>Teacher explicitly pays attention to language or notation used. The teacher defines terms, emphasizes the</td>
</tr>
<tr>
<td></td>
<td>meanings, shows how to use them, and specifies the labels and names used in mathematics. Warrant: Ladson-</td>
</tr>
<tr>
<td>ETR</td>
<td>Explicit Talk about ways of Reasoning</td>
</tr>
<tr>
<td></td>
<td>The teacher helps students to reason mathematically, by prodding or asking good questions that further student</td>
</tr>
<tr>
<td></td>
<td>exploration and reasoning, and provides students opportunities to reason and engage with rigorous mathematics</td>
</tr>
<tr>
<td></td>
<td>content. The teacher ensures that all students participate in mathematical reasoning. Warrant: Ladson-Billings,</td>
</tr>
<tr>
<td>ETMP</td>
<td>Explicit Talk about Mathematical Practices</td>
</tr>
<tr>
<td></td>
<td>The teacher explicitly uses mathematical practices in her teaching, such as how to use representations, how</td>
</tr>
<tr>
<td></td>
<td>to hypothesize, how to use a definition, test a proposition, or respond to an argument. Warrant: Ladson-Billings,</td>
</tr>
</tbody>
</table>
Table 15 continued

<table>
<thead>
<tr>
<th>Category II</th>
<th>Pedagogical Orientation (Purposeful support of students as learners)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EST</td>
<td><strong>Explicit Student Tasks and work</strong></td>
</tr>
<tr>
<td></td>
<td>Teacher gives students clear instructions about what tasks are expected and the work that is expected of them. The activity might involve listening, demonstrating, working on an activity, or solving a mathematics problem. Making teacher expectations clear in the classroom is one aspect of pedagogy that is culturally relevant and student focused (Ladson-Billings, 1995, Delpit, 1993).</td>
</tr>
<tr>
<td>IT</td>
<td><strong>Quality of Instructional Time spent on mathematics</strong></td>
</tr>
<tr>
<td></td>
<td>The teacher spends time on mathematics, or a mathematical task rather than on disciplinary, organizational, or matters irrelevant to the content. Warrant: Ladson-Billings’ (1995) advice to look at how efficiently the teacher uses instructional time.</td>
</tr>
<tr>
<td>EDC</td>
<td><strong>Encouragement of a Diverse array of mathematical Competencies</strong></td>
</tr>
<tr>
<td></td>
<td>The teacher supports a wide range of mathematical skill and ability, explicitly invites the participation from students with diverse understanding and supports student interactions involving a variety of competencies. The diverse mathematics may be in terms of how problems might be approached and solved as well as representational views, reasoning, precision and use of mathematical language, and questioning. Mathematical work is rigorous and diverse and student interactions support that array of mathematical reasoning. Warrant: According to Boaler (2004), and Cohen and Lotan (1997, 1999), teachers who create a classroom environment in which all students’ ideas are accepted and encouraged provide a space for all students to learn and be successful at mathematics. Culturally responsive and caring theories (Ladson-Billings, 1995; Parsons, 2005) argue for equitable teaching practices to include diverse ways for students to participate in the mathematics classroom.</td>
</tr>
<tr>
<td>AU</td>
<td><strong>AUtonomous student work opportunities</strong></td>
</tr>
<tr>
<td></td>
<td>Teacher encourages and gives opportunities for students to work autonomously. Teacher allows students to make</td>
</tr>
</tbody>
</table>

Continued
Table 15 continued

<table>
<thead>
<tr>
<th>Category III</th>
<th>Contextual Relevance (Awareness of instructional context)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWP</td>
<td><strong>Real-World Problems or examples</strong></td>
</tr>
<tr>
<td></td>
<td>Code for whether real-world contexts and examples were used and if they were relevant to students’ experiences. This is based on research that says that when problems are drawn from students’ experiences outside the classroom, mathematics becomes more accessible for students’ learning (Burton, 1998; Carraher et al., 1994; Gutstein, 2006). When contexts that are unfamiliar to some students are used, it tends to exclude them from the experience of learning the subject. For example, an activity to design one’s own bedroom might be a sensitive topic for children sharing their rooms with other members of the family. Some games played in certain cultural groups might be unfamiliar to those of another cultural group. If the teacher uses a real world context appropriately in the mathematics lesson, it is coded RWPE, while it is coded RWPN if used superficially or inappropriately.</td>
</tr>
<tr>
<td>ESE</td>
<td><strong>Emphasis of Student Effort and message that effort will eventually pay off</strong></td>
</tr>
<tr>
<td></td>
<td>Teacher verbally emphasizes student effort and conveys message that effort will eventually pay off. Teacher may praise student effort or encourage students to keep trying.</td>
</tr>
<tr>
<td>EE</td>
<td><strong>Expressed Expectation that everyone will be able to do the work</strong></td>
</tr>
<tr>
<td></td>
<td>The teacher conveys belief that mathematics or the mathematics task at hand is something everyone can do. Examples may include encouraging students to share their ideas, recognizing a student’s idea or solution by giving them opportunity to share with the rest of the class, giving opportunity for students to add or comment on mathematical work. Warrant: Culturally relevant pedagogy values having high expectations for all students (Ladson-Billings, 1995).</td>
</tr>
</tbody>
</table>

Continued
Table 15 continued

<table>
<thead>
<tr>
<th>Category IV</th>
<th>Social Justice Objectives (Intentional student self-empowerment)</th>
</tr>
</thead>
</table>
| OCK         | **Opportunity for Co-construction of Knowledge**  
The teacher provides opportunities for students to collaborate with each other to construct knowledge, and provide support by asking questions or encouraging the students to communicate with each other. Literature on collaboration in the mathematics classroom suggests that providing opportunities for students to learn through participation in cooperative groups can position all students as competent learners and move from peripheral to central participation (Lave & Wenger, 1991). Moreover, helping students assume positions of authority can further support confidence and mathematics understanding (Cochran-Smith, 2004; Esmonde, 2009). |
| SVA         | **Fore-grounding Student Voice and Agency**  
The teacher not only accepts students’ ideas and solutions, but gives them prominence and bases future work in the classroom on those ideas. Foundational to teaching for social justice is that all voices are heard and respected, and student agency becomes central to the teacher’s pedagogy. Through dialogue and exchange of ideas, the teacher challenges the students “little by little to find their voices, to get into voice, into speech, into concreteness” (Freire, 1973), while the teacher moves little by little into the background as a facilitator in student-centered learning (Leedy, LaLonde, & Runk, 2003). |
| EMR         | **Explicit attention to Mutual Respect**  
The teacher is intentional in creating a classroom where there is mutual respect, by modeling respectful behavior and expecting students to be respectful of each other by listening to one another and using respectful language in the classroom. Respecting students, and their families and cultures is one of the foundational principals of teaching for social justice (Cochran-Smith, 2004). |
| ECT         | **Encouraging Critical Thinking**  
The teacher uses mathematics to facilitate reflection, critical thinking, and problem solving explicitly around social awareness and change (Adams, 2007). Students are led to ‘read the world with mathematics’ (Gutstein, 2006). This involves using mathematics as a lens to develop sociopolitical consciousness and students’ critical thinking as a personal process. |

(Erchick et al., 2010; Goffney, 2010; M. P. Joseph & Erchick, 2012)
Appendix B. The “Vignette”

As I entered Ms. Lara's class that day, I saw Sonia peering into the glass bowl placed on a counter at the back of the room.

“Ms. Lara,” she said, pointing to the grow-in-water toy immersed in the water. "I wonder if this toy will grow as large as this room!"

Ms. Lara smiled, picked up the bowl and placed it to the front of the class. "That's an interesting question!” she said. “Let's talk about it!"

I was intrigued! I wondered where this was going.

Ms. Lara went on to help the kids break down Sonia's 'wondering' and turn it into a mathematical exploration! "What would they like to know?” she asked. Is it “how much the toy would grow in the water, or how much it would shrink if left out of the water?” Soon they were excitedly chalking out a plan. They talked about what measurements they would need, what time of day they would measure, how they would keep a record of the data, what they would calculate, and the like. Sonia was lead on the team.

I heard that project went on for days!

Ms. Lara's students are an energetic and inquisitive bunch with numerous questions and creative ideas. They come from diverse ethnic, cultural and language backgrounds. Most of them are low SES. They each bring different things to the table. Some see things visually, some are good with numbers, some are meticulous, and some
are good at planning. There are also those who are sulky, easily bored, distracted, or just refuse to participate! Ms. Lara refuses to give up on anyone. She knows they are creative, and they can learn and do mathematics. She believes in her kids and continues to do everything she can to support them.

Ms. Lara is a white, middle class teacher with over thirty years of experience. She simply loves her kids. She had always chosen to work where there is great need: schools that were underperforming, and in violent neighborhoods and poor districts. She says she has received so much from kids who had many factors working against them, and that she wants to 'give back' somehow. This is her way of giving back.

Everything Ms. Lara does is student-centered: What do they already know? What do they want to learn? What are their challenges? Everything they do in her classroom is planned around these questions. But how does she know what the kids know and want and need? She observes them. She listens to them. She asks them questions. She welcomes their questions, because only then, she says she will know what they are confused about. That is how she has her finger on the pulse of her classroom.

Ms. Lara expects the best for every one of her kids. She helps them to choose learning by telling them that they are partners and that she could not help them unless they were fully 'present' with her. She is firm with those who seem to be slacking, and to those who are engaged, she gives one more thing to think about.

Ms. Lara teaches a ‘connected’ curriculum. She tells me that she understands the world through connections, and wants to help her students do the same. The image of mathematics she teaches is richly connected, with integrated concepts, multiple representations, and real-world problems. Ms. Lara prods them to think critically about
everything. From politics to poetry, weather to world news, food to fashion, she facilitates discussions on topics of their choosing.

I can see Ms. Lara’s kids have grown more confident over the year. They are doing better in their assessments. They are making connections. They are using different strategies to do mathematics. They are learners. They seem to be thinking and making wise choices. There is no looking back for Ms. Lara’s kids now. The future is bright.

Students who are disadvantaged for one reason or another are falling out of the education pipeline every day. Ms. Lara's classroom gives me hope! I see what a teacher who is caring, giving, and unrelenting in the cause for social justice can achieve. There are no walls, no barriers to learning in Ms. Lara’s classroom. All children have the freedom to let their imagination run wild, to explore and discover. This is their world, and they have the right to determine what they learn and how they would learn. Here, their voices are heard, their thinking is valued, and it is safe to question. They are accepted for who they are and respected for what they bring, even if they also bring pain and struggle. This is their ‘haven of freedom’.